ASSESSMENT OF THE PRACTICAL APPLICATION OF CORPORATE BANKRUPTCY PREDICTION MODELS

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crossref http://dx.doi.org/10.5755/j01.em.17.3.2106

Abstract

In order to accurately and objectively evaluate the performance of the company and to determine the factors influencing the company's financial condition and results of operations, it is necessary to use an integrated methodology of bankruptcy forecasting. The aim of the article is to evaluate the validity of conceptual economic principles in bankruptcy prediction models and evaluate the potential practical application of these models. To achieve the aim of the article and using comparative literature analysis and descriptive approach the summarize of corporate bankruptcy prediction models is done in the theoretical aspects, empirically tested the appropriateness of their application in real situations, assessed the dynamics of corporate bankruptcies and trends in Lithuania in 2006-2010. In order to clarify the reliability of bankruptcy prediction models as well as using current bankruptcy tendencies of Lithuanian companies the probability of bankruptcy in companies is evaluated, which usually meets at least one failing business signs: 1. the company is attributed to small and medium seized business category; 2 .According to the classification of economic activities, company is attributed to wholesale or retail trade, construction or manufacturing industry; 3. The company operates in metropolitan of Lithuania. The probability of bankruptcy is evaluated in five currently operating companies and two already bankrupted companies using Altman, Springate, Zavgren and Chesser models. After the verification of availability and application of bankruptcy prediction models in seven companies, findings show that linear discrimination model reflects the most accurate financial condition of the company. Whereas the results of logistic analysis model do not reflect the actual performance of the the company and there is no purpose to use it for bankruptcy forecasting.

Keywords: corporate bankruptcy, corporate bankruptcy prediction models.
JEL Classification: D22, E37.

Introduction

Practice shows that a high standard of living which determines country's economic situation, are the competitive companies in the international market with high labour productivity and the ability to create new products and services. However, there is natural corporate development and corporate bankruptcies in the market economy. The importance of prior diagnosis of corporate bankruptcy is becoming more important, because of the hard economic period and the growing number of bankrupted companies in Lithuania. In the scientific literature (Bivainis & Garškaitė 2000; Purlys 2001; Bradley & Cowdery 2003; Grigaravičius 2003; Purlys 2003; Sakalas & Virbickaitė 2003; Garškaitė & Garškienė 2003; Grigaliūnienė & Cibulskienė 2004; Charitonovas 2004; Purvinis *et al.*, 2005; Mackevičius & Rakštelienė 2005; Mackevičius & Silvanavičiūtė 2006; Platt, & Platt, 2006; Adnan & Humayon 2006; Jakševičienė & Paliušytė. 2006; Stoškus *et al.*, 2007; Garškaitė 2008; Januševičiūtė & Jurevičienė 2009; Mackevičius 2010; Rugenytė *et al.*, 2010) the corporate bankruptcy prediction models are considered in theoretical terms, but there is lack of attention paid to evaluate their suitability. Practice shows that it is not enough to calculate a few ratios for the probability of bankruptcy. In order to accurately and objectively evaluate the performance of the company and to determine the factors influencing the company's financial condition and results of operations, it is necessary to use an integrated methodology for bankruptcy prediction.

Research object - corporate bankruptcy prediction models. This study aims to evaluate conceptual principles of the validity and potential practical application in the bankruptcy prediction models. Thereby the following goals were raised: to summarize and organize theoretical models corporate bankruptcy prediction and identification; to present the dynamics of corporate bankruptcies in Lithuania in 2006 – 2010; Check the suitability and reliability of theoretical corporate bankruptcy prediction methods in the Lithuanian business enterprises. Rresearch methods: a comparative analysis of scientific literature, statistical data analysis, corporate financial report analysis and the methodology for calculating the probability of bankruptcy.

The substance of bankruptcy and forecasting models theoretical concept

In the scientific literature bankrupt both financially and legally is defined quite differently. Bankruptcy, as an interpretation of the concept is related to the environment in which scientific research is

conducted, organized scientific transactions, laws and aspects on the basis the bankruptcy analysis is carried out (Lileikienė & Kulyčienė 2009). In the scientific literature (Bradley & Cowdery 2003; Sakalas & Virbickaitė 2003; Grigaravičius 2003; Charitanovas 2004; Sneidere 2005; Mackevičius & Silvanavičiūtė 2006; Mikuckienė 2007; Rugenytė *et al.*, 2010) usually bankruptcy is defined as the inevitable existing market situation, showing that the company can not fulfill all its commitments, i.e. it fails to settle with creditors within the statutory time limit in law acts and due to that can not continue their activities.

