

*Dragan Zlatanović**, *Mile Bugarin***, *Vladimir Milisavljević****, *Vukašin Zlatanović*****

FORECASTING THE FINANCIAL DISTRESS OF MINING COMPANIES: TOOL FOR TESTING THE KEY PERFORMANCE INDICATORS

Abstract

There are numerous studies and research work related to the forecasting of financial distress of companies. Developed theoretical and practical models were used for forecasting such problems. Application of specific model is relatively novel analytical approach and represents an indicator which sometimes could have large importance for decision makers. Indicators for production and business aspects are represented by one of the most suitable synthetic parameters – Altman Financial Distress Ratio, which is sum of weighted individual parameters. The aim of this paper is to present a method for forecasting the financial distress, mainly based on financial parameters of a company. Calculation of financial parameters was based on the public annual financial reports of companies included in the example. Authors applied the Altman Z-score model on sample of two mining companies, to establish accuracy of this model and possibility for application on other mining companies.

Keywords: *financial distress, mining company, Altman Z-score, performance indicators*

INTRODUCTION

Importance for examination of such problems and application of suitable model for forecasting business distress or mining company failure forecast is very important in our commercial situation, since a number of failed companies, including those from mining sector, increases permanently. The research has indicated that there are more bankrupt companies than those which are re-industrialized. Bankruptcy of mining company has a negative impact on overall national economy, therefore this area requires a special attention since it affects numerous beneficiaries. Beside the management team, there are various parties interested in the company business and its future, such as

employees, current and potential creditors, suppliers and other users of financial information.

Rescue for failed companies can be found in searching the available founding and interests of potential investors, through privatization or some other form of association which would enable rehabilitation of mining industry.

Mining and metallurgy are extensive industries with low productivity in almost all transition countries, as left behind by the socialist economy. Also, economy transition during last 15 years did not yield the positive effects. Privatization of such companies is complex and specific, mainly due

* *Innovation Centre, Faculty of Mechanical Engineering, University of Belgrade, Serbia;*
e-mail: dr.dragan.zlatanovic@gmail.com

** *Mining and Metallurgy Institute, Bor, Serbia; e-mail: mile.bugarin@irmbor.co.rs*

*** *Faculty of Mining and Geology, University of Belgrade, Serbia;*
e-mail: vladimir.milisavljevic@rgf.bg.ac.rs

**** *FEFA - Faculty of Economy, Finance and Administration, Singidunum University, Belgrade,*
Serbia; e-mail: vukasinzlatanovic@gmail.com

to the exposure to large social pressure. Such companies also have larger national impact, additionally contributing to complexity of privatization [1].

Due to these reasons, the Serbian Government has taken the steps in finding solutions establishing which companies have the "strategic importance" [2].

Strategic importance of these companies is established according to:

1. Positive impact on employment in the region,
2. Positive impact on business of other companies,
3. Market share and market potential,
4. Feasibility of production and business,
5. Product/service of strategic importance for Serbian economy,
6. Privatization certainties in period of one year and
7. Company potential for attracting significant investment.

As it can be seen, these aspects consider both external and internal social and business environment.

There are two mining complexes among the companies for privatization with strategic importance and those are: Public Company for Underground Coal Mining (JP PEU) in Resavica and RTB Bor Group with subsidiaries.

Any further analysis must include the basic assumption that any mine is not feasible without investments. This criteria evaluates the possibility for investment in improvement of technology, transport, infrastructure and similar, i.e. privatization of the mine.

Investment potential, which includes the amount of investment for execution the project, is the result of technical and economic analysis which should be considered as separate criteria due to lack of cheap funding and difficulties to obtain them. The existing mines and mining companies in Serbia have huge problems in finding the investors in environment with controlled selling price of

coal, historical debts, outdated infrastructure, inherited environmental issues, variations on metals market, etc.

Some of the previously privatized mines have exhibited the efforts to utilize chances at the open market. In order to use business opportunities, these mines attempted to utilize the controversial market effects without any safety measures. This includes incompetent utilization of resources and exploitation of only those parts of deposit which generate high profit. Such approach resulted in difficult situation for further operation of these mines.

Described conditions had a serious social impact on mining, hence it should be considered in time. Threats to individual industries and their parts in Serbia are not equally distributed, where mining industry is probably in the most difficult situation, resulting in allocation of capital toward industries with larger profit. All mentioned indicators suggest that during privatization process of mining companies the governmental institutions must have significant regulating role. This means that these institutions must be supplied with suitable information which defines the business and social status of each mine and their importance for local community [3].

