ASSESSING THE PREDICTIVE POWER OF THE MULTIFACTORIAL MODELS OF THE BANKRUPTCY RISK

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Abstract

The bankruptcy prediction of the enterprises is a great interest issue, which has continued such attention to researchers and specialists for several decades. This paper evaluates the risk of bankruptcy of a sample of 20 enterprises acting in the construction sector in Romania, in 2008. The bankruptcy risk is evaluated using 4 models: 2 models very well-known at the international level - Altman model (1968) with 5 variables and Conan & Holder model (1979) - and 2 models created taking into account the specificity of the Romanian business environment: the A model (2000) and the model of determining the financial performance developed especially for features of the enterprises acting in the construction sector (2008). The aim of this paper is to find a link or match between predictive power of the most used multi-factorial models of bankruptcy risk, taking into account the period in which they were created, the specific characteristics of the economy and industry.

Keywords: risk of bankruptcy, construction sector, prediction, multi-factorial models, discriminate analysis, uncertainty area, multivariate analysis, Altman model, Conan & Holder model, A model

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1. Introduction

The risk of bankruptcy was and still is in the managers' attention. They are interested in the smooth running of the production cycle and the investors in the credit recovery and its interest. Many researchers and financial institutions were concerned with the development of methods for predicting the bankruptcy risk. The method used is the statistical technique for analyzing the financial characteristics of the companies operating normally and of those with difficulties in the economic and financial management.

The main problem is usually the risk anticipation, and in case of the risk appearance, minimizing and controlling it.

The causes generating difficulties for companies are of diverse origin. Most of them come from the social-economic and competitive environment in which the firm acts (external causes): increased national and international competition; the emergence of the substitute products; loss of a major customer or its bankruptcy; the bankruptcy of a major provider that provide certain materials, parts etc., essential to the continuation of the business; the bankruptcy of a bank with which the company had prevailed financial relations; the aggressive competition policy leading to the elimination of the enterprise by the market; the failure to keep pace with technological change, leading to release of the products less competitive and reduce the market share; the development of regulations on safety and environmental line; the continuous decline in the stock market.

From statistical studies found that these external causes have, in average, approximately 51% in triggering a default.

The internal causes are related mainly to a poor management: inventory and customer turnover lower than the sector rules and charging of lower margins of these rules; funding investments with sources associated to operational activities; repeated operating losses; inability of credit renewal.

These cases are in almost half of bankruptcies recorded.

Many studies have been conducted, especially in the United States and France, in order to analyze and classify enterprises according to their degree of distress, based on statistical surveys, with samples of enterprises in difficulty, thus establishing highly predictive indices [27].

The studies developed in France and the United States have shown that in order to predict the bankruptcy of an enterprise, can be used: *accounting methods* (quantitative and analytical methods, used in comparative analyses to estimate the future evolution of the enterprise) and *banking methods* (that suggest an early detection of vulnerability and bankruptcy risk by means of synthetic risk notes resulted from statistical methods of discriminate analysis, allowing the calculation of a score function).

The calculation of the score function requires the prior awareness of certain rates that help to determine the bankruptcy risk of an enterprise and the early protection by correcting measures. A note, called Z score, is given for the company, representing a linear combination of rates and, varying with the value of the score, enterprises are classified as vulnerable, bankrupt and healthy.

Most score functions used to determine the probability of bankruptcy of the enterprise, have used as statistical technique the discriminate analysis, the latter being highly recommended, especially when we want to extract from the multitude of calculated financial indices, the ones that most clearly explain the bankruptcy risk of an enterprise[27].

The development of many models for bankruptcy prediction, which had made and still make the subject of numerous works of specialty in the country and abroad show the importance of the bankruptcy models. Sharma and Mahajah (1980) present a general pattern of bankruptcy in which the ineffectual management doubled by the inability of anticipating events cause a systematic deterioration of performance indicators. In the absence of some corrective actions, this deterioration to the financial conditions determines the bankruptcy [28].

This paper evaluates the predictive power of the bankruptcy models applied to enterprises acting in the construction sector using multi-factorial models designed taking into account the characteristics of economies in which they were performed. We selected for this analyse 2 international models, that we consider representatives, as Altman model with 5 variables and Conan & Holder model. Also, we selected one national model (A model) and one local model of determining the financial performance developed especially for features of the enterprises acting in the construction sector.