The concept of bankruptcy is generally associated with the legal aspects of law, i.e., creditors and debtors in their favour law to defend their rights when borrowers are unable and unwilling to pay its' debts and at the same time related to insolvency an usually insolvent company is often synonymous with bankrupted one, and often these terms are considered equivalent.

Depending on the type of company activity, the objectives of leadership and the expedience of risk assessment, bankruptcy can be real, technical, intentional and dummy. Real bankruptcy is published in the company which fails to comply with its obligations, is insolvent, in the future its financial stability can not be restored and no longer make sense to carry out economic activities, so it is discontinued. The technical bankruptcy, it is the companies' state of insolvency due to the lengthy indebtedness of debtor which amount exceeds the amount of financial liabilities. Technical bankruptcy can be stopped if it is transferred to anti-crisis management company in time. Fictitious and deliberate bankruptcy – assumed the insolvency or bankruptcy announcement of the company, on the purpose to delay payments or reduce the amount of debt. Real bankruptcy can be avoided if the necessary decisions are taken in time, intentional and dummy bankruptcy - conscious company management operating result for certain purposes.

According to bankruptcy implementing manner and Lithuanian Republic Enterprise Bankruptcy Law there to two types of bankruptcy: extrajudicial and judicial. Extrajudicial bankrupt – when a company - a debtor declares an inability to fulfil its obligation and in written inform each creditor. In extrajudicial way the process of bankruptcy can not take place if the company has instituted a case in which are made legal property claims or are recovered by the courts or other executive documents of authorities. Judicial bankruptcy proceedings may be taken by the court where the company has its seat.

Considering the nature of bankruptcy, there are appointed (Mackevičius 2005; Рукинов 2006) failed, false and reckless corporate bankruptcies. Failed bankruptcies are formed due to unforeseen circumstances (e.g., natural disasters, the country's political instability and crisis, borrowers and others.). False corporate bankruptcies related to the conscious management of the company activities in order to avoid paying debts and trying to hide assets. When a company goes bankrupt due to high-risk operations, inefficient operations, the lack of evaluation in the changing economic situation, the reckless corporate bankruptcies are formatting.

Practice shows, that the likelihood of the company bankruptcy to determine is insufficient to calculate several comparative indicators. In order to evaluate as accurately as possible and more objective the business transactions of the company and economic events, to reveal the factors, making the most affecting impact for the company financial position and performance, it is necessary to use an integrated bankruptcy prognosis methodology. In the scientific literature (Mackevičius & Silvanavičiūtė 2006; Ooghe & De Prijcker 2007; Ooghe & Spaenjers 2009; Rugenytė et al., 2010) is suggested all bankruptcy prognosis models divided into two major groups: classical statistical and artificial intelligence.

Classical statistical models include linear discriminant analysis and logistic regression models. Linear discriminant analysis models linear function basis provides dependence between probability of bankruptcy, as the dependent variable, and the independent variables – financial indicators of the company. Linear discriminant analysis models include Altman, Springate, Taffler and Tisshaw models. Logistic regression model mainly include Zavgren and Chesser created models. Artificial intelligence models consist of the decision tree and the neural networks.

The biggest theoretical and practical significance for the bankruptcy prognosis has Edward Altman works. According to (Kuruppu et al., 2003), precisely these models can help as accurately as possible to assess the status of business continuity. The essence of this model (Chuvakhin & Wayne Gertmenian 2002; Mackevičius & Silvanavičiūtė 2006; Stundžienė & Boguslauskas 2006; Mackevičius 2005; Stoškus et al., 2007; Mavlutova & Leshinskis 2007; Nedzveckas et al., 2003; Garškaitė 2008; Ooghe & Spaenjers 2009), is that the company operational wide range of areas are evaluated by financial indicators from which resumptive comprehensive Z coefficient is derived (see Table 4). Depending on the coefficient Z size it is concluded that the probability of bankruptcy is as follows: the smaller coefficient Z value, the bankruptcy probability is higher. It can be stated that he majority of classical statistical models for the bankruptcy

prognosis are the primary, i.e., Altmano model modifications. At present, this model is widely used by scientists, financiers, investors, creditors and other market participants (Stundziene & Boguslauskas, 2006).

