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## Bankruptcy prediction in the sector of construction in Lithuania

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### Abstract

The paper presents the results of the research in the application of bankruptcy prediction models in the sector of construction in Lithuania. During the financial crisis, many companies in the construction sector went bankrupt. Therefore, the research aims to reveal if conventional bankruptcy prediction models are applicable in this sector. The present study distinguishes by its broad scope that was targeted for the first time (521 companies whose bankruptcy was initiated in 2009-2013 were examined).

Moreover, empirical research provide conflicting results as well.

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### 1. Introduction

In order to identify the reasons of the deterioration of the company's financial state and factors which determine the financial decline of companies as early as possible, the executives must constantly carry out bankruptcy prediction. There are many models to predict bankruptcy, whereas a company must choose proper and the most accurate models of bankruptcy prediction.

Many of the researchers who have investigated various models of bankruptcy prediction have not come up to an agreement as to the suitability of bankruptcy prediction models for Lithuanian companies. Nonetheless, they emphasized that the academic research in the field must be continued. There is also a lack of research on the specifics of bankruptcy models' application in different sectors of economic activity. The object of the research is bankruptcy prediction of companies. The aim of the research is to investigate and evaluate the possibilities to apply bankruptcy prediction models in Lithuanian companies in construction sector. The formulation of the aim is drawn on the fact that mainly construction companies have gone bankrupt since the world crisis till now.

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## 2. The research of the application of bankruptcy prediction models in Lithuania

Lithuanian researchers have mostly applied the model of E.I. Altman to examine and apply bankruptcy prediction models. However, they have not reached a common agreement as to the application of this model in Lithuanian companies. Mackevičius and Poškaitė (1999) employed the methodology of the analysis of the financial statements' changes in several years and used the E. I. Altman model to examine the bankruptcy probably of several companies whose shares were quoted in stock exchange. The researchers arrived at the conclusion about the expediency of the E. I. Altman model. Mackevičius and Rakšteliienė (2005), having investigated 30 cases of bankruptcy, suggest applying all three Altman's models to predict bankruptcy in Lithuanian companies. According to them, prediction must be carried out every year because the results of a single year do not allow for a univocal conclusion. However Tvaronavičienė (2001), Purvinis, Šukys, and Virbickaitė (2004) keep to an even stricter opinion and maintain that this model is not appropriate to evaluate the insolvency of Lithuanian companies.

Mackevičius and Silvanavičiūtė (2006) examined the application of five classical statistical models: Altman (dedicated to evaluate companies whose shares are quoted in stock exchange), Springate, Taffler & Tisshaw, Zavgren and Chesser. The researchers have formulated the following statements regarding the prediction of bankruptcy in Lithuanian companies: 1) linear discriminant analysis models (Altman, Springate, Taffler & Tisshaare) are applicable; 2) bankruptcy prediction calculated according to the Chesser model was not accurate in all companies; 3) the Zavgren model is unreliable and inappropriate to predict bankruptcy in Lithuanian companies.

Garškaitė (2008) applied the Altman (all three), Liso, Taffler and Springate models in Lithuanian companies from a single economic branch and came to the conclusion that the results of the models nearly match the real situation, i.e., predict bankruptcy. However, the research is not strict as to the appropriateness of the models; she states that it is not advisable to rely blindly on each of the models and their suitability to predict bankruptcy in Lithuanian companies because the peculiarities of both the state's economy and activity of the company must be taken into consideration.

Kanapickienė, Rudžionienė, and Griauslytė (2008) investigated the suitability of six bankruptcy prediction models in Lithuanian companies of various size. The list of models includes: Altman, Springate, Taffler & Tisshaw, Zavgren, and the ones proposed by Grigavičius, Stundžienė & Boguslauskas. It was determined that the analysed models do not always precisely indicate the possibility of bankruptcy. The most appropriate ones to predict bankruptcy appeared to be that of Stundžienė & Boguslauskas (in the group of small companies) and Altman (in the group of large companies).

Karalevičienė and Bužinskienė (2012a) investigated modern models of bankruptcy prediction. After the investigation of ten companies, the research infer that the analysed models, with the exception of Romania Bankruptcy and Shumway models, are suitable for the prediction of a company's bankruptcy.

Scholarly research in Lithuania gives unanimous prospects of the possibilities to apply bankruptcy prediction models. It should also be noted that earlier research tackled small numbers of companies which could have determined a rather great inaccuracy of the results. The above mentioned reasons encourage evaluating the accuracy of bankruptcy prediction models by considering large numbers of companies as well as attesting real benefits of the acquired information.

