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PREDICTION OF THE FINANCIAL HEALTH OF THE COMPANY USING THE BANKRUPTCY MODEL IN05 AND THE CREDITWORTHINESS INDEX

Abstract: Predictive approaches to the evaluation of corporate performance can also include aggregate evaluation indices (bankruptcy and creditworthiness models). The evaluation of the performance of enterprises on the basis of traditional procedures uses aggregate evaluation indices in order to assess the financial situation of the enterprise through a number of absolute, differential and ratio indicators. These indicators define the basic areas in the forecast of financial health - financial stability, financial structure, income and expenditure analysis, efficiency of asset management, corporate solvency and productivity. The most well-known models include the Tamari index, the Kralicek quicktest, the creditworthiness index, the credibility index, the Altman index, the Taffler model, the Beerman discriminant analysis, the Argenti model, the Beaver model and other models. Only some of the mentioned models are mentioned in this article. The aim of the paper is the application of selected prediction models to a selected company.
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JEL classification: L25, H12

Introduction

The aim of aggregate indices of assessing the financial health of a company is to predict the future state of the company, namely financial decline or good financial health. The explanatory power of these models and indices was questioned during the financial crisis in 2008, when

companies that were in good financial condition according to the models and did not face financial problems went bankrupt. For this reason, several authors are skeptical, e.g. to the Altman index. (Aasen, 2011)

The following criticism of traditional indicators points to the fact that traditional indicators do not take into account the risk factor, time or sacrificed costs. The reason for the criticism is the fact that traditional indicators in the evaluation of the company's performance come into conflict between the company's market valuation and the accounting valuation on the basis of financial statements.

Several authors use different approaches to predict the financial situation in the company. Lam (2004) examines the ability of neural networks, specifically the backpropagation algorithm, to integrate basic and technical analysis to predict financial performance. Al-Kassar (2014) examines the performance of the same solvency companies in predicting bankruptcy and comparisons in terms of the Altman model - Z score. Radhi (2019) recommended users of financial statements of companies in Saudi Arabia to use the Zmijewski model, which works well in assessing their financial situation.

The team of authors represented by Kováčová (2019) analyzed the used prediction models in the V4 countries. Using statistical analysis, they determined that the individual V4 countries use different variables also due to the method of reporting.

Methodology

In this research paper, we will use predictive models to evaluate financial performance. Specifically, we will focus on the IN05 bankruptcy index and the creditworthiness index.

INDEX IN 05

Aggregate index of the assessment of the financial health of companies composed of coefficients representing the areas of financial management of the company. Index IN05 was created for the business environment of the Czech Republic with a success rate of 80% bankruptcy. This index has been compiled and supplemented on the basis of Index IN01 and In-

dex IN95. The Index IN05 index was created in 2005 as an update to the IN01 model, designed by the Neumaier couple (2005).

The construction of the index was performed using discriminant analysis and was based on data from 1915 companies, which were divided into three groups: 583 companies were in the group of companies that created value, 503 companies were bankrupt or headed for it and the remaining 829 companies were among the remaining. The index should be able to reflect the conditions of countries in the Central European region, as well as make more use of data from domestic financial statements than foreign models, which are mainly adapted to Western countries. Equation of Index IN05: (Neumaierova, 2008)

IN05 = 0.13 * A + 0.04 * B + 3.92* C + 0.21* D + 0.09*E

A - assets/liabilities

B- EBIT/interest expense

C - EBIT/assets

D - sales/assets

E - current assets/current liabilities and bank loans

The resulting value of the index places the company in one of three zones: (Sedláček, 2001)

IN05> 1.6 - the company creates value.

0.9 < IN01 <1.6 - gray zone of undefeated results.

IN05 <0.9 - the company does not create value.

CREDITWORTHINESS INDEX

This creditworthiness model uses 6 ratios, for their calculation it is necessary to know 6 accounting indicators. The creditworthiness index is based on multivariate discriminant analysis. We are calculated the creditworthiness index from the equation: (Haque, 1996)

$$BI = 1.5\, x_1 + 0.08\, x_2 + 10\, x_3 + 5\, x_4 + 0.3\, x_5 + 0.1\, x_6$$

The creditworthiness index is based on multivariate discriminant analysis. The following six indicators are being worked on:

$x1 = cash\ flow/foreign\ sources$

$x2 = total\ assets/liabilities$

$x3 = profit\ before\ tax/total\ assets$

$x4 = profit\ before\ tax/total\ output$

$x5 = inventories/total\ output$

$x6 = total\ output/total\ assets$

The larger the BI index, the better the company's forecast. The following scale shows a detailed assessment: (Haque, 1996)

-3 <B <-2 the financial situation of the company is extremely bad

-2 <B <-1 the financial situation of the company is very bad

-1 <B <0. the financial situation of the company is bad

0 <B <1the company has certain problems

1 <B <2the financial situation of the company is good

2 <B <3 the financial situation of the company is very good

B> 3 the financial situation of the company is extremely good

The object of research in our work is the company ABC (Civic Association, based in Košice). The civic association was founded in 2012, whose main task is the administration and management of a sports club of the same name with a focus on floorball. The main task of the ABC is to provide sports activities for its members and supporters, organizing social events, especially sports, but also cultural.

