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THE FORECAST OF BANKRUPTCY RISK USING ALTMAN MODEL

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Abstract:
The manifestation of financial crisis leads to the appearance or the increase of the risk of bankruptcy. Therefore, the analysis of bankruptcy risk interests a number of users (customers, organizations, financial institutions) and itself the company, in preventing the financial difficulties encountered from the early stages of the degradation process. This article explores the top 10 companies on the BSE during 2010-2011 period by using the Altman model for the determination of those firms who may experience in a close period a higher risk of bankruptcy.

Keywords: risk of bankruptcy, Altman model, financial crisis, BSE

JEL classification: G17, G20

INTRODUCTION

Over time, it had been developed different methodologies for analysis of bankruptcy risk on the one hand, because the number of users of such information (customers, organizations, financial institutions) on firm performance and risks involved in economic activity has increased and secondly, it proves extremely useful in preventing the difficulties encountered by companies from the early stages of the degradation process.

The instruments and methods of financial analysis of the risk of bankruptcy can be (Balcaen, 2004):

1. The method of comparison or analysis of the dynamics of indicators, which involves the use of indicators values (absolute values), whose dynamics is analyzed by reference:
- Financial statements of earlier years. This type of comparison (in time) allows analysis of development and financial performance indicators such as turnover, operating results, capital, total assets.
- Financial statements of other companies (comparision in space). An organization that registers low levels of performance to competitors (in the same sector of activity and the same size) can present a high risk of bankruptcy. Also, the record of performance below the industry average should lead to enhanced surveillance activity.
2. The method of rates, which allows creation of links between indicators of accounts, indicators of the results and indicators of financial condition and results account, complete comparative analysis in time and space.
3. The method of financial flows emphasizes financial performance indicators, with which reflected aspects of exploiting activity and its impact on cash, which is one of the main parts of the depreciation of the financial situation of the company. Early analysis of financial flows provides information about registered business difficulties.
4. The method of scores is a method for predictive risk analysis of bankruptcy and developed in response to criticisms of the traditional methods of financial analysis, the method is based on rates financial or nonfinancial.

LITERATURE REVIEW

The scores method is an overall investigation of how creditworthy status of a firm in order to determine possible risk event of bankruptcy. This method occupies an important position in financial analysis and is based on discriminating analysis.

The ''scoring'' technique has its origins in the USA where, in the '50s is looking into the relationship of causes and ways of manifestation of disease in medical research. It is a statistical technique that helps to establish characteristics of the comments made on an object, phenomenon, and process. The scores method was taken over by other disciplines including economic and financial analysis, as Americans have used this method of assessing the risk to a company belonging to a particular policy area.

The scores method is an external diagnostic method, which aims to measure the risk to which they expose the investor, creditor and the trader himself in future work. In the context of financial analysis, the observations were made on the basis of selected indicators, both vulnerable and healthy business from financially point of view. The significance of indicators and their combination depend on the specific interest of each user or analyst (Hillegeist, 2004).

This combination of indicators lead to the construction of a linear function called "function score" which is a forecasting tool, both to the management and external users.

$$Z=a1r1+a2r2+\ldots\ldots\ldots+anrn$$

Where: Ri = financial parameters set by users and ai = weights coefficients

The selection of financial indicators characterizing the reliability of operators should consider their independence in function Z. A certain degree of correlation between the information provided by financial ratios would result in recording the score obtained of the same influence on the financial phenomenon analyzed.

On each operator is assigned a value of the function Z which highlights the quality of internal management in relation to the activity sector, offering an overview of activity.

To build a model analysis based on scores method takes up several stages:

1 - financial indicators are chosen that reflects best the financial health of an operator

2 - comparing selected indicators development on two categories of operators in the same line of business, some in distress, and other financially healthy

3 - engaging in the development of predictive function Z by combining those financial ratios that have a strong and constant action;

4 - Z function setting ranges from observations made on the activity or not, of the risk of bankruptcy.

The use of financial indicators (indicators of efficiency, balance indicators, indicators of solvency, management indicators) to predict the risk of bankruptcy is based on the fact that their systematic deterioration reflects the difficulties in leading and managing that business.

An evolution of the score function models using financial and other non-financial characteristics, over time, is shown in the table below.