Linear discriminant analysis models are complement by Springate model, which consist of four variables (Mackevičius & Silvanavičiūtė 2006; Nedzveckas et al., 2003). Model calculation methodology and analyzed variables are presented (see Table 5). If Springate coefficient Z value is lower than 0,862 – it is concluded that a company has a risk of bankruptcy. The scientist applied the model for 40 companies and indentified that bankruptcy can be determined with 92% accuracy, but the later studies showed that the accuracy of the model is only 83% (Nedzveckas 2003).

In order to find methodology which can be adapted to accounting and audit companies of the analysed business subjects for the continuity of action determine British scientist Taffler and Tisshaw analyzed 80 financial indicators, selected four most significant and concluded linear discriminate analysis bankruptcy prognosis model (Olejnik & Horvathova 2008; Bivainis & Garškaitė 2000; Garškaitė 2008). However, various authors interpret the general formula forming variables differently (see Table 1).

Table 1. Taffler ir Tisshaw model variations

Z = 0,53K_1 + 0,13 K_2 + 0,18 K_3 + 0,16 K_4	
Bivainis et al., 2000	K_1 = gross profit/current liabilities K_2 = Net working capital/liabilities K_3 = current liabilities/property K_4 = profit/property
Mackevičius 2005	K_1 = profit from sales/current liabilities K_2 = current assets/liabilities K_3 = current liabilities/property K_4 = income/property
Purvinis et al., 2005	K_1 = income/current liabilities K_2 = working capital/liabilities K_3 = current liabilities/property K_4 = sales/property
Mackevičius & Silvanavičiūtė 2006	K_1 = profit before tax/current liabilities K_2 = current assets/liabilities K_3 = current liabilities/property K_4 = (quick realized assets – current liabilities)/operating costs
Olejnik & Horvathova 2008	K_1 = profit before tax/current liabilities K_2 = current assets/foreign investments K_3 = current liabilities/profit K_4 = income/profit

In the model of Taffler and Tisshaw a central position occupies profitability which according to significance is so far as the other three financial indicators and even a little bit more. According to Taffler and Tisshaw, when calculated Z value is less than 0,2 company leaders is worth to worry, because it is a big probability for the company's bankruptcy. If you receive Z value higher than 0,3 – probability of bankruptcy is low. The main linear discriminant analysis model shortage was that the microeconomic factors were analysed, without taking into account the macroeconomic environment, structural economic changes, which may also affect company's' financial condition. In this context the logistic regression models were created, which calculate the probability of bankruptcy and besides the linear functions, the logistic regression function is used.

One of the first logistic regression models for the prognosis of bankrupt were used by Martin (1977) and Ohlson (1980). From the logistic regression models for the prediction of corporate bankruptcy are commonly used Zavgren ir Chesser models (Mackevičius & Silvanavičiūtė 2006; Adnan & Humayon 2006; McGurr & DeVaney 2005). In the model of Zavgren different ratios are used to predict bankruptcy, depending on, how old is the data of financial statements for the analysis. Depending on the calculated probability value is concluded what is the probability of bankruptcy of the company (Mackevicius & Silvanaviciute 2006). If we predict bankruptcy using Zavgren model, we firstly count Z value, as the expression of the linear function. After that, counted value Z is inserted into logistic regression formula (sea Table 6), and it is determined the bankruptcy probability in percentage. Using Chesser model, as same as first tame, with the linear discriminant analysis basis is counted Z value, which later is inserted into logistic regression function and it is obtained probability of bankruptcy (sea Table 7).

ISSN 2029-9338 (ONLINE)
ISSN 1822-6515 (CD-ROM)

After some time beyond the traditional statistical models in bankruptcy prediction with mathematical programming have been created so-called artificial intelligence models: decision tree and neural networks (Mackevičius & Silvanavičiūtė 2006; Nasir et al., 2001; Purvinis et al., 2005). Decision tree model selects features, which breaks companies to in bankruptcy and non-bankruptcy (Adnan & Humayon 2006). Artificial neural networks are used to model quite complicated nonlinear dependence. To determine the probability of bankruptcy with neural network model is used a computer programs, that from many indicators select these, which have the greatest impact on bankruptcy. Scientists Kumar and Bhattacharya (2006) emphasizes, that this method is more suitable for predicting short-term results than long-term. Computer programs evaluate not only the financial data, but also the country's economic and political factors on company probability of bankruptcy. Artificial intelligence models, compared to traditional statistical models are new and still under study. Therefore, they have not yet received wide recognition and are not widely used in practice (Lebedžinskaitė 2007). Currently there are quite a lot of artificial neural network modeling programs, starting from such popular packages, as Matlab accessories and finishing temporarily free programs, such as "Alyuda Forecaster" (Purvinis et al., 2005).