The civic association is implementing its intention in the region of the city of Košice and the wider area. The main product that the company offers is a service associated with the provision of sports facilities, a person in charge of conducting a sports activity - a volunteer, sports equipment, or other materially related products. The company currently does not employ any employees, the performance of activities and mana-

gement of the civic association is performed by people, members of the civic association on the basis of volunteer contracts.

It should be noted that in order to calculate financial indicators and forecasting models, it was necessary to transform simple accounting items into double-entry bookkeeping. We apply selected models to the years 2016, 2017, 2018. As a result of COVID-19 measures, the financial statements have not yet been entered in the register of financial statements.

1. Research

When calculating the creditworthiness index, we will work with data that we have available from the surveyed company or that we have already calculated in the previous chapters. The creditworthiness index contains six indicators to which weights are assigned.

In the following Table 1, we calculated the individual indicators for the creditworthiness index.

Table 1: **Values of indicators x_1 - x_6 for the calculation of the creditworthiness index**

Indicator/year	2016	2017	2018
x_1	1,7379	4,4401	2,9790
x_2	8,6019	7,4995	8,6426
x_3	0,2020	0,5921	0,3447
x_4	3,2032	5,6358	4,6890
x_5	0,3000	0,1433	0,3970
x_6	0,0631	0,1051	0,0735

Source: own processing

After calculating the value of individual indicators x1-x6 and multiplying by the value of the coefficient for the given indicator, we obtained the final value of the relevant indicator x1-x6 for the creditworthiness index. By adding up all the indicators, we obtained the calculated creditworthiness index, listed in the last row of Table 2.

Table 2: **Values of indicators x_1 - x_6 for the calculation of the credit-worthiness index after taking into account the**

Coeficient of indicator/year	2016	2017	2018
1,5	2,6068	6,6601	4,4686
0,08	0,6882	0,6000	0,6914
10	2,0203	5,9206	3,4469
5	3,1051	7,0860	5,3284
0,3	0,0174	0,0108	0,0271
0,1	0,0325	0,0418	0,0323
B	8,4704	20,3192	13,9947

Source: own processing

According to Table 2, the resulting values of the creditworthiness index in each monitored year are higher than 3, from which we state that the company is in an extremely good financial situation, if we take into account the interval determined by the creditworthiness index in theoretical assumptions. As in previous cases, we also subject a competing company to the same test for the creditworthiness index. The resulting values of the creditworthiness index of a competing company are shown in the following table 3.

Table 3: **The resulting values of the creditworthiness index for a competing company**

year	2016	2017	2018
B	17,1661	11,9190	19,4953

Source: own processing

In the following part, we will evaluate the financial situation and health of the monitored company according to the bankruptcy model IN05 in order to analyze whether the resulting values and especially their course differ from the previous creditworthiness index, which we dealt with in the previous calculation. Table 4 below shows the calculation of the individual indicators for the bankruptcy model IN05. All the indicators listed in Table 4 are ratios of the quantities in question for the calculation of the IN05 bankruptcy model.

Table 4: **Calculation of indicators for the bankruptcy model IN05**

indicator	weight	2016	2017	2018
A	0,13	8,6019	7,4995	8,6426
B	0,04	367,8788	1466,9091	1134,1818
C	3,92	0,2015	0,5913	0,3439
D	0,21	0,9796	1,3311	0,9198
E	0,09	9,3336	7,1559	10,0000
Value of IN05		17,6690	62,8928	48,9321

Source: own processing

Based on the results from Table 4, we state that the company monitored by us forms a value, as the value of the IN05 index is greater than 1.6 in each of the monitored years, which is the value that according to the theoretical assumptions of the IN05 bankruptcy model. The following Table 5 shows the resulting values of the IN05 index for a competing company.

Table 5: **The resulting values of the IN05 bankruptcy model for a competing company**

year	2016	2017	2018
Value of IN05	**66,1165**	**66,0046**	**71,3982**

Source: own processing

According to Table 5, the competing company achieves higher values within the measurement of the value of the bankruptcy index IN05, which supports the results achieved in the previous parts of the work.