In this approach has been started with a short presentation of the background literature related to the risk of bankruptcy models, the description of each above mentioned model, the score function calculation for the sample of 20 companies using financial data from 2008, and their ranking after this score, the results interpretation and finally is achieved a comparative analysis of the classification of each company in a certain area of bankruptcy risk of each of those 4 models used.

2. The description of the risk bankruptcy models

The bankruptcy risk prediction for companies, the lack of ability in paying the contracted debts, is a topic of great interest, which for decennials continues to be of great interest for

researchers and practitioners. Setting up of models for bankruptcy prediction was, and continues to be today, the subject of many scientific papers presented at national and international levels.

2.1 Background literature of bankruptcy risk models

The models that have been used within the financial literature in order to quantify the bankruptcy probability are of three types: quantitative ones, based on accounting information extracted from the Financial Statements such as Balance Sheet and Profit and Loss Account and the structural ones, based on Contingent Claims Methodology which assess corporate risk of bankruptcy by the intermediary of the derivatives and Reduced Form Models which conceive corporate bankruptcy as a random variable which is not influenced by the financial structure of the company [33].

In this paper are analysed four models from the first category. The models proposed until today have the disadvantage that they may be applied only in the economies of the countries where the statistical study was performed, or within the branch or sector of activity studied, their use unable to be extended to a greater area. Furthermore, the periods marked by economic instability determine the alteration of the correlations examined by the developed score function, which limits in time the use of these models. This situation requires an update at regular intervals of time, or development of other models valid for the new conditions [30].

By studying the intervals found for each score function, some enterprises are classified as presenting a high bankruptcy risk, or a lower one, or without bankruptcy risk. Researchers of the statistical models have used the financial rates for building some predictive functions of bankruptcy. All the predictive studies of enterprises bankruptcy are based on original contribution of Beaver's (1966) and Altman (1968).

Beaver has brought the most important contribution to the *univariate analysis of bankruptcy* for an enterprise. The technique of the univariate analysis implies the use of a single financial rate in a model of bankruptcy prediction. Beaver separately analysed few financial rates and selected the critical point for each rate, so as to maximize the prediction accuracy. Altman realized a *multivariate analysis of bankruptcy* that supposes to develop a multiple discriminate analysis. The main idea of the multivariate analysis is represented by combining information related to few financial rates in a single function as weighted index [8].

Beaver and Altman had many successors who developed the performances of models for analysis the bankruptcy risk, initiating alternate analysis methods. Thus, for bankruptcy prediction had been shown by two schools [4]: *the Anglo-Saxon school* represented by the Beaver model, the models developed by Altman, the Edmister models (1972), the Diamond model (1976), the Deakin probabilistic model (1977), the Springate model (1978), the Koh and Killough model (1980), the Ohlson model (1982), the Zavgren study (1983), the Fulmer model (1984), the Koh model (1992), the Shirata model (1999) designed in Japan on the basis of Anglo-Saxon school studies; *the continental school* represented by the Yves Collongues model (1976), the Conan and Holder model (1979), the model of Balance Exposure of France Bank, the model of the French Commercial Credit (CCF), Chartered Accountants model (CA Score – 1987), the Score Function AFDCC 2 (1999).

The literature review, therefore, covers a discussion of some of the popular bankruptcy prediction models. The models developed over the years fall under different approaches. Jones (2002) classified the models as follows:

- *Univariate* – a singe factor or ratio was important in predicting the bankruptcy. Beaver (1966) described as one of the earliest researchers used this approach;
- *Matched-pair multi-discriminate* – were a sample of bankrupt and non-bankrupt enterprises is used. An example under this classification is Altman's Z-score (1968);
- *Logit* – were an estimate is made of the maximum likelihood of bankruptcy leading to a probabilistic prediction. One example of this approach is that used by Ohlson (1980);
- *Gambler's Ruin* – the principle of the approach is that bankruptcy is probable when an enterprise's net liquidation value becomes negative. The contributor to the development of this type of model is Wilcox (1971);
- *Artificial Neural Networks* – the approach applies computers constructed to process information in almost the same way that the human brain processes information. This approach, developed in 1990, has been in use ever since [23].

In the recent years many studies were undertaken. Shumway (2001) elaborates a corporate default prediction model based on the financial indicators of Altman and Zmijeski to which he adds the company history and the standard deviation of the return on equity and return on assets [34].