Approach presented in this paper uses a relatively simple tool for condition assessment and sustainability of production capability of mining company in the domain of financial distress.

SUSTAINABILITY OF CURRENT PRODUCTION AND BUSINESS ACTIVITY

Subject of this paper is related to the sustainability of business activities of the companies in the mining industry. Finances of the mining company can be analyzed by determination of so called Z value of the company. Z value represents quantity indicator of probability for bankruptcy of the company, i.e. it describes the financial

strength of the company. Calculation of Z value for two mining companies is given below.

This approach can be justified by the fact that bankruptcy of a company is a foreseeable consequence of economics. Economy strengths and weaknesses are related to the stimulations created by solutions of who takes the burden in case of bankruptcy. Real life suggests that market economy has relative advantage since market identifies troubled companies quickly and cheaply and also distributes the generated losses in manner which does not hamper the economic development. Of course, subsidies to companies which generate losses are usual in developed economies as well, but in strictly controlled manner. Such attitude is also applied in the mining industry, especially to companies related to energetics and metallurgy [4].

Zeta Altman Model for Forecasting the Financial Distress

One of the most common synthetic indicators is the Altman synthetic financial distress ratio, which represents the sum of weighted individual parameters.

Altman Z score is the first model for forecasting the financial distress, which uses model of iterative Multiple Discriminant Analysis. This model is still one of the most popular models for forecasting the bankruptcy. Original model was developed in 1968 for production companies and it forecasts bankruptcy if Z value sets in the specific ranges [5].

Research performed by Edward Altman included 33 failed and 33 successful companies. He developed the following relation, as a result of iterative Multiple Discriminant Analysis:

$$Z = 0,012 * X1 + 0,014 * X2 + 0,033 * X3 + 0,006 * X4 + 0,999 * X5 \quad (1)$$

where following ratio are:

$$- X1 = \text{Current assets} / \text{Total Assets}$$

Measure of net liquidity in relation to total assets. Company that generates the operational losses will have reduced current assets in relation to total assets.

$$- X2 = \text{Retained earnings} / \text{Total assets}$$

Fairly new companies will have lower value of this ratio, since they did not have time to generate assets.

$$- X3 = \text{Operating Profit} / \text{Total Assets}$$

Since the future of company is based on capability to generate profit with own assets, this ratio is suitable for conclusion the possibility for bankruptcy.

$$- X4 = \text{Market value of Equity} / \text{Book Value of Total Debt}$$

This ratio indicates the level of assets value losses before liabilities surpass the assets and company become insolvent.

$$- X5 = \text{Sales} / \text{Total assets}$$

Lower limit is 1.81, meaning that companies with Z score below this limit will go to bankruptcy, while the upper limit is 2.99, meaning that companies above this value will not go to bankruptcy. For values between 1.81 and 2.99 the original sample of companies showed mistakes. Accuracy of model discrimination between successful and unsuccessful companies for the period of one year before bankruptcy is 95%, and for the period of two years is 82%.

Altman revised original model in 1993, in such manner to develop a model for private companies also. This was achieved by replacement the Market value by Book value in ratio X4.

Result was the following Z'-score model:

$$Z' = 0,717 * X1 + 0,847 * X2 + 3,107 * X3 + 0,420 * X4 + 0,998 * X5 \quad (2)$$

In this case, lower limit is $Z'=1.23$. Companies below the score value bellow are considered to be those that will surely go bankrupt, and the upper value is $Z'=2.90$ for the companies with above score value considered as successful. Scores between these

values are in "grey" area, and same rules are valid as in the previous case.

Probability for company bankruptcy can be calculated by applying the following formula: $1 - \text{EXP} (Z \text{ score value}) / (1 + \text{EXP} (Z \text{ score value}))$.

Since this assessment is based on financial reports and business information provided by companies itself. These can be arbitrary corrected in relation to the real situation, therefore validity and accuracy of method can questionable.

