Company bankruptcy and its prediction in conditions of globalization

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Abstract. The internationalisation and globalisation of today's world, especially in business, brings whole new range of opportunities, challenges and also many kinds of risks. Today´s global market in process of globalization offers many different ways of doing business and also whole new ranges of methods how to analyse optimize and also minimize it´s risks. The issue of bankruptcy models is still relevant given by the high competition in the markets and the increasingly frequent crises. Not only in the world, but also in our country, we can see a huge number of bankruptcies of businesses. If the company wants to thrive and successfully compete in the market environment, it should conduct a regular financial analysis of its activities, evaluate successes and failures, and use the results obtained to make strategic decisions about future business development. The aim of the article is to examine the possibilities of predicting the bankruptcy of companies and describe their individual procedures. In the first part of the paper we defined the terms such as insolvency, decline of company and bankruptcy. We continue with a brief overview of the development of bankruptcy models from the first attempts to modern practices. We have described and defined each model in detail, described its specifics, and described the calculation procedure. The biggest added value of this paper is a comprehensive elaboration of an overview of the possibilities of predicting company manrots through bankruptcy models. We can say that the goal of the post has been fulfilled.

1 Introduction

Businesses are currently in an economic environment that is constantly evolving and changing, depending on many different factors. After the centrally planned economy and the transition to a market economy system, firms in the Slovak Republic had to adapt not only to the changing state system, but also to the harsh emerging competitive environment. After more than a decade of transition, businesses faced another challenge, namely joining the European Union and then Schengen. This opening of economic space has given businesses a huge market, covering almost the whole of Europe, with many business

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opportunities but also new competitors. Survival in such an economic environment requires not only maintaining its business competitive advantage, but also quality financial management of the company, for which knowledge of the company's financial condition is important.

2 Methodology

The issue of forecasting the future development of the company's financial condition has been addressed by many economics since the beginning of the second half of the last century. The main aim of their scientific work was primarily to create models that would be able to predict with a sufficient degree of probability the future development of the company in advance. Multidimensional models assessing the overall financial situation of a company have proven to be one of the best methods by providing a single result value by combining individual ratios. This resulting value should be able to predict how the financial condition of the company will develop. The two main groups of multidimensional models are creditworthy and bankruptcy models. However, the distinction between creditworthy and bankruptcy models is not always so firm, as there are some creditworthy models capable of predicting the company's future insolvency, which in most cases is a precursor to bankruptcy. If we want to try to predict the bankruptcy of a company, it is necessary to define the basic terms.

2.1 Crisis in enterprises

In crisis management of the company, the problem is the precise definition of the concept of corporate crisis. In M. Synka, E. Kislinger et al. refers to: a stage in the life of an enterprise where, over a prolonged period of time, its performance potential unfavorably develops, a radical decrease in sales volume, a decrease in net assets, a reduction in liquidity, which directly threatens its continued existence if this development will continue [14]. Zuzak and König understand the crisis as a situation of varying length of time, in which the company decides whether to return to the pre-crisis state, or if the achievement of its business goals or the company's survival is prospectively threatened [19]. H. Pollak agrees with the previous authors and identifies the crisis as an economic situation in which the existence of a company is in jeopardy and its redevelopment is necessary [10].

2.2 Causes of the crisis

The reasons for which firms get into crises are the innumerable number, and they can operate individually or more at once. There are several divisions of causes of corporate crises in the scientific literature. This issue is dealt with by a very comprehensive publication by Zuzak and Königova, from which the theoretical basis for this subchapter is drawn. The causes of the business crisis can be caused by the different risk situations in which the business may be located [19].

In his publication Zuzak divides them as follows [19]:
1) Internal and external economic risks - In this case, risk factors from other areas are projected. The company has a limited opportunity to influence them, but is able to predict the effects of some factors and to some extent to insure against them.
2) Supply and customer risks - These risks may be caused directly by the supplier and the customer or arise from force majeure. A common phenomenon is passing the problems of the supplier or customer to the company.
3) Manufacturing, technical and technological risks - These are risks resulting from the operation of technological equipment, for example, fatigue of material, failure

to maintain or operator error. Subsequent product offerings may lack certain technical parameters or required quality.

4) Information risks - Information risks are divided into three groups, data, software and hardware. This is primarily the failure of information systems, data security and software from misuse.

5) Social or occupational risks - In this case, the behavior of workers is in most cases a reflection of the employer-employee relationship and also the perception of the business by customers.