Tabel no.1 Methods of establishing a predictive function

Nr.crt.	Domain	Author
1	Inclusion of other variables than the financial rates Development of forecasting nonfinancial models for bankruptcy	Peel (1986), Keasey (1987), Booth (1983), Reynolds si Miller (1989), Coper Gascon si Woo (1991), Lussier (1995)
2	Study of the bankruptcy process Typical alternatives in the bankruptcy	Argenti (1976), Laittinen (1991)
3	Development of new statistical methods for estimate the probability of bankruptcy	Ohlson (1980) Gentry si Witheford (1987)
4	Analysis of the assumptions of the limits set methods	Richardson si Davidson (1983), Karels si

		Prakash (1987)
5	Analysis of the effect of statistical simplification	Znijewsky (1984), Peel (1987)
6	Adjustement of financial ratios	Mensah (1983), Bartezak (1985), Watson (1986), Bear (1986, Aziz,Lawson (1988)
7	Increased attention to the influence of industry in which are part the sample firms	El Hennawy si Marris (1983)
8	Development of conceptual methods	Sharma si Mahayou (1980)
9	Analysis of creditors's environmental	Keasey si Watson (1986), Houghton si Woodleff (1987)

Source: Balcaen, S. Ooghe, H. (2004). 35 Years of studys on Business Failure: An Overview of the Classic Statistical Methodologies and their Related Problems, *Vlerick Leuven Gent Working Paper Series* 2004/15

Bankruptcy assessment models were primarily based on examination of firms went bankrupt, so by analyzing the causes of bankruptcy after its occurrence. Under these conditions it sought to establish features both financial and non-financial, of those companies. Investors and banks are concerned about the chances of success of businesses that need support and so they ask forecasting models of business success. The practice showed that it paid too little importance to non-financial aspects, which is one of the major limitations of national evaluation models of bankruptcy. The focusing almost exclusively on information provided by financial indicators has greatly reduced power forecasts of these models.

THE APPLICATION OF ALTMAN MODEL ON COMPANIES LISTED ON BSE

In economic theory was developed a number of models based on the scores method, of which the most common are: Altman model, Conan Holder model and Bank of France Model**.**

One of the first feature score was developed in the United States by *E.I. Altman* in 1968. He studied the informations from a broad sample of firms, both among those who failed and those who survived. He found that analysis based on more than 5 variables, allowed the provision of 75%, 2 years before of their bankruptcy. Financial analysts have tried to develop the capacity for forecasting of initial model, so Taffler in Europe and Koh and Killoungh, created analytical models Z with an increased capacity prediction.

The Altman model (Zeta Analysis - A new model to identify bankruptcy risk of corporations, Journal of Banking and Finance, June 1968) conducted a multivariate analysis of bankruptcy using multiple discriminating analyses.He combined the information provided by five rates constructing a "function score" of the form (Altman, 1968):

$$Z=1.2X1+1.4X2+3.3\ X3+0.6\ X4+1.0\ X5$$

Where:
*X*1 = Working Capital/Total Assets
*X*2 = Retained Earnings/Total Assets
*X*3 = Earnings before Interest and Taxes/Total Assets
*X*4 = Market Value of Equity/Book Value of Total Liabilities
*X*5 = Sales/Total Assets
Z = Overall Index or Score

In it, the variables X1 .... X5 are economic and financial indicators and coefficients which are amplified indicators are static in nature and express in a significant way the variable weight or importance in the economic logic of evaluation of bankruptcy risk.

Tabel no.2 The explanation of the financial rates in Altman Model

*X*1 = Working Capital/Total Assets	The rate measures business flexibility and shows the share of working capital in total asset; as the result of this report is higher the allocation of permanent sources in exploiting coverage is optimaler

*X*2 = Retained Earnings/Total Assets	Measure the capacity of internal financing of the enterprise and therefore it is recommended that value ratio is as higher
*X*3 = Earnings before Interest and Taxes/Total Assets	The rate is as a rate of economic return or the rate of efficiency using of assets, it is desirable to be as higher
*X*4 = Market Value of Equity/Book Value of Total Liabilities	Express indebtedness of the company by long-term loans, it is desirable to be as higher
*X*5 = Sales/Total Assets	The rate is an indicator of efficiency of use assets, expresses total asset turnover by sales; as the company's activity is more efficient, the sales will be higher, and assets will soon renew the turnover

Source: Altman, E. (1968). Financial Ratios, Discriminant Analysis, and the Prediction of Corporate Bankruptcy. *Journal of Finance*, 23 (Sept.), 589-609

The companies studied were analyzed and classified by Z score value fixing the limit and a second area of uncertainty as follows:

Z <1.8 bankrupt in a year;
1.81 ≤ Z ≤ 2,675 area of uncertainty at high risk of bankruptcy;
2.67 ≤ Z ≤ 2.99 the low risk of bankruptcy;
Z> 2.99 without the threat of bankruptcy.