Kahl (2002) elaborates a research based on a group of companies which are close to the corporate default threshold. He concludes that only a third of these companies manage to survive independently, while the other companies either are taken over or disappear. Consequently Saretto (2004) creates a model of corporate risk of bankruptcy assessment in a continuous way (Duration model) using financial

ratios which reflect both book value and market value [33].

Davydenko (2005) makes a research on the financial indicators which impact in an essential way corporate default probability, valorising Moody's database CRD – Customer Research Database. He concludes that bankruptcy probability is determined by alarming ratios assets [34].

Recently, Naidoo (2006) developed a predictive model he termed the Financial Risk Analysis Model. This is based to a large extent on the multi-state models of Lau (1987) and Ward (1994) [23].

Unlike the Anglo-Saxon school and continental school, the *Romanian school* is more distinguished by theoretical contributions. The economic and financial modelling made history in traditional domains: multi-criteria models for the financial and macroeconomic equilibrium and for the quantification of this equilibrium. The Romanian school [4] is represented by following empirical models: Mânecuță and Nicolae model [22] proposed in the metallurgical industry, Model B – Băileşteanu [6], Model I – Ivonciu [16] and Model A – Anghel [27]. Siminica, M. I. has achieved a *Model for analysis of bankruptcy risk in the Romanian industrial firms* [30]. Also, was designed an *aggregate index of financial performance for the building sector enterprises* from Galati [7].

Bankruptcy risk prediction models have a predominantly statistical character, being designed with a starting point that takes into account the past financial status of bankrupt enterprises and of some enterprises that experienced no financial difficulties. The obtained results will be generalized for all enterprises showing the same features with those under focus. In this paper we try to find a link or match between predictive capacity of the selected models, taking into account the period in which they were created, the specific characteristics of the economy and industry.

So, for analyse we select the Alman model with 5 variables from the Anglo-Saxon school, Conan & Holder model from the continental school, A model and the aggregate index of financial performance from the Romanian school. The common features of the selected models are: these models were designed based on multicriteria discriminate analyse; the selected models use 5 variables for determining the score function; these models were based on a large number of variables on which were kept only 5, the most relevant variables; the score function can be applied to companies acting in the construction sector; all models have captured the evolution of financial variables at least of 4-6 years. But the main differences between these models are referred to the geographical area of the companies used to the model designing, the period time of the companies financial data used to create the models, which shows that the models were created at different time, which means that the economic conditions were different. And what makes them more different are the model variables derived from discriminate analysis, presented below.

2.2 Altman model with 5 variables

Altman is a name invariably cited in studies related to the bankruptcy prediction [1]. The original study included a sample comprising 66 industrial companies, 33 bankrupts and 33 non-bankrupts and the considered period for analysis being 1946-1965. The author found a total of 22 potential variables, based on annual reports of the companies, grouped in 5 categories: liquidity, profitability, debt, solvency and activity indicators. By the initial list of 22 indicators, the author retains 5 variables with the highest significance, as a result of using statistical techniques and discrimination analysis.

Whereas the first model built by Altman has shown some limits on the accuracy of predictions, the selection of variables, the selection of the sample and the cost of error, it was necessary the refining of the model, resulting the following function [2]:

$$Z' = 0.717 \times X_1 + 0.847 \times X_2 + 3.107 \times X_3 + 0.420 \times X_4 + 0.998 \times X_5,$$ where:

$X_1 = \frac{\text{Current assets}}{\text{Total assets}}$ measures the net liquidity assets relative to total capitalization. Generally, an enterprise experiencing continuous operating losses would have decreasing current assets in relation to total capitalization.

$X_2 = \frac{\text{Reinvested profit}}{\text{Total assets}}$ is a measure of cumulative profitability in relation to total capitalization. The age of the company is a factor in this ratio. A firm in its infancy (first five years of activity) would not have had time to build up its cumulative profits and would therefore have this ratio, at a lower level. For this reason, Altaman (2000) explains that the situation in the real world is that the incidence of failure is much higher in a firm's earlier years. Another aspect measured by this ratio is leverage. A high ratio indicates that the enterprise has financed its assets through the retention of profits with little use of debts [23].