6) Market risks - They arise from the business activities of the enterprise towards the surroundings. Customers and competitors can respond to these activities, endangering business goals with potentially undesirable financial impact.

7) Political risks - There may be a variety of business-undesirable situations when changing or behaving political systems.

8) Legislative risks - Consequences for undertaking adverse changes in legislation, whether in its own state or in the state of commerce. Business interest should be an effort, individually or through 'lobbying' groups, to change or mitigate such legislation.

2.3 Symptoms of crisis

In the previous sub-chapter, the reasons why businesses could go into crisis were presented. But how to identify this unfavorable situation in advance? The views vary across experts, but what is extremely important for companies is to be able to detect the coming crisis in a timely manner. According to Pollak, the first signs that a company is in trouble have been reflected in the management of the company for several years before they reach the financial statements. It adds that this is mainly due to management's efforts to conceal the adverse situation of the company. It defines the main symptoms as follows [10]:

1) Lack of management - The primary cause of problems in the company is unqualified or narrowly focused management. For small or family businesses, it is often the case that one dominant person is in the management of a company, who is difficult to replace after leaving and the company is subsequently sentenced to dissolution.

2) Slow response to change - It is known from practice that a fast-growing, successful enterprise will become cumbersome due to slow reactions to new circumstances and self-satisfaction. Management is focused on the success of the past and overlooks the gradually emerging shortcomings, which leads to decreasing product quality or obsolescence, shortage in the organization of the company, backward production technology and others.

3) Insufficient information system - The third symptom of emerging problems in the company is the failure of communication. However, the primary concern is not the insufficient number of reports or statistics within the company, but their sufficient selection. Unless accurate and targeted information is available to management, it is not possible for it to make informed and beneficial business decisions.

2.4 Altman's bankruptcy model

The Altman model (1968) is without a doubt one of the best known bankruptcy models. E. I. Altman analyzed 66 businesses, one half being prosperous and the other half bankrupt. He chose companies between 1946 and 1965. The author identified 22 potential financial indicators, which can be divided into 5 groups: indicators of activity, liquidity, profitability, indebtedness and solvency. Finally, he developed a discriminatory function consisting of five financial indicators, which he used to calculate the Z score [2, 4].

$$Z = 1,2\,X_1 + 1,4\,X_2 + 3,3\,X_3 + 0,6\,X_4 + 1\,X_5$$

X1 = net working capital / assets
X2 = retained profit / capital
X3 = profit before interest and taxes / capital
X4 = market value of equity / foreign capital
X5 = sales / capital

The interpretation of Z score is as follows:
Z > 2.90   the financial situation is good
1.81 < Z ≤ 2.90   the so-called gray zone
Z ≤ 1.81   critical financial situation, threatening bankruptcy

As a result of the specifics, Altman constructed a model for US publicly traded companies in 1983. In Indicator X4, in market capitalization he used equity. The new discriminatory function already had other weights for variables and limits for determining bankruptcy [3].

$$Z = 0,717\,X_1 + 0,847\,X_2 + 3,107\,X_3 + 0,420\,X_4 + 0,998\,X_5$$

The interpretation of Z score is as follows:
Z > 2.60   the financial situation is good
1.10 < Z ≤ 2.60   the so-called gray zone
Z ≤ 1.10   critical financial situation, threatening bankruptcy

2.5 Tafler model

Another model that assesses the risk of bankruptcy is the Taffler model (1983), which is based on the Altman model methodology. Taffler considered that the indicators of the degree of funding and profitability were decisive for predicting bankruptcy. Liquidity indicators are less important. The design was based on a sample of British manufacturing companies from 1969 to 1975, half of them bankrupt and the other half showed no signs of a bad financial situation. The Taffler model (1983) uses four ratios: profitability, financial risk, working capital adequacy and liquidity.

$$T = 0,53\,X_1 + 0,13\,X_2 + 0,18\,X_3 + 0,16\,X_4$$

X1 = profit before interest and taxes / short - term liabilities
X2 = current assets / foreign capital
X3 = short - term liabilities / total assets
X4 = sales / total assets

If the value of T > 0.3 this means a very low probability of bankruptcy, the company is highly liquid. If T < 0.2 the company is in a risk area, which predicts a high probability of bankruptcy. The authors recommend comparing only companies within the same sector.