Comparison of the results of the creditworthiness index and the IN05 bankruptcy model

In the following subchapter we will compare the results achieved in our work using the creditworthiness index and the bankruptcy model IN05. In order to be able to compare the results of both models in the company we are monitoring and in a competing company, we need to know whether the resulting data for individual data are interrelated. For

this purpose, we performed a simple test of linear correlation using Pearson's correlation coefficient in Table 6. According to Pearson's correlation coefficient, the results of individual measurements using different indices are dependent, as their value is close to 1. Based on this test, we will consider the results in our financial analysis. both models.

In the company we monitored, we can observe a strong correlation between changes in the results of both examined indices. In the case of a competing company, the change in the values of both indices does not have a correlation to the same extent as in the case of the company we are monitoring.

Table 6: **Pearson's correlation coefficient between the resulting values of the creditworthiness index and the IN05 index in the observed period**

Company	Pearson's correlation coefficient
ABC	0,9673
Competing company	0,749

Source: own processing

After a simple correlation test, in Table 7 we quantified the outputs of the creditworthiness index and the IN05 bankruptcy model according to the relative change of the indicator compared to the previous period, for the company we examined and for the competitive one.

Table 7: **Comparison of the percentage year-on-year change in the surveyed indices in both companies**

|	2017		2018	
ABC	**B**	**IN05**	**B**	**IN05**
annual change (%)	+139,88	+255,95	-31,13	-22,2
Competing company				
annual change (%)	-30,57	-0,17	+63,57	+8,17

Source: own processing

The correlation can be seen in relative terms, if one index decreases and the other decreases, and vice versa, if one increases, we see an increase in the other, although to a different extent.

Conclusion

After showing the percentage year-on-year change, we showed in Figure 1 the course of the absolute value of both examined indices for both companies. In both examined companies we state an increase in creditworthiness for the observed period. In the case of our selected company ABC, it was a year-on-year increase in 2017 compared to 2016 and a subsequent decline in 2018. In the last year of the period under review, however, according to both indices, the company showed a higher credit rating than at the beginning of the period under review. In the case of a competing company, we observe a slight decline in creditworthiness in 2017, followed by growth in 2018. In this case, too, the competing company shows greater stability, as the resulting values in Graph 1 do not differ significantly and remain constant.

Figure 1: **The course of the value of the creditworthiness index and the IN05 index for the researched company ABC and a competing company**
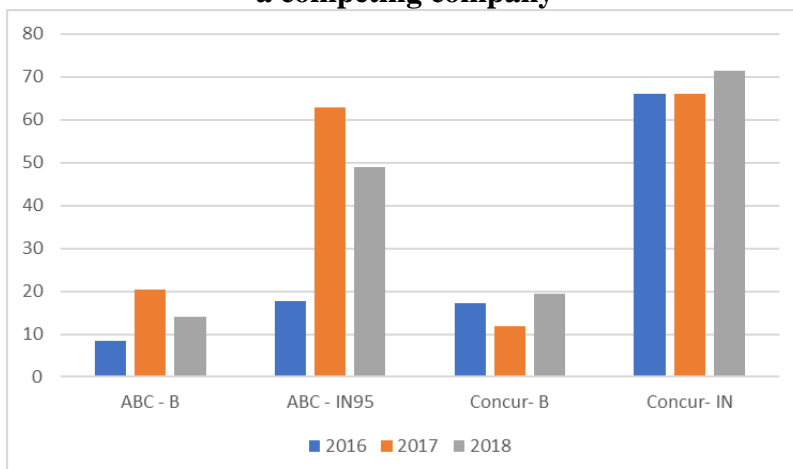
Source: own processing

In our research, we focused on the financial analysis of a company whose purpose is not to make a profit. Which means that even the achie-

ved values for selected prediction models are higher than normal results. We reiterate that with this paper we wanted to point out the non-existent methods of evaluating the performance and predictions of companies accounting in the system of simple accounting. From the achieved results in the previous subchapters of the analytical part of the work, we can state that the company is generally in excellent financial condition.

When evaluating the financial situation of the company and calculating its creditworthiness, we came to the conclusion that the company is currently in a safe zone outside the zone of immediate threat to the company's financial health. However, the creditworthiness index and the IN05 bankruptcy model are primarily designed to assess the financial situation of companies set up for profit. For this reason, we do not recommend giving the company much weight for its needs and to continue to manage prudently.

These tests have shown that the company is creditworthy, but since the mentioned methods are designed primarily for companies focused on generating profit, we can not take the resulting values as sufficient in our case. For this reason, in the following research we will try to find a suitable system and methods for measuring the performance of non-profit organizations in the conditions of the Slovak Republic.

Overall, we evaluate the objectives of the contribution as fulfilled, as we were able to analyze a non-profit organization by transforming simple accounting into double-entry bookkeeping.

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