Subsequently, Altman proposes a revised model to be applicable to private firms and non-manufacturier:

$$Z = 0.0656\,X1 + 0.0326\,X2 + 0.0105\,X3\ 0,\ 672X4$$

X1 = net working capital / total assets
X2 = retained profit to the firm / total assets
X3 = Operating profit / total assets
X4 = Market value of equity / total liabilities

Table no.3 Risk assessment based on Altman model (1968)

Z Score	Company type	Comments
2.99	Continued operation	Superior limit
2.78	Continued operation	
2.68	Continued operation	
2.67	bankruptcy	
2.10	bankruptcy	
1.98	bankruptcy	
1.81	bankruptcy	Lower limit

Source: Altman, E. (1968). Financial Ratios, Discriminant Analysis, and the Prediction of Corporate Bankruptcy. *Journal of Finance*, 23 (Sept.), 589-609

In conclusion, interpretation score "Z" is this:
Bankruptcy 1.81> R> 2.99 – well positioned

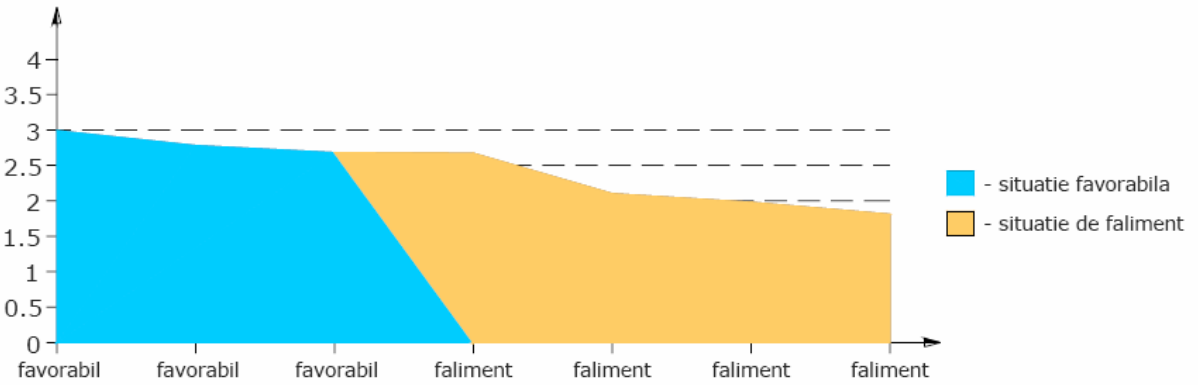

Figure 1 Interpretation of the model Altman Z score

Next we apply the Altman model the first 10 companies listed on BSE during the 2010-2011 period, separately for each year, to determine which firms can go bankrupt.

The year **2010** was an atypical year and lots of events and left their mark on the evolution of the Bucharest Stock Exchange (BSE). Amid crisis emerging international markets, stock has seen many corrections during the year, thus limiting its growth over the past years. The BET index, which includes the top ten companies in the market during the year, saw an increase of only 22.05%, being the smallest in six years. Even in these conditions, the BET index first exceeded the threshold of launching 10,000 points this summer, was boarded by significant increases in bank securities and pharmaceutical component. The value of transactions on the Stock Exchange this year reached a new high of 3.92 billion euros (13.8 billion lei), 40% higher than in 2006, while market capitalization has advanced by 17,2%, to 24.6 billion euros (85.96 billion lei).

Applying the Altman model led to results presented in Table 4. All 10 companies have values over the critical values of 1.81; 4 of them being over the superior limit of 2.99 (Petrom, Biofarm, Dafora, BRD).