Dealing with the principles of diagnosis of corporate bankruptcy and on the basis of their Lithuania public limited liability companies operating financial data, the first Lithuanian bankruptcy prediction model is developed by Grigaravicius (2003). The author suggest a complex instruments and alternative methods model, which is appropriate to apply for potential Lithuanian companies for solvency difficulties to diagnose. Grigaravicius generated model is special because of fact that it has been adapted for Lithuanian companies, since it was thoroughly examined and evaluated Lithuania's economic environment (Grigaravicius 2003).

In the analyzed bankruptcy prediction models (Altman, Springate, Zavgren ir Chesser) is used 16 comparative financial indicators evaluating the company's profitability, liquidity, solvency, operating efficiencyand other activities. It appears that analysis of the relative rates is recurring, so you can identify the most popular financial indicators, which scientists perceive the most important and most significant corporate bankruptcy to predict. They are structured in Table 2.

Table 2. Bankruptcy prediction models of the relative rates

Financial ratios	The authors of bankruptcy prediction models and year of model creation					
	Altman (1968)	Springate (1978)	Chesser (1974)	Zavgren (1985)	Taffler ir Tisshaw (1977)	Occurrence of indicators
Operating capital/property	+	+				2
Retained profit/property	+					1
Profit before tax/property	+	+	+			3
Share capital at market value/liabilities	+					1
Sales income/property	+	+		+	+	4
Profit before tax/short-term liabilities		+			+	2
Money/peoperty			+	+		2
Sales income/money			+			1
Long term current tangible assets/equity capital			+			1
Operating capital/volume of sales			+			1
Money/short-term liabilities				+		1
Reserves/ sales income				+		1
Debtors/reserves				+		1
Long-term liabilities /(capital – short-term liabilities)				+		1
Profit from ordinary activities/(capital – short-term liabilities)				+		1
Operating capital /sales income						

Analyzed bankruptcy prediction models the main features are structured and summarized in Table 3.

Table 3. Bankruptcy prediction models comparative analysis

Criteria of comparison	Altman model	Springate model	Taffler and Tisshaw model	Zavgren model	Chesser model	Grigaravi-čius model
The model formed based on	Discriminant analysis	Discriminant analysis	Discriminant analysis	Logistic analysis	Logistic analysis	Logistic analysis
The model variable numbers	5	4	4	7	6	9
Model accuracy in percentage (one year ago)	90	83	97	82	78	The more accurate, the lower forecasting period

Many scientists believe, currently has not been created accurate method of forecasting corporate bankruptcy. It is appropriate to create each branch of the economy or individual corporate bankruptcy probability assessment models. Each analyzed corporate bankruptcy prediction model reliability depends on the company added efforts, analyzing information about their activities, financial statements values changes and future of the business prediction accuracy. For the purposes of corporate bankruptcy risk assessment models, found high risk of bankruptcy, this should be viewed as a warning signal and perform again the company's external and internal environmental investigations, absolute financial indicators changes estimates, relative financial indicators calculations and estimates.

Business bankruptcy dynamics in Lithuania in 2006 – 2010

Enterprise Bankruptcy Law of Lithuania came into force in 15 October 1992., the first bankruptcy proceedings are instituted in March 1993. Corporate bankruptcy process is regulated by the Republic of Lithuania Enterprise Bankruptcy Law, adopted in 20 March 2001. In the period since 1993 till 31 December 2010 bankruptcy was published to 10 248 companies and 14 banks, of which 6 650 firms (64.9 percent) and 14 banks (100 percent). bankruptcy process is complete. At the end of 2010 the bankruptcy process was carried out to 3 598 companies from which liquidation is conducted to 2429 companies, 1169 companies the bankruptcy decision for further implementation of the bankruptcy proceedings had not yet been adopted (The Department of Enterprise Bankruptcy Management, 2010).

The beginning of economic recession and real estate crisis has had a very negative impact on Lithuania's corporate business. Disturbed account flow caused the bankruptcy settlement not for the one company. It is noted that the slowing Lithuanian economy rise corporate bankruptcies. In 2010 bankruptcy was proceeded to 1574 businesses, i.e., 14.6 percent. fewer companies than in 2009 (1844 companies). Number of completed bankruptcy proceedings in 2010 compared to 2009 grew by 22.2 percent.