$X_3 = \frac{\text{Gross profit}}{\text{Total assets}}$ measures the true productivity of the firm's assets before any non operations costs: i.e. tax and leverage costs. Since the assets are held for the purpose of generating earnings the ratio is relevant in measuring the extent of achieving the firm's earning objective. Altman (2000) asserts that this ratio outperforms other profitability measures including cash-flow.

$X_4 = \frac{\text{Own capital}}{\text{Debts on long term}}$ is an indicator of the gap at which assets can decline in value before they are exceeded liabilities. The greater the ratio, the greater the extent at which assets would have to reduce and to be exceeded by liabilities. The greater the ratio, the more remote the chance that the assets would be exceeded by liabilities [23].

$X_5 = \frac{\text{Turnover}}{\text{Total assets}}$ illustrates the ability of a firm's assets to generate sales. This ratio is said to rank second in the contribution to the overall discriminating ability of the model [3].

The interpretation of the Z' score function is as follows: a score of $Z' < 1.23$ means a high risk bankruptcy; a score of $1.23 < Z' < 2.90$ means the uncertainty area; a score of $Z' > 2.90$ suggests a low risk of bankruptcy or non-bankruptcy.

The model shows an inverse correlation between all variables and risk of bankruptcy. Thus, the enterprises that have a low share of current assets, gross profit, reinvested profit and turnover in total assets and a low proportion of equity by debts have high risk of bankruptcy.

2.3 Conan & Holder model

The model developed by these authors is included in the statistical tested methods. The researchers have established a sample of 95 small businesses of industrial profile, which they have studied by means of financial variables in the period 1970-1975 [11].

The appraisals for the proposed score function were based on an initial set of 50 indicators studied by the category: the asset structure, the financial dependence, the treasury, the working fund, the exploitation, the profitability etc. The analyzed companies were grouped on sectors of activity, the determined score function Conan & Holder being applicable for the industrial enterprises, construction enterprises, the gross wholesale enterprises and transport enterprises. As it has been built, the score function entails a deviation of probabilities a posteriori and an uncertainty area. According to the definitions given by the authors, the retained rates for the industrial enterprises are as follows:

$R_1(\text{profitability by creditors}) = \frac{\text{Gross surplus of exploitation}}{\text{Total debts}}$

measure the creditors profitability; the model shows when this rate is higher, the probability of bankruptcy is lower.

$R_2(\text{solvency}) = \frac{\text{Own capital}}{\text{Total liabilities}}$ measures the share of own capital in total liabilities. There is an inverse relation between solvency and bankruptcy risk.

$R_3(\text{liquidity}) = \frac{\text{Current assets} - \text{Stocks}}{\text{Total liabilities}}$ expresses the company's ability to meet debts on short term from liabilities and availabilities.

$R_4(\text{rate of financial expenses}) = \frac{\text{Financial expenses}}{\text{Turnover}}$

is a global indicator on the financial autonomy of the company appreciated on its overall financing.

$R_5(\text{rate of personnel costs}) = \frac{\text{Personnel costs}}{\textit{Added value}}$

measures the share of personnel costs in added value.

The model shows a direct relation between the last 2 variables and probability of bankruptcy that means the bankruptcy risk is high to companies that have high costs of personnel or financial costs.

Thus, the score function found is:

$$Z = 0.24 \times R_1 + 0.22 \times R_2 + 0.16 \times R_3 - 0.87 \times R_4 - 0.10 \times R_5$$

.

The interpretation of the Z score function is as follows: a score of $Z < 0.04$ is equivalent to a probability of a bankruptcy risk of > 65%; a score of $0.04 < Z < 0.09$ mean a probability of bankruptcy between 30% - 65%; a score of $Z > 0.09$ suggests a probability of bankruptcy of < 30%.

2.4 A model

This model was built by Ion Anghel in 2000 [27]. Model building was based on financial analysis of a sample of 276 enterprises, using data from period 1994-1998, distributed in 12 branches of the Romanian economy, including building sector.

The a priori predictive capacity analyse of the function showed a 97% success rate, which

confirms the high rate of success of the A function, for the abovementioned period.