Table no.4 The application of the Altman model to10 companies BSE in 2010 (mil.RON)

	Transilvania	**BRD**	**Petrom**	**Transgaz**	**Rompetrol**	**Transelectrica**	**Dafora**	**Azomures**	**Biofarm**	**Electromagnetica**
Working Capital	9180	19272	2110	262	2146	902	138	284	55	151
Total Assets	13876	38965	20997	2605	4289	4045	368	523	166	182
Retained Earnings	180	1250	5850	986	2086	1569	41	23	38	13
Earnings before Interest and Taxes	403	1090	1964	271	-36	158	25	82	15	45
Market Value of Equity	611	696	5664	117	2109	733	97	52	97	91
Book Value of Total Liabilities	12081	34532	2609	919	2216	1571	212	1173	38	24
Sales	22706	49945	12284	1051	5475	2348	318	822	62	24
Z - score	2,6017	3,0246	3,0771	2,4747	2,1006	2,8006	2,978	2,831	2,938	2,292
Average Z score			2,7120			Standard deviation Z score			0,3323	

Source: own calculations

Petrom has the highest Z score of 3.07. The explanation of the very good situation of company is on recent explosive evolution of international quotations of oil and gas, but it is beginning to feel the positive impact of investments made in recent years for identifying and exploiting new production capacities. In the profit and loss count of Petrom, we attended the following significant developments: an advance of 34.86% of turnover; an increase of 17.63% of operating revenue; a 161.01% increase in operating brut profit; financial profit up 112.21%; obtain a net profit up 156.30% from the previous year.

The lower value of 2,29 belongs *Electromagnetica*, which is close to the critical value of 1.81 and that in the future may cause the company to have problem.

The *average* of 10 companies is 2.7120, which is close to a high value and higher value of 2.99. The *standard deviation* has a value of 0.332, which is also a good value.

The year **2011** was the black year in the history of the Bucharest Stock Exchange, most issuers of decreasing market strong in the international financial crisis. The index of the Bucharest Stock Exchange (BSE), BET, lost 70.5% in value in 2011, this is the biggest annual fall in index history. The decrease in 2008 advanced practice canceled the last four years. All shares traded on BSE in 2011, without exception, have ended with negative returns. The value of transactions with shares registered on BSE in 2011 fell by 53% compared to the registered in 2010. The value of transactions with shares listed on BSE fell by 50% in 2011 to 7.0 billion (EUR 1.9 billion). The number of shares traded in 2008 fell by only 9.7% and the number of transactions dropped by 13.2%.

Applying the Altman model led to results presented in Table 5. 8 companies have values over the critical values of 1.81; only one of them being over the superior limit of 2.99 (Biofarm). The Biofarm business climbed by 9% this year and the company's profit was maintained at a similar level, from 9.3 million (2.2 million euros). This in the condition that most companies on the Stock Exchange recorded significant decreases in the same period of business, many passing loss. The liquidity of Biofarm fell from 26 million RON to 23.6 million RON, while receivables increased by 44% to 27.5 million RON. Biofarm is the only pharmaceutical company of the three who reported profit and business growth this year. Biofarm shares registered the largest increase of the Stock Exchange in this year, 205%.

Table no.5 The application of the Altman model to10 companies BSE in 2011 (mil.RON)

	Transilvania	**BRD**	**Petrom**	**Transgaz**	**Rompetrol**	**Transelectrica**	**Dafora**	**Azomures**	**Biofarm**	**Electromagnetica**
Working Capital	10947	26608	1638	250	1840	1074	136	344	68	41
Total Assets	17014	49239	24799	3278	4269	4375	473	610	146	88
Retained Earnings	203	1245	6366	1841	2090	1595	75	29	39	13
Earnings before Interest and Taxes	470	1614	1605	280	17	204	27	129	14	-70
Market Value of Equity	1059	696	5664	117	2109	733	97	52	109	94
Book Value of Total Liabilities	14646	44768	4950	932	2672	1851	301	1202	15	15
Sales	24293	57688	17399	1138	8678	2955	299	1293	66	8
Z - score	2,423	2,473	2,040	1,89	2,72	1,972	1,886	1,847	4,061	1,497
Average Z score			2,281			Standard deviation Z score			0,721	

Source: own calculations

2 companies are close to the critical value of 1.81 (Transgaz and Azomures). The company with the lowest value last year, continues its fall, being far below the value of 1.81, (SSIF Broker 1,4970). The turnover of *Electromagnetica* in 2008 fell more than eight times from the level of 3.9 million RON (1.1 million euros) to nearly 0.5 million RON (0.1 million euros); company recorded a loss of 2.3 million RON (0.5 million euros) from a profit of 1.4 million RON (0.4 million euros) in 2008. Furthermore during 2008, the creditors opened its insolvency procedure.