When analyzing the trends of the bankruptcy proceedings by county it may be noted that in 2010 the biggest number of bankruptcy proceedings was started in Vilnius (37.7%), Kaunas (17.7%) and Klaipėda (15.1%) counties. In 2010, as in all other years, largely companies have gone bankrupt in Vilnius, Kaunas counties, least - Tauragė, Utena and Marijampolė. It is worth noting that most companies are failing in cities where there are more companies, so it is natural that the three largest cities of Lithuania lead by the number of companies in bankruptcy. Comparing the year 2010 to 2009 during the same period the number of bankrupt companies has fallen in many counties. Standout only Tauragė County, where the number of bankrupt companies increased by 22.2 percent.

Analysing failed and bankruptcy companies in the context of economic activities, it is worth noting that in 2010 the started bankruptcy proceedings decreased almost in all economic activities of enterprises. According to the Statistics Department during the period from 1993 to 2010 corporate bankruptcy proceedings by type of activity shows that the major part of the bankrupt company make the wholesale and retail companies (34.1 percent), manufacturing firms (21.7 percent) and construction companies - 14.5 percent. It is worth noting that most bankruptcies are in commercial - 407 (25.7 percent), construction - 333 (21 percent), manufacturing - 196 (16.5 percent) and transport and storage - 171 (12.6 percent) companies.

Compared 2010 to 2009, mainly the number of bankruptcies declined in manufacturing, transport and storage and construction activities companies. More bankruptcies initiated administrative and service activities, real estate, lodging and food service operations and water supply, sewerage, waste management activities of reclamation plants. Compared 2010 data to 2009 judicial bankruptcy proceedings decreased by 14 percent and extrajudicial proceedings fell 37.5 percent. In 2010 bankruptcy proceedings were initiated in

1549 firms (98.4 percent), 25 companies (1.6 percent) to start bankruptcy proceedings out of court when a debtor declares an inability to meet obligations and notify in writing to each creditor.

Analysing the corporate bankruptcies species may be noted that most extrajudicial bankruptcy are recorded in 2007 and accounted for 9.7 percent of the total number of corporate bankruptcies. It is also quite a large number of bankruptcies recorded in court in 2008, but it accounted only for 5.5 percent of the total number of corporate bankruptcy of the year. The lowest number of extrajudicial bankruptcy was recorded in 2006 and in 2010. They accounted for 29 and 25 of corporate bankruptcies respectively. As has been said bankruptcy might be intentional. Recognition of deliberate bankruptcy proceedings are generally considered a long time, because of that the bankruptcy case proceeding and execution are prolonged, and increases the administrative costs of the enterprise. According to the Enterprise Bankruptcy Management Department, since 1993 to 30 September 2009 bankruptcy proceedings were started to 14 banks and 8 214 companies from which deliberate bankruptcy was declared to one bank (ie 7.1 per cent.) and 30 firms (ie, 0.37 per cent.), of which four companies deliberate recognition of the bankruptcy was annulled. Many of the fraudulent bankruptcy is completed, in current 7 processes are carried out (fraudulent bankruptcy Review, 2010).

Since 1 January 2006 (Enterprise Bankruptcy Law provisions concerning the simplified bankruptcy process of coming into force) to the end of 2010, the simplified bankruptcy process was applied to a total of 1311 companies. In 2010 streamlined bankruptcy procedures were carried out in 251 company. Each year, the simplified bankruptcy is decreasing from 2006 to 2010, this type of bankruptcy proceedings decreased by 20 percent and in 2010 accounted for only 16.6 percent from the all started bankruptcy proceedings. Although the largest number of simplified bankruptcy number was recorded in 2009, which was applied to 306 companies, but it was only 16.6 percent from the number of all started bankruptcy processes.

Bankruptcy prediction models the practical application analysis

In order to ascertain the reliability of the bankruptcy prediction models and based on current bankruptcy trends in Lithuanian companies rated bankruptcy probability of companies, which fulfil at least one often bankrupt company features: 1. The company classified as the small and medium-sized business category; 2. According to the classification of economic activities the company classified as the wholesale and retail trade, construction or manufacturing industry; 3. The company operates in a Lithuanian big city. Probability of bankruptcy evaluated in five currently operating and in two bankrupt companies with Altman, Springate, Zavgren and Chesser models. Corporate bankruptcy probability is not calculated on the basis of Taffler and Tisshaw, also S. Grigaravicius models. Taffler and Tisshaw model unverified due to different interpretation of variable values, while Grigaravicius method not used for the lack of accuracy assessment in model. Since two companies are now in bankrupt, this allows the verification of analyzed models application in Lithuanian companies' appropriateness and determine whether they represent company's financial condition. For reasons of confidentiality, company names are not published and coded. According to Altman model for businesses whose shares are non quoted on the Stock Exchange the following results are presented in Table 4.