The A model has the following structure:

$$A = 5.667 + 6.3718X_1 + 5.3932X_2 - 5.1427X_3 - 0.0105X_4, \text{ where:}$$

$X_1 = \frac{\text{Net profit}}{\text{Incomes}}$ measures the commercial return, the net profit margin obtained to the total revenues;

$X_2 = \frac{\text{Cash - flow}}{\text{Totalassets}}$ shows the share of cash-flow in total assets, that is the company's ability to generate cash-flow from use of company assets;

$X_3 = \frac{\text{Totaldebts}}{\text{Assets}}$, debts to assets ratio, measures the general indebtedness of the company;

$X_4 = \frac{\text{Totaldebts}}{\text{Turnover}} * 360$ shows the rotation speed of debts, respectively while the turnover will assure the payment of all debts.

The interpretation of A model is:

$A < 0$ - enterprise bankruptcy is imminent;

$0 < A < 2.05$ - enterprise is in a situation of uncertainty, which require further analysis;

$A > 2.05$ - enterprise is in a good situation, the risk of bankruptcy is unlikely.

The main advantages of the model refer to:

- is the first Romanian model using multiple discriminate analysis to forecast the bankruptcy;
- the model manages a success rate of prediction about 97%, similar to that produced by internationally recognized models. This success rate of the A function has been confirmed by a randomly chosen sample;
- based on the author's analysis showed that Model A provides for the sample of Romanian companies, higher success rate of the models in the literature;
- the relatively general applicability of the model for the Romanian economy, while the sample that led to the development of the function included 12 different branches, covering industrial activities, agriculture and services (excluding financial).

The model presents some limitations:

- delineation success-failure, i.e. bankruptcy – non-bankrupt could be the main limit of the A model. The sample and separation of the two groups was based not only on legal declaration of the bankruptcy, but also considered a broader component as held in the group of companies bankrupt:

- those firms in default, and that were forced to reschedule their debts to banks, state, suppliers etc.;
- those companies which consolidates payments due to a critical limit, i.e. arrears exceed 1/3 of the assets;
- those companies with a delicate performance in that reported losses in the last three years, and their size is critical to the shareholders capital;

- the model A can not prove that is based on a statistical relevant population, respectively the sample not necessarily reflect the situation bankruptcy – non-bankruptcy in the Romanian economy;
- the absence of a longer period of analysis before bankruptcy (the model is based on an analysis period of four years) may be a cause of a reduction of the predictive ability with that stated, because the Romanian economy is not in a period of economic stability and it is possible that a period of four years to be proved insufficient to maintain a successful prediction rate of 97%.

2.5 Model of determining the financial performance by financing

This model was created taking into account 11 enterprises acting in the building sector. There were used the annual reports of these enterprises in the period 2001 – 2006. From the representative financial ratios presented in the literature, were selected only 8 for the discriminate analysis, which were thought the most significant. Finally, out of these were selected just 5 for the model variables:

$R_f = \frac{\text{Net result}}{\text{Owners' capital}}$ = the return on equity measures the profitability of owners' capital that is the financial investment made by shareholders when buying the enterprise shares [31] and is influenced by the way of asset securing and, thus, by the financial structure of the enterprise [20]. This ratio quantifies the remuneration of capital invested by shareholders, including the net profit at the disposal of the enterprise for self financing [21].

$G_{ig} = \frac{\text{Total debts}}{\text{Own assets}}$ = general leverage reflects the degree in which own assets ensures the financing of the enterprise activity. This parameter can be also interpreted as a ratio of financial autonomy of the enterprise, as it indicates the degree in which its long and short term commitments are guaranteed by own assets.

$R_{pr} = \frac{\text{Profit reinvestit}}{\text{Dividende} + \text{Profit reinvested}}$ = retained profit ratio is less used in the Romanian literature and in banking, but it was chosen to use within the model as the enterprises used extensively the profits for

reinvesting, as we can see in the analysis of the sample. The reasons for doing this refers to enhancing the enterprise position on the competitive market, increasing the degree of capitalization, redimensioning the social asset, and even taxation.

The retained profits are an alternative and cheaper method of increasing owners' capital in comparison with new shares issued and, also, is the most important source of capital used for financing intangibles. More frequently, the literature deals with the ratio of dividends distribution (R_{Dv}) by the shareholders [19], computed as: $(1-R_{pr})$. This is because the investors, especially the ones who speculate, are interested mainly in the level of earnings on short term and in the time of recovering their investment by cashed dividends.

$R_{lg} = \frac{\text{Circulating actives}}{\text{Short term debts}}$ = general liquidity measures the capacity of cash flow of the enterprise that is short term solvency and reflects the degree in which the turning into cash flow of circulating actives can satisfy the exigible payment obligations.