## 3. Methodology of the survey to evaluate the applicability of bankruptcy prediction models in the construction sector

Lithuanian economy underwent essential changes during the period of independence: it had to orient to a new economic market system, enter new markets, change the structure of economy, and survive economic crises. Since 1993 till the end of 2012, there were 12922 bankrupts of companies and 15 bankrupts of banks. In the end of 2012, the bankruptcy process was over for 9042 companies (70%) and 14 banks. The growth of bankrupts was indicated during the crisis, namely, the process of bankruptcy was initiated for averagely 239 companies per quarter in 2008, whereas the number reached 461 companies per quarter in 2009. Since 2010 till 2011, the number of bankrupts declined: averagely 409 bankrupt companies per quarter in 2010; 318 bankrupts per quarter in 2011. In 2012, the number of initiated bankrupt processes has increased; it reached 335 initiated bankrupt processes per quarter (Statistics Lithuania, 2013). Huge scale of bankruptcy indicates that companies are not able to rationally evaluate

their financial status. The evaluation of a company's financial risk by applying the models of bankruptcy prediction might help a company to avoid going bankrupt.

While organizing the survey, first of all, the population, sampling, minimal screening scope and the method of source data acquisition were determined.

**Population.** After the evaluation of the tendencies of bankruptcy development in Lithuania and with regard to the statistics of the bankrupt companies, companies from the construction and transport sectors were selected for the present survey. The choice was determined by the following factors:

1. According to the data of the Statistics Lithuania, there were 84574 economic operators in Lithuania on 1 January, 2009, whereas on 1 January, 2013, the number was 86929. The majority of the economic operators is constituted by business units working in the fields of manufacturing, construction, wholesale and retail trade, and transport and storage (on 1 January 2009, respective to the type of the economic activity 8.7%; 8.4%; 26.3%; 7.2%; on 1 January 2013, 7.8%; 6.9%; 25%; 7.5% respectively).

2. What concerns these four major sectors, in 2009-2013, most of bankruptcy processes were initiated in the construction, wholesale and retail trade, transport and storage sectors (in 2009, respective to the type of the economic activity 23.6%; 23.2%; 14.9%).

3. The analysis of the sectors which show the highest bankruptcy rate reveals that the construction sector have the highest per cent of the bankruptcy processes initiated in the respective year regarding the whole number of economic operators in the sector registered in the beginning of the year (in 2009 6.1%; in 2013 4%).

**The population size.** The present survey investigates the construction companies whose bankruptcy processes were initiated in 2009-2013. That is, 1571 bankruptcy processes were initiated in the construction sector during this period.

**Sampling.** In statistic investigation, the survey related data is obtained by means of sampling. Sampling is defined as a part of the population selected for the survey which can properly and sufficiently represent the population and provide necessary information. The elements of the population for the survey were selected by means of probability sampling.

**Minimal screening scope.** The results of the sampling are always more or less inaccurate. This inaccuracy decreases, whereas the precision of the conclusions increases when the screening scope is extended. In order to evaluate the accuracy of bankruptcy prediction models and ensure the quality of the acquired data, empirical calculation of 521 companies whose bankruptcy processes were initiated in 2009-2013 was carried out. In this way the following results were acquired: 95% probability and 3.5% error in the construction sector.

**Source data acquisition.** Annual financial statements of 2007-2012 of the investigated companies were analysed. Since bankruptcy processes for the investigated companies were initiated in 2009-2013, the financial data of the companies was taken from the period of three years before the bankruptcy initiation.

#### **4. Explication of the survey results on the applicability of bankruptcy prediction models**

To achieve the aim of the research, i.e., to evaluate the applicability of bankruptcy prediction models in Lithuanian companies of construction sector, 5 classical statistical bankruptcy prediction models were chosen (see Table): 3 linear discriminant analytical models (Altman, Springate, Taffler&Tisshaw) and 2 logistic regression models (Chesser, Zavgren).

**Altman model.** By applying this model it was discovered that 388 companies out of 521 had a real bankruptcy threat one year before the bankruptcy initiation. In order to determine the accuracy of the model, the accuracy of the bankruptcy prediction model was calculated. It comprised 74.47% with regard to the total number of the companies in the sector. The accuracy of bankruptcy prediction model decreases when the period considered is two years before the bankruptcy initiation. It has been determined that 278 companies had a bankruptcy threat (the accuracy of the prediction model is only 53.35%). If the period of three years before the bankruptcy initiation is taken into consideration, the accuracy of the prediction model declines even more. Regarding the construction sector, there were 170 companies whose critical value Z-score indicated threat of bankruptcy which made 43.36% of the prediction model's accuracy. According to the scholarly literature (Karalevičienė & Buzinskienė, 2012b), in case the Altman model is applied the possibility to indicate bankruptcy probability is 95% one year before the bankruptcy

initiation. It reaches 72% two years before the bankruptcy initiation. Nonetheless, the survey has proved that the accuracy of the Altman model is much lower when it is applied in Lithuanian companies of construction sector: it is lower by 20 percentage points when bankruptcy is being predicted 1-2 years before bankruptcy initiation.