Table 4. Altman model relative indicators importance applied to companies

Financial ratios		Company A	Company B	Company C	Failing firm D	Company E	Company F	Failing firm G
The calculation model		**Z** = $0,717X_1 + 0,847X_2 + 3,107X_3 + 0,420X_4 + 0,995X_5$						
X_1	Operating capital/property	0,33	0,22	0,56	0,25	1,0	0,3	0,15
X_2	Sales income/property	2,05	1,35	0,94	0	16,7	-0,1	0
X_3	Profit before tax/property	0,11	0,09	-0,02	-0,14	-2,9	-0,14	-0,1
X_4	Equity capital/liabilities	0,69	0,93	14,02	0,79	0,9	0,5	0,7
X_5	Retained profit/property	0,29	0,33	0,67	0,29	0,8	0,9	0,2
Z value		2,927	2,324	11,088	0,804	7,03	0,95	0,5
The probability of bankruptcy assessment		Low	Low	Very low	Very high	Very low	Very high	Very high

ISSN 2029-9338 (ONLINE)
ISSN 1822-6515 (CD-ROM)

Companies, whose shares are quoted on the Stock Exchange (analized companies C, F and G), according to Altman model calculated Z coefficient to evaluate the results, used the following regularities: Z value is less than 1,80 - very high probability of bankruptcy, when Z value ranges between 1,81 and 2,79 - high probability of bankruptcy, and when the 2,80 and 2,99 – bankruptcy possible. Z coefficient value exceeded 3,00, states that the bankruptcy probability is very low. The remaining analyzed companies whose shares are not quoted on the Stock Exchange, subject to the results of the evaluation criteria: Z value is less than 1,23 - very high probability of bankruptcy, Z value ranges between 1,23 and 2,90 – bankruptcy is possible, but if it is higher than 2,90, this is a small probability of bankruptcy. The results show that B probability of company bankruptcy is possible (Z=2,324), and Company A and E should not go bankrupt in the near future (Z=2,927). Bankrupt companies D and G Z indicators states a fact, that it is very big probability of bankruptcy, what as a result, and happened. In this case, Z rate significantly lower than 1,23 (Z=0,804). However, it was considered of D company and previous year's results, which showed the opposite result, i.e., Z was received 6,8018, i.e., probability of bankruptcy was none. Upon such in bankrupt company D results showed, that a year ago the company operated at a profit, bankrupt due to adverse macroeconomic indicators changes and effects of the recession in the country. Calculated the probability of bankruptcy of seven analyzed companies according to Altman model, can be argued that they reflect the companies' financial situation, and the results show the suitability of these models to predict bankruptcy Lithuanian companies.

Adapted to predict a probability of bankruptcy Springate model (see Table 5). If Springate Z coefficient value is lower than 0,862 – it is concluded that the bankruptcy is unavoidable.

Table 5. Springate model value ratios applied to companies

Financial ratios		**Company A**	**Company B**	**Company C**	**Failing firm D**	**Company E**	**Company F**	**Failing firm G**
The calculation model		**Z** = $1,03X_1 + 3,07X_2 + 0,66X_3 + 0,4X_4$						
X_1	Operating capital/property	0,33	0,22	0,56	0,250	1	0,3	0,15
X_2	Profit before tax/property	0,11	0,09	-0,02	-0,14	-0,4	-0,14	-0,11
X_3	Profit before tax/short – term liabilities	0,22	0,18	-0,33	-0,26	-2,9	-0,5	-0,22
X_4	Sales income/property	2,05	1,35	0,94	0	16,7	0,9	0,2
Z value		1,6827	1,18	0,6823	-0,4487	4,6	-0,09	-0,25
The probability of bankruptcy assessment		Very low	Very low	Very low	Very high	Very low	Very high	Very high

Based on the selected Lithuanian company bankruptcy probability identification results according to Springate model, can be argued that the best financial position has the company A, the Z coefficient greater more than twice critical point (1,6827>0,862) and E (4,6>0,82). In company B, also the limit is exceeded, therefore, probability declared bankrupt to this company in the short term is projected very low. Profitable company C received z coefficient is below the critical limit (0,6823<0,862), however, the bankruptcy probability is high enough. Bankrupt company D last year's results (Z=4,08) showed, that the company over the coming year bankruptcy does not threaten, however, during the reporting year company's financial condition deteriorated significantly, thus probability of the bankruptcy increased to a very high (Z = -0,4487). Bankrupt company G results showed identical results both reporting and the previous year - probability go bankrupt very high. By Springate model of bankruptcy probability made report confirmed the suitability of the model prediction for Lithuanian companies. Springate linear discriminant analysis model results consistent with Altman and shows the companies' financial condition.