The *average* of 10 companies is 2.2818, which is close to the critical value of 1.81. The *standard deviation* has a value of 0.721, which is not a good value.

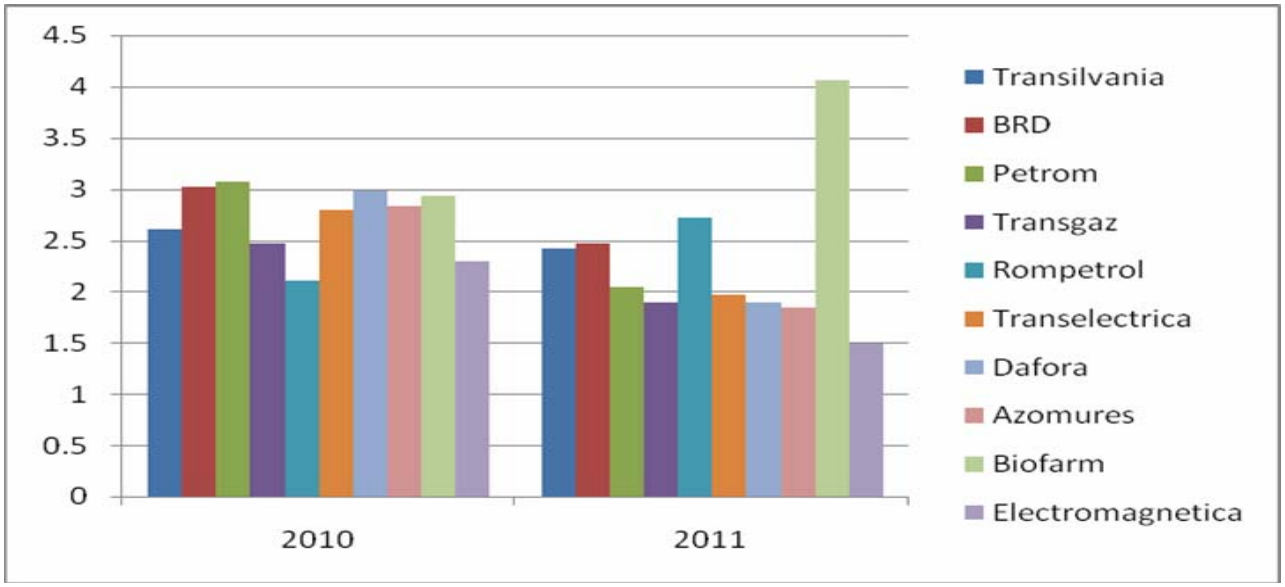

Figure 2 The application of the Altman model to10 companies BSE in 2010-2011

Compared to 2010, the average fell by 16% and standard deviaton increased by 116%. The effects of financial crisis on the top 10 companies listed on BSE manifest as follows (Chart 2):
- In 2010 all companies had values greater than 1.81; 4 have values higher than 2.99;
- In 2011, one company has a value greater than 3; 4 were near the critical limit of 1,81 and 1 below the same limit.

CONCLUSION

Some of the companies listed on the BSE felt in revenue and expenditure budgets the effects of financial crisis, while others "well madam" even in this period. The banks and petroleum companies have been replaced by issuers less visible in the top turnover.

The external turmoil raised new company-star on the Bucharest Stock Exchange. The reconfiguration of portfolios pulled to the forefront of the league seconds issuers, as BIOFARM.

The most traded corporate profits have been "rendered" by the crisis, and therefore, their actions followed a descending trend. The main negative factors for the evolution of companiesr were difficult adaptability to new conditions of market, very few correctly anticipating the economic crisis proportions, the sharp decline in demand, increasing financing costs, high volatility of the RON against the euro, a weak management of currency risk.

The importance of bankruptcy prediction and understanding of the causes of economic failure is finally a pragmatic matter.

The direct costs of insolvency or bankruptcy (legal fees, accounting honor, the auditors and lawyers) are low compared to losses that can record shareholders / creditors as a result to decrease firm value. Also indirect costs such as losses to managers, business partners, financial institutions, state are considerable. All have been fully felt on the Romanian market in financial crisis. Anything progress in identifying causes and failure prediction can minimize costs discussed.

Given the current financial crisis is a real challenge to try building a bankruptcy prediction function score for Romanian companies, because the bankruptcy process is quite different coordinated in Romania compared with most developed countries for which there Z Score methodology.

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