1. Table. Calculation of the probability of the Altman, Springate, Taffler & Tisshaw, Chesser, Zavgren bankruptcy prediction models

Year till bankruptcy	Altman model		Springate model		Taffler & Tisshaw model	
	Companies	Probability	Companies	Probability	Companies	Probability
1 year	388	74.47 %	453	86.94 %	224	42.99 %
2 years	278	53.35 %	347	66.60 %	155	29.75 %
3 years	170	43.36 %	210	53.57 %	100	25.51 %
Year till bankruptcy	Chesser model		Zavgren model			
	Companies	Probability	Companies	Probability		
1 year	483	92.70 %	403	77.35 %		
2 years	419	80.42 %	318	61.03 %		
3 years	259	66.07 %	260	66.32 %		

Source: created by the authors

Springate model. One year before bankruptcy initiation, 453 companies in the construction sector had a bankruptcy threat (accuracy of the model is 86.94%). When data of the two years period before the bankruptcy initiation is being examined, the accuracy of the model is 66.60%. The accuracy of the model decreases even more when the data is tested three years before the bankruptcy initiation. According to the scholarly literature (Kasilinga & Ramasundaram, 2012), the Springate model has reached 88% of accuracy. However, in Lithuanian companies of construction sector such accuracy is obtained only if the model is applied one year before bankruptcy initiation.

Taffler&Tisshaw model. Calculation revealed that this model is not accurate. It is possible to assume that the accuracy of the model is very low. Among the construction sector companies, 224 had a bankruptcy threat one year before the bankruptcy initiation (the accuracy of the model is 42.99%. When two years period before the bankruptcy initiation is considered, the bankruptcy prediction model shows the accuracy as it follows: 29.75%. Three years before the bankruptcy initiation the accuracy of the bankruptcy prediction model is even lower. Scholars indicate that the accuracy of the Taffle & Tisshaw model one year before the bankruptcy initiation is 97% (Mackevičius & Silvanavičiūtė, 2006). Nevertheless the application of the model in Lithuanian companies of construction sector shows the accuracy to be lower by 2.3 times.

Chesser model. A bankruptcy threat one year before the bankruptcy initiation was indicated in 483 companies (the accuracy of the model is 92.70%). Considering the data two and three years before the bankruptcy initiation in the companies, the accuracy of the model is 80.42% and 66.07% respectively.

According to scholarly research, the accuracy of the Chesser bankruptcy prediction model is 78% one year before bankruptcy initiation, 57% two years before the bankruptcy initiation, therefore the model was not acknowledged to be an accurate one (Karalevičienė & Bužinskienė, 2012b). The results of the present survey show that the accuracy of the model when applied in Lithuanian companies of construction sector is much higher.

Zavgren model. 403 companies were indicated as suffering a bankruptcy threat one year before the bankruptcy initiation (the accuracy of the model is 77.35%). When the data of two and three years before the bankruptcy initiation is considered, the accuracy of the model is as it follows: 61.03% and 66.32% respectively. The accuracy of the Zavgren model 1-2 years before the bankruptcy initiation is 82%, whereas 3-4 years before the bankruptcy initiation it falls to 73% (Karalevičienė & Bužinskienė, 2012b). The present survey indicates lower accuracy of the model.

To generalize, the analysis of each of the above mentioned bankruptcy prediction models in Lithuanian companies of construction sector revealed that the linear discriminant Springate model and logistic regression Chesser model show the highest bankruptcy probability and are the most accurate ones to determine bankruptcy prediction.

## 5. Conclusions

The survey proved that the least accurate bankruptcy prediction model is the Taffler & Tisshaw model. The results of this bankruptcy prediction model were the least in comparison with all the rest bankruptcy prediction models. To illustrate, bankruptcy probability in the construction sector companies one year before the bankruptcy initiation was designated with the following accuracy: 42.99% according to the Taffler & Tisshaw model, 74.47% according to the Altman model, 86.94% according to the Springate model, 92.70% according to the Chesser model.

After the research has been carried out it is possible to arrive at the conclusion that the most accurate bankruptcy prediction models whose bankruptcy probability is the highest are the following ones: the linear discriminant Springate model and the logistic regression Chesser model.

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