$D_{f(\%)} = \frac{\text{Financial debts}}{\text{Total debts}}$ = the weight of financial debts within the total debts reflects the ratio of financial debts with a view of pointing out the nature of enterprise financing. This parameter shows the dependency of enterprise towards banks and other business partners. This is a relevant indicator in what concerns the temporal stability of financing sources used by the enterprise.

Using these variables, the ***model for financial performance assessment*** [6] obtained is:

$$P_f = 0.32 \times R_f + 0.4554 \times G_{ig} + 4.0207 \times R_i + 0.8787 \times R_{lg} - 10.7815 \times D_{f(\%)}$$

This model allows for framing an enterprise with the characteristics of those enterprises selected for the sample, in a certain performance area. For this, there are firstly calculated the 5 financial ratios involved in the analysis, on the basis of which the score P_f is determined. In accordance with its value, the enterprise will fall in one of the following 5 performance areas: if $P_f \geq 4.25$ the enterprise has a very high financial performance; if $2.75 \leq P_f < 4.25$ the enterprise has a medium financial performance; if $1.25 \leq P_f < 2.75$ the enterprise has a satisfactory financial performance; if $-0.25 \leq P_f < 1.25$ the enterprise has a low financial performance; if $P_f < -0.25$ the enterprise has a very low financial performance.

The higher the value of score P_f determined for an enterprise, more than the value of 1.25, (the limit that mathematically separates the enterprises with high financial performance apart from the low financial performance ones), the greater the possibility of obtaining a higher performance. To always have a higher financial performance, the recurrent calculation of the score P_f is needed, as its reduction in value implies a reduction in the financial performance and, in these conditions, the managers should take measures for recovery. In this study, we will strictly separate the companies after their performance only in 3 areas of performance: those who have a high financial performance with $P_f \geq 4.25$ (lower risk of bankruptcy), those who have a low financial performance $P_f < -0.25$ (higher risk of bankruptcy) and a uncertainty area $-0.25 \leq P_f < 4.25$.

The success rate of the model shows that the financing is an extremely important factor in valuating the level of the financial performance of an enterprise. The highest the success rate of the model, the financing more influences the financial performance.

The model of establishing the financial performance by financing has a wide use as, on the one hand, it allows for ranking enterprises active in the building sector in terms of their financial performance, and, on the other hand, it demonstrates that the financial performance of these enterprises is greatly determined by the way of financing the activity.

Also, the model shows a direct relation between the weight of financial debts in total debts and failure prediction and an inverse correlation between the first four variables.

The model still shows a controversial issue between 2 variables: the higher general leverage, the lower risk of bankruptcy and the higher share of financial debts, the higher probability of bankruptcy. Overall, the model shows that for reducing the risk of bankruptcy, the company should use less the financial debts and more the operating debts (i.e. increasing the overall debts to be determined by the growth of operating debts).

3. Testing the capacity of risk bankruptcy prediction

The capacity of bankruptcy prediction of these models was tested on data extracted by the annual reports of the above mentioned companies at the end of 2008.

Firstly, we are predicting the risk of bankruptcy using Altman model. The appreciation and ranking the companies after the bankruptcy risk increase is presented in the Table 1. Of the 20 companies assessed, only 5 are outside the bankruptcy risk, 4 enterprises presents a very high risk and 11 enterprises are in the uncertainty area.

Table 1. Ranking of the enterprise after the Altman model

Company Name	Z' score	Z' intervals	Appreciation
CONSAL SRL	12.141	$Z' > 2.90$	Low risk of bankruptcy or non-bankruptcy
KATY SRL	11.655		
ARCADA SRL	4.615		
CONSTRUCȚII FEROVIARE SA	4.172		
VIVA CONSTRUCT SRL	3.902		
BAZA SRL	2.865	$1.23 < Z' < 2.90$	Uncertainty area
VEGA 93 SRL	2.796		
UNICOM SA	2.584		
ARCADA COMPANY SA	2.577		
VÎLCEANA SA	2.342		
DRUMURI ŞI PODURI SA	2.241		
COMTIEM SRL	2.164		
CONSTRUCȚII AVRAM IANCU SRL	2.078		
MOLDOVULCAN SA	1.969		
ICMRS SA	1.558		
TRIPLEX SRL	1.344		
SOREX SA	1.182	$Z' < 1.23$	High risk bankruptcy
CONFORT SA	0.867		
BRICO SRL	0.595		
CONSTRUCȚII ŞI REPARAȚII SA	-0.737		

Source: Calculus performed by authors

Secondly, we are predicting the risk of bankruptcy using Conan & Holder model. Also, the appreciation and ranking the companies after the bankruptcy risk increase is presented in the Table 2. This model presents a more optimistic situation in the sense that 11 enterprises are evaluated as outside the bankruptcy risk, 4 are in the uncertainty area and 5 companies are in bankruptcy area.