2.6 Indexes IN

The IN index group includes 4 models based on mathematical statistics methods. The acronym IN bears the initials of the creators, spouses Inca and Ivan Neumeier. These are bankruptcy models used to predict the financial health of businesses in the Czech Republic, more precisely industrial enterprises. The Czech Republic and the Slovak Republic are similar in several economic fundamentals, therefore it is possible to successfully apply

these methods also in our conditions in the Slovak Republic. The first model was IN95, which was later modified to IN99, IN01 and finally to the latest version of IN05.

2.6.1 IN 95

The IN95 index is also referred to as the trust index or creditor model. The construction of the index is based on the financial statements of Czech companies and is the result of an analysis of 24 empirical-inductive indicator systems [2, 5]. IN95 does not contain any indicator working with the market value of the company. The index was verified on the data of thousands of Czech companies in 1994 and the index shows a 70% success rate prediction of the company's financial situation.

$$IN95 = V_1 X_1 + 0.11\,X_2 + V_3 X_3 + V_4 X_4 + 0.10\ X_5 + V_6 X_6$$

X_1 = total assets / foreign capital
X_2 = EBIT / interest expense
X_3 = EBIT / total assets
X_4 = total revenues / total assets
X_5 = current assets / short-term external resources
X_6 = overdue payables / sales

The interpretation of IN95 is as follows:

$IN95 > 2.00$	the enterprise outside financial distress
$1.01 < IN95 \le 1.99$	the so-called gray zone
$IN95 \le 1.10$	the enterprise is in financial distress

2.6.2 IN 99

The IN99 index focuses on the performance component of the business, which is the meaning of the existence of the business and represents the main interest of the owner. The success rate of this index is higher than 84%. IN99 adjusts the weights used in the IN95 index to achieve a positive EVA value.

$$IN99 = -0.017\,X_1 + 4.573\,X_2 + 0.481\,X_3 + 0.015\,X_4$$

X_1 = total assets / foreign capital
X_2 = EBIT / total assets
X_3 = total revenues / total assets
X_4 = current assets / short-term external resources

The interpretation of IN95 is as follows:

$IN99 > 2.07$	the company achieves positive economic profit
$1.42 \le IN99 \le 1.99$	an ambiguous situation, but the enterprise is more of a value
$1.089 \le IN99 \le 1.42$	it is a problem to determine whether or not an enterprise creates value
$0.684 \le IN99 \le 1.089$	rather, the enterprise does not create value
$IN95 < 0.684$	the company has a negative economic profit

2.6.3 IN 01

The index IN01 is referred to as a complex variant of the IN index. This index is the result of a discriminatory analysis of the financial indicators of 1915 enterprises, which were divided into a group of 583 value-generating enterprises, a group of 503 bankruptcy enterprises and 829 other enterprises. It is mainly used in industry and has a bankruptcy character [6, 12]. The index shows a success rate of 74% for bankruptcy and 69% success for value creation. The form of the discriminatory function is as follows:

$$IN01 = 0,13\,X_1 + 0,04\,X_2 + 3,92\,X_3 + 0,21\,X_4 + 0,09\,X_5$$

X1 = total assets / foreign capital
X2 = EBIT / interest expense
X3 = EBIT / total assets
X4 = total assets / foreign capital
X5 = current assets / short-term external resources

2.7 Springate model

The Springate model was created in 1978 by Gordon L.V. Springate based on Altman model. Based on a multidimensional discriminatory analysis, he chose 4 out of 19 ratios. This model chooses indicators to identify shortcomings in the areas of revenue, liquidity and profit [8, 11].

$$S = 1,03\,A + 3,07\,B + 0,66\,C + 0,4\,D$$

A = net working capital / assets
B = EDIT / assets
C = EBT / short-term liabilities
D = sales / assets

The model achieves a 92% success rate prediction of financial problems when applied to 40 businesses. If the values of S are less than 0.862, then we can very likely expect some problems because the company has poor financial health.

2.8 Fulmer model

This model was published by Professor Fulmer in 1984. The Fulmer model is designed for small and medium-sized businesses. It originally analyzed 60 companies using 40 indicators. Half of the businesses were successful and the other half showed financial problems. The author reports a 98% accuracy rate for one year before bankruptcy and an 81% accuracy rate for more than one year before bankruptcy. If the value of F> 0 the company is without problems, but if the value of F <0, the company is going into bankruptcy [9, 15]. The form of the discriminatory function is as follows:

$$F = 5{,}528\,X_1 + 0{,}212\,X_2 + 0{,}07\,X_3 + 1{,}27\,X_4 - 0{,}12\,X_5 + 2{,}335\,X_6 + 0{,}575\,X_7 + 1{,}083\,X_8 + 0{,}894\,X_9 - 6{,}075$$