The bankruptcy prediction models application in Lithuanian companies have been adapted to the practical analysis and logistic regression Zavgren and Chesser models. Using Zavgren model, selected analyzed company bankruptcy probability to determine, based on, that if Z value is calculated by a linear equation and the result inserting into logistic regression equation, the result is more than 50 percent, it is concluded, that the probability of bankruptcy is high.

ISSN 2029-9338 (ONLINE)
ISSN 1822-6515 (CD-ROM)

Table 6. Zavgren model comparative indicators value applied for companies

Financial ratios		Company A	Company B	Company C	Failing firm D	Company E	Company F	Failing firm G
The calculation model		$Z = 0,11X_1 + 1,58X_2 + 10,78X_3 - 3,07X_4 - 0,49X_5 + 4,35X_6 - 0,11X_7 - 0,24$						
Logistic regression formula for calculating		$P_B = \frac{1}{1+e^{-z}}$ P – probability of bankruptcy; e – 2,71828; Z – linear analysis of the function						
X_1	Reserves/sales income	0,11	0,03	0,08	0	0,03	0,3	0,5
X_2	Debtors/reserves	1,66	12,73	0,55	39,13	7,7	0,5	0,2
X_3	Money/profit	0,2	0,06	0,03	0,0005	0,01	0,002	0,003
X_4	Money/short-term liabilities	0,38	0,12	0,06	0,0009	0,02	0,008	0,006
X_5	Operating profit /(capital- short-term liabilities)	-0,51	-0,24	0,35	0,35	-0,4	-1,9	1,09
X_6	Long-term liabilities/(capital- short-term liabilities)	-0,17	-0,04	-0,01	0	0	6,05	-1,3
X_7	Sales income/profit	2,05	1,35	0,94	0	3,5	0,92	0,2
Bankruptcy probability proc.		61,4	28	63	23,1	99	-	0,24
The probability of bankruptcy assessment		Very high	Low	Very hihg	Low	Very high	Low	Low

Calculated three-profitable companies A, C and E results, the coefficient z values is higher than 50 percent. Already in bankrupt companies G and also D company's financial condition, based on this model results are the best, because the probability of bankruptcy is accordingly company G, not even 1 percent, and D company 23 percent. Company F results also contradict with the previous used models. In this case, only overlapped company B results. Assessing the results, obtained by calculating the companies E and F probability of bankruptcy, it is important to note, that the probability of bankruptcy is difficult to calculate. Secondly the company E by Zavgren model have found significant probability of bankruptcy and such result is contrary to previously defined probabilities, which have been assessed as low or very low. Third, in order to adapt model of Zavgren, observed lack of relevant data issued by the companies in the financial statements.

Chesser model practical application presented in Table 7. Calculated Z coefficient value, probability of bankruptcy also shows the logistic regression formula result, and if it is less than 50 percent., can be argued, that the company bankrupt in the short term is unlikely.

Table 7. Chesser model, relative indicators value applied in companies

Financial ratios		Company A	Company B	Company C	Failing firm D	Company E	Company F	Failing firm G
The calculation model		$Z = -2,0434 – 5,24X_1 + 0,0053X_2 + 6,6507X_3 – 4,4009X_4 - 0,079X_5 + 0,1021X_6$						
Logistic regression formula for calculating		$P_B = \frac{1}{1+e^{-z}}$ P – probability of bankruptcy; e – 2,71828; Z – linear analysis of the function						
X_1	Money/profit	0,2	0,06	0,03	0,0005	0,01	0,002	0,003
X_2	Sales income/money	10,25	21,47	24,38	0	16,7	0,9	0
X_3	Profit before tax/profit	0,11	0,09	-0,02	-0,14	-0,4	-0,14	-0,11
X_4	Liabilities/profit	0,59	0,51	0,06	0,55	0,32	0,08	0,01
X_5	Long term tangible assets/equity capital	0,33	0,38	0,32	0,43	0,34	0,25	0,12
X_6	Operating capital/sales income	0,16	0,16	0,59	0	0,13	0,16	0
Bankruptcy probability proc.		0,76	1,97	9,6	14	13	8,7	0,12
The probability of bankruptcy assessment		Very low	Low	Low	Low	Low	Low	Very low

Analyzed company bankruptcy probabilities' applying this method is relatively small: probability of company A not even 1 percent. The bankrupt company D probability is the highest, although according to the model value is also low.