Table 2. Ranking of the enterprise after the Conan & Holder model

Enterprise	Z score	Z intervals	Appreciation
KATY SRL	2.468	Z > 0.09	Probability of a bankruptcy risk of > 65%;
CONSAL SRL	0.472		
ARCADA COMPANY SA	0.338		
VÎLCEANA SA	0.366		
MOLDOVULCAN SA	0.288		
VIVA CONSTRUCT SRL	0.235		
VEGA 93 SRL	0.177		
CONSTRUCȚII FEROVIARE SA	0.171		
ARCADA SRL	0.170		
TRIPLEX SRL	0.114		
UNICOM SA	0.111		
BAZA SRL	0.070	0.04 < Z < < 0.09	Probability of bankruptcy between 30% - 65%;
DRUMURI ŞI PODURI SA	0.058		
ICMRS SA	0.061		
COMTIEM SRL	0.046		
SOREX SA	0.022	Z < 0.04	Probability of bankruptcy of < 30%.
CONFORT SA	0.018		
BRICO SRL	0.017		
CONSTRUCȚII AVRAM IANCU SRL	-0.032		
CONSTRUCȚII ŞI REPARAȚII SA	-0.172		

Source: Calculus performed by authors

Then, we are predicting the risk of bankruptcy using A model. Also, the appreciation and ranking the companies after the bankruptcy risk increase is presented in the Table 3. This model shows a similar optimistic situation as the preview model, in the sense that 9 enterprises are evaluated as outside the bankruptcy risk, 6 are in the uncertainty area and 5 companies are in bankruptcy area.

Table 3. Ranking of the enterprises after the A model

Enterprise	A score	Interval A	Appreciation
ARCADA COMPANY SA	6.189	A > 2.05	Enterprise bankruptcy is imminent
MOLDOVULCAN SA	5.276		
VIVA CONSTRUCT SRL	4.878		
KATY SRL	4.660		
VÎLCEANA SA	3.502		
VEGA 93 SRL	2.825		
CONSTRUCȚII AVRAM IANCU SRL	2.690		
CONSTRUCȚII FEROVIARE SA	2.381		
ARCADA SRL	2.127		
COMTIEM SRL	1.676	0 < A < 2.05	Enterprise is in a situation of uncertainty, which require further analysis
UNICOM SA	1.290		
DRUMURI ŞI PODURI SA	1.230		
CONSAL SRL	0.853		
BRICO SRL	0.549		
ICMRS SA	0.100		
TRIPLEX SRL	-0.426	A < 0	Enterprise is in a good situation, the risk of bankruptcy is unlikely
BAZA SRL	-0.525		
CONFORT SA	-0.867		
SOREX SA	-6.018		
CONSTRUCȚII ŞI REPARAȚII SA	-10.716		

Source: Calculus performed by authors

Finally, we are predicting the risk of bankruptcy using the model of determining the financial performance (Table 4). We can conclude that is the most optimistic situation, in sense of only 3 enterprises are evaluated in the bankruptcy area, 7 enterprises are in the uncertainty area and 10 enterprises presented a low risk of bankruptcy.

Table 4. Ranking of the enterprise after the model of financial performance assessment

Enterprise	P_f score	Interval P_f	Appreciation
KATY SRL	11.056	$P_f \geq 4.25$	Company has a very high financial performance (very low risk of bankruptcy)
ARCADA SRL	9.555		
TRIPLEX SRL	9.231		
BAZA SRL	7.345		
CONSAL SRL	6.565		
VEGA 93 SRL	6.131		
ARCADA COMPANY SA	5.934		
COMTIEM SRL	5.225		
SOREX SA	5.021		
VIVA CONSTRUCT SRL	4.346		
CONSTRUCȚII AVRAM IANCU SRL	3.865	$-0.25 \leq P_f < 4.25$	Uncertainty area
UNICOM SA	3.531		
MOLDOVULCAN SA	1.792		
VÎLCEANA SA	1.598		
DRUMURI ŞI PODURI SA	1.472		
CONFORT SA	1.093		
ICMRS SA	0.428		
CONSTRUCȚII FEROVIARE SA	-0.332	$P_f < -0.25$	Company has a very low financial performance (very high risk of bankruptcy)
BRICO SRL	-2.191		
CONSTRUCȚII ŞI REPARAȚII SA	-3.463		