Table 1 Mining company "X"

		Mining company "X"				
	$Z' = 0.717 \cdot X1 + 0.847 \cdot X2 + 3.107 \cdot X3 + 0.42 \cdot X4 + 0.998 \cdot X5$	2010	2011	2012	2013	2014
	<i>Probability for bankruptcy</i>	1.16%	0.54%	0.05%	0.04%	0.07%
	<i>Scores between 1.23 and 2.90 (grey zone)</i>	4.449	5.214	7.683	7.935	7.291
(Private) production companies	X1 - Working Capital / Total Assets	X1	X1	X1	X1	X1
		0.333	0.254	0.245	0.348	0.342
	X2 - Retained Earnings / Total Assets	X2	X2	X2	X2	X2
		0.155	0.227	0.262	0.154	0.225
	X3 - Earnings before Interests and Taxes / Total Assets	X3	X3	X3	X3	X3
		0.151	0.216	0.239	0.137	0.201
	X4 - Book Value Equity / Book Value of Total Liabilities	X4	X4	X4	X4	X4
		3.755	4.324	8.598	11.120	8.722
	X5 - Sales / Total Assets	X5	X5	X5	X5	X5
		2.038	2.358	2.938	2.462	2.573
	Y1 - Index of fuel and energy costs in total costs	13.01%	13.67%	12.47%	12.55%	13.36%
	Y2 - Index of labor costs in total costs	25.78%	27.47%	26.94%	29.51%	38.08%
	Y3 - Average costs per employee (gross) per month (RSD)	42,277	52,460	61,153	62,804	84,308

Table 2 Mining company "Y"

		Mining company "Y"				
	$Z' = 0.717 \cdot X1 + 0.847 \cdot X2 + 3.107 \cdot X3 + 0.42 \cdot X4 + 0.998 \cdot X5$	2010	2011	2012	2013	2014
	<i>Probability for bankruptcy</i>	22.8%	12.9%	17.1%	22.6%	39.6%
	<i>Scores between 1.23 and 2.90 (grey zone)</i>	1.222	1.912	1.578	1.231	0.423
(Private) production companies	X1 - Working Capital / Total Assets	X1	X1	X1	X1	X1
		0.271	0.441	0.087	0.143	0.049
	X2 - Retained Earnings / Total Assets	X2	X2	X2	X2	X2
		0.013	0.052	0.050	0.002	0.064
	X3 - Earnings before Interests and Taxes / Total Assets	X3	X3	X3	X3	X3
		0.006	0.052	0.039	0.010	0.090
	X4 - Book Value Equity / Book Value of Total Liabilities	X4	X4	X4	X4	X4
		1.156	1.158	0.588	0.609	0.338
	X5 - Sales / Total Assets	X5	X5	X5	X5	X5
		0.512	0.905	1.107	0.904	0.651
	Y1 - Index of fuel and energy costs in total costs	11.29%	13.85%	13.11%	11.90%	16.00%
	Y2 - Index of labor costs in total costs	13.89%	14.44%	15.00%	19.56%	34.67%
	Y3 - Average costs per employee (gross) per month (RSD)	47,608	57,399	60,229	65,021	97,229

Application of Altman Z'-score Model

Application of Z'-score model is given further on in this chapter, for two privatized mining companies. The purpose was to establish the accuracy of this approach. Z'-score model is applied for the mining company "X" which is successful and the mining company "Y" which is in bankruptcy. Values of Z' were calculated for previous 5 years according to the data publicly available at the Serbian Business Registers Agency and Statistical Office of the Republic of Serbia websites.

Results of Analysis the Altman Z'-score Model

Since Z' value for company "Y" is significantly lower than limiting value of 2.90, it can be considered as the unsuccessful in period of analyzed 5 years. This was proved in real life. Bankruptcy probability of company "Y" 2014 was 39.7%.

Our opinion is that the additional explanations are necessary for ratios used in Z' model and their analysis:

X1 – is a liquidity indicator representing portion of Working capital in Total assets. Research indicated that companies operating with losses show decline of short-term assets in total assets. Company "Y" had this indicator in last year in negative values, meaning that total assets are larger than the operating capital (which represents difference between short-term assets and short-term liabilities). Net working capital is also negative as a consequence of larger short-term liabilities in relation to short-term assets.

X2 – is a ratio of Retained earnings and Total assets of the company, and it indicates a portion of reinvested assets during one calendar year. Retained earnings are considered as best indicator of company growth and sources of financing. This indicator for company "Y" is low, even negative in the

last year, meaning that retained earnings are very low and negative in relation to total assets.

X3 – ratio which indicates the profit. This ratio for company "Y" is negative since it has business losses.

X4 – ratio indicates how much the value of company assets could lose its value before company becomes insolvent. When this ratio is lower than 1 total then total liability are smaller than book value equity, as is the case for company "Y".