In conclusion, after getting the results of applied bankruptcy prediction models to Lithuanian companies, it can be stated, that the most accurate and reliable way to predict probability of corporate bankruptcy is linear discriminant analysis and it's Altman and Springate models, the results of which were consistent with the actual state of the company, except for Spring model projected unavoidable bankruptcy for company C. Logistic regression model's results are even contradictory with each other, not coincide with discriminant analysis methods results and did not comply with the company's financial position, so it is worth to doubt the suitability of these models to predict the company's bankruptcy.

Following the bankruptcy prediction models for Lithuanian companies verification, it can be concluded, that they cannot be completely trusted, not only because the companies often distorts the financial statements and the data does not reflect their real financial situation, but also because the scientists have created models for different time periods, different countries, differing in level of economic development, at competitive conditions and other features, different economic activities were used when developing companies financial data. It is appropriate to compare models' results with each other, calculate the riskiness of companies' performance indicators, and continuously monitor the company's financial condition changes.

Conclusions

After summarizing and structuring corporate bankruptcy prediction and determination of the theoretical models, it was noted that the focus is on classical statistics, i.e., linear discriminant analysis and logistic regression models for bankruptcy prediction. Artificial intelligence models, compared with traditional statistical models, are still new and not sufficiently investigated, and currently they have not yet received wide recognition and are not widely used in practice. Altman model has received most research attention, but the estimates are inconsistent. Some scientists have criticized it, others argue that there is no better model for predicting corporate bankruptcy created, but it needs to be improved by adjusting the values of its components. The british scientists Taffler and Tisshaw the variables consisting bankruptcy prediction model are interpreted differently by different authors, so it is very difficult to carry out the practical applicability of this model analysis, as it is unclear which figures in the calculations are reliable.

The comparative analysis of the bankruptcy prediction models showed that there are four most commonly used ratios: working capital and assets ratio, profit before taxes and assets ratio, sales revenue and sales of assets as well as income revenue and monetary relations. It means that when predicting bankruptcy it is important to evaluate how efficiently the company uses the assets to assure sales process and profit earning. While some authors ratios differ, but usually they want to emphasize the same and the largest relative share of assets profitability and asset efficiency indicators. Actually all bankruptcy prediction models use similar techniques, in some cases even similar financial ratios, but assigns a different assessment of the significance of corporate financial position changes and solvency.

The examination of statistical dynamics of corporate bankruptcies trends in Lithuania in 2006 – 2010 suggests that during the examined period there was observed upward trend in business bankruptcies, but in 2010 the number of corporate bankruptcies in Lithuania started to decline in almost all economic activities. Great part of the bankrupted companies are in the wholesale and retail business, manufacturing and construction companies. The analysis of the bankruptcy process under the County notes that the trend has not changed and most of bankruptcies were initiated in the country's largest counties: Vilnius, Kaunas and Klaipeda. The most common causes of bankruptcy in Lithuania are underestimated or not enough estimated competitive environment and enterprise performance risk factors. Also significant business failures are bad business administration. However, it is noted that increasingly companies go bankrupt due to the economic situation in the country, i.e., external causes become increasingly important reason of bankruptcy.

After the implementation of theoretical models for the diagnosis of bankruptcy and the calculation of seven analyzed corporate likelihood bankruptcies the relevance of theoretical prediction models and their reliability in the Lithuanian business enterprises was verified. Calculation of the seven companies analyzed the probability of bankruptcy by Altman and Spring models, can be stated that the results reflect the company's financial position, and as a result, these models can be used in Lithuanian business bankruptcy prediction. Atman linear discriminant analysis model results coincide with the Spring model. Meanwhile, logistic analysis models (Chesser and Zavgren) contradicts the results of linear discriminant analysis group model to analyze the results and do not reflect the financial position, so their application can be only partially or at all unreliable to predict the likelihood of bankruptcy for Lithuanian companies. It is assumed that one can not rely solely on one model and it is necessary to compare them with each other.

It should be noted that based on the bankruptcy diagnostic results, the reasonable investment and financial decisions are made, the available resources are evaluated, their use trends are estimated, and the developing forecasts of the company are prepared. Bankruptcy prediction reliability and efficiency depends on the company's ability to gather and compile information on their activities and make analysis of this information objectively and timely.

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