Source: Calculus performed by authors

Making a comparative analysis on bordering in a particular class of risk, we found a concordance for the following 6 companies: *Katy*, *Viva Construct* and *Arcada* fall within the range of minimal risk of bankruptcy; *Drumuri şi poduri* and *ICMRS* fall within the range of uncertainty and finally *Constructii şi reparaţii* fall within the range of maximum risk. Although these models use different variables, however, for those 6 mentioned companies lead us to the same assessment, which indicates that essentially, all models created, regardless of period of time, geographical area or economic conditions, in a large part, identify the risk of bankruptcy for any company, which fit best in the patterns taken into account in their designing. Also, the enterprise *Consal* was evaluated by 3 models in the category without risk and by one of the model in the uncertainty area, as well as the enterprise *Brico* was evaluated by the same 3 models in the uncertainty area and by a model in the range of high risk of bankruptcy.

Another line was identified in a group of 5 enterprises that had the same assessment by Altman and Conan & Holder models, but different in the Romanian model of evaluation the financial performance: *Construcţii feroviare* has a low risk of bankruptcy by the international models and Romanian A model and a very high risk by the Romanian model of assessing the financial performance; *Baza* is in the uncertainty area in the international models, in the high risk of bankruptcy in the A model and in the low risk of bankruptcy in the second Romanian model; *Comtiem* was ranged in the uncertainty area in the international models and A model and in the low risk of bankruptcy in the model of financial performance. *Sorex* and *Confort* are in low performance area in the international models and in the A model, and in the high performance (*Sorex*), respectively uncertainty area (*Confort*). These differences arise because the Romanian model of assessment the firms' financial situation is based on financing of the activity, unlike the international models and A model that take more into account the results and business rates.

There is a linear correspondence between another group of 3 companies framed by the

Romanian models and Conan & Holder model in the area of low risk: *Arcada Company* and *Vega 93* that are ranked by the Altman model in the uncertainty area, which shows a more rigor of the Altman model. Finally, there is a group of 4 companies framed in the uncertainty area (*Vîlceana, Moldovulcan, Unicom* and *Construcţii Avram Iancu*) by the Altman model and Romanian model of assessing the financial performance. Of these companies, *Vîlceana, Moldovulcan, Unicom* were placed in the very low risk of bankruptcy and *Construcţii Avram Iancu* in the high risk area by the Conan & Holder model.

4. Conclusions

The models for assessing the risk of bankruptcy are more relevant only if there are satisfied conditions related to the presence of some similar economic characteristics in the analyzed period and enforceability on some enterprises in the sector of activity had referred to.

Consequently, very important is the discriminate analysis, that presents as results the significant differences between the two groups of enterprises (bankrupt and non-bankrupt), for each of the ratios employed. This analyse help to appreciate if the sample used is representative for setting up the model of determining the financial performance.

Also, a sensitive issue is represented by the method of variables inclusion within the discriminate analysis and then in the model. The authors which designed such models had to choose between two methods for the selection of the variables of the models: inclusion of all ratios that are likely to allow for the classifying in two groups and further selection on the basis of statistical criteria or selective inclusion of potential ratios, in terms of an a priori basis (for example the notoriety in the literature), that gives a subjective character in choosing the model variables. The subjective character of the model is also given by the aim of the model creator, as in the Romanian model was followed the separation in performing or bankrupt companies, primarily in the manner of financing choice (structure of used assets, own assets and borrowed, on short, medium, and long term), as the leading cause of bankruptcy.

Results that by the comparative analysis carried out is confirming, but not totally (because of the 8 companies assessed in the same area of risk), the fact that the models proposed until today have the disadvantage that they may be applied only in the economies of the countries where the statistical study was performed, or within the branch or sector of activity studied, their use unable to be extended to a greater area.

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