X1 = retained earnings / assets   X6 = current liabilities / assets
X2 = sales / assets   X7 = logarithm tangible fixed assets
X3 = EBT / equity   X8 = net working capital / foreign capital
X4 = cash flow / foreign capital   X9 = log (EBIT / interest expense)
X5 = debts / assets

2.9 Beerman model

The Beerman model was created using discriminatory analysis and is used to assess and forecast the financial-economic situation, particularly in manufacturing companies. The author does not recommend using this method in commercial companies. According to Beerman, the following 10 indicators are relevant [14]:

$X1$ = depreciation of tangible fixed assets / Initial balance of tangible fixed assets + Increment

$X2$ = additions to tangible fixed assets / depreciation of tangible fixed assets

$X3$ = EBT / sales

$X4$ = liabilities to banks / foreign capital

$X5$ = inventory / sales

$X6$ = cash flow / foreign capital

$X7$ = foreign capital / assets

$X8$ = EBT / assets

$X9$ = sales / assets

$X10$ = EBT / foreign capital

Based on discriminatory analysis, Beerman created the following formula:

$$BE = 0{,}217\,X_1 - 0{,}063\,X_2 + 0{,}012\,X_3 + 0{,}077\,X_4 - 0{,}105\,X_5 - 0{,}813\,X_6 + 0{,}165\,X_7 + 0{,}161\,X_8 + 0{,}268\,X_9 + 0{,}124 X_{10}$$

3 Results

The previous chapters offered us an insight into the issue of the company's bankruptcy prediction. We had the opportunity to find out that there are many ways to predict the default situation. But how to find out which model is the most suitable? The answer to this question is simple. The best model is one that minimizes type 1 and type 2 errors while showing a high percentage of correct classification [7, 17]. However, the problem may arise at the moment when it is necessary to determine a particular model or at least the method that would be most accurate in a given situation. From this we can deduce why such a large number of bankruptcy models and their modifications are used. Many authors such as Anadarajan et al., or Shunway find the early causes of this problem [1,13]. The main point is that each author uses different time periods when creating his model, classifies bankrupt companies in different ways, different sample of companies, sample is created in the countries of the country, but the fact that the ratio of bankrupt entrepreneurs v differs in the examined samples. Even studies that deal with the problem of evaluating individual methods often times to conflicting results. Muller, Steyr-Bruwer and Hamman tried to compare some selected techniques [7, 16]. The aim of their work was to investigate whether some techniques predicted bankruptcy with better predictive power than others. The comparison was made on data of South African stock exchange companies. As a result of their analysis, each method produced different results. Next, they tried to test the effectiveness of the individual bankruptcy models Wu, Gaunt and Gray [18]. They conducted 49,724 non-bankruptcy and 887 bankruptcy American companies that were traded on the stock exchange. Their outcome was that multiple discriminant analysis yielded worse results than other models used. The results of the logit and probit models were fair, especially during the first years of the reporting period, which was in the years 1980-2006, and over time their predictive skills deteriorated.

4 Discussion

Based on these statements, we can say that the need to predict possible bankruptcy of companies is high. This may be due to the need to effectively minimize investment or credit risk, or to identify potential problems in a timely manner and to try to avert bankruptcy. There are many models of bankruptcy prediction in the world, and even more changes and modifications. This may be due to the high need for bankruptcy prediction or the absence of a generally valid model. From the mentioned individual descriptions of the models, their quantification, but mainly from the quantities involved in the calculation, we can see the effort to optimize individual calculations in order to identify potentially bankrupt company as effectively as possible. However, this optimization inevitably results in individual models functioning only under specific conditions. Individual models are targeted and optimized to deliver good performance only in a particular economic sector, in a particular market situation, only when applied to a business in a particular region and so on. If there is an effort to unify and develop a universal predictive bankruptcy model, then research should take exactly the opposite direction, namely the generalization of the individual variables examined. However, this can be hindered by different legislative amendments to tax reporting.

5 Conclusion

The aim of the article was to examine the possibilities of predicting the bankruptcy of companies and describe their individual procedures. In the first part of the paper we defined the terms such as insolvency, decline of company and bankruptcy. We continued with a brief overview of the development of bankruptcy models from the first attempts to modern practices. We have described and defined each model in detail, described its specifics, and described the calculation procedure. The biggest added value of this paper is a comprehensive elaboration of an overview of the possibilities of predicting company manrots through bankruptcy models. We can say that the goal of the post has been fulfilled.

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