X5 – ratio is a coefficient of total asset turnaround. It is obvious that company "X" is far better than company "Y" since it turns much of its asset into the business income.

Possibility for Using other Financial Indicators

Tables 1 and 2 are also providing indexes Y1, Y2 and Y3 (beside ratios required for calculation of Z' value). These indexes also can be calculated with publically available information. As already mentioned, these sources are mainly annual reports such as the Balance sheet and profits and losses, which are available at website of the Serbian Business Registers Agency[†] (APR) and statistical annual and monthly bulletins available at website of the Statistical Office of the Republic of Serbia websites[‡] (RZS).

The mentioned Balance sheets of companies are also having following data: cost for fuel and energy, cost for gross salaries and remunerations, as well as the average number of employees. Therefore, it is fairly simple to determine their ratios:

Y1 - Index of fuel and energy costs in total costs;

[†] <http://www.apr.gov.rs/РезултатиПривреднаДруштва/ДруштваПреправнодатока.aspx>

[‡] <http://webz.s.stat.gov.rs/WebSite/>

Y2 - Index of labor costs in total costs;

Y3 - Average costs per employee (gross) per month (RSD).

It should be mentioned that same data was obtained for JP PEU and RTB Bor, strategic companies mentioned in the introduction of this paper. Analysis of Z' model for these companies are not presented in this

paper. These two companies are for long time having total liabilities larger than total assets. This is the reason why they are in restructuring process and not in bankruptcy. Instead, the indexes Y1, Y2 and Y3 will be presented and compare their values with analyzed companies "X" and "Y" and analyze those.

Table 3 *Indexes of fuel and energy costs, labor costs and salaries in total costs*

JP PEU – Consolidated balance sheets		2008	2009	2010	2011	2012	2013	2014
Y1 -	Index of fuel and energy costs in total costs	4.37%	4.30%	5.01%	5.12%	4.91%	4.95%	6.38%
Y2 -	Index of labor costs in total costs	49.36%	48.55%	44.67%	43.96%	46.45%	45.82%	69.36%
Y3 -	Average costs per employee (gross) per month (RSD)	49,740	53,730	54,164	61,294	68,981	72,559	94,745
RTB BOR GRUPA – Consolidated balance sheets								
Y1 -	Index of fuel and energy costs in total costs	24.36%	26.13%	23.08%	24.28%	23.76%	23.90%	27.96%
Y2 -	Index of labor costs in total costs	26.34%	26.27%	22.68%	23.12%	22.57%	21.23%	28.47%
Y3 -	Average costs per employee (gross) per month (RSD)	52,257	55,471	62,722	82,504	95,918	98,689	123,296

As it can be seen in table 3, index Y1 (cost of fuel and energy in total costs) varies for all analyzed companies but is consistent without large deviations from the average values for each individual company.

However, in case of index Y2, which ratio of labor cost and total costs, it is unacceptable that this ratio is up to 70%. This means that there is no production and consequent income which could compensate such a large share of labor cost in total costs. This is additionally confirmed by 5% value of Y1 (share of fuel and energy cost).

Comparing this value for various mines this index is generally between 20 and 30%, which is the reference range for this ratio.

Finally, the largest paradox can be seen in the analysis of gross cost per employee per month (index Y3). The analyzed compa

ny "X" has the best financial indicators and it is furthest away from any financial distress, but it also has the lowest average gross salaries in comparison to other companies. Company "Y", which is in bankruptcy, together with other two strategic companies, which are protected from bankruptcy so far, are having negative capital and fairly high average gross salaries. Proper review of this situation shows that on one hand there is a responsible salary policy and on the other hand there is a situation that salaries are higher in proportion to poorer condition of the company. This situation is more typical for social companies than for mining ones. Therefore, it is very dangerous situation to have the bankruptcy of such company, since it could lead to high social turmoil both at local and national level.

Since two strategic companies are employing almost one third of workers in the Serbian mining industry, then they would have significant impact on gross salaries at the industry level. Hence, the question what

is the realistic mining salary in the Serbian mining industry remains. Data given in Table 4 clearly show that the salaries in the mining industry are 50% higher than the average salary at the level of the Republic of Serbia.

Table 4 Indicators of gross salary shares in the Republic of Serbia and mining industry

Indikatori/Indicators*	2008	2009	2010	2011	2012	2013	2014
AVERAGE GROSS SALARY							
Average gross salary in RS	<u>45,674</u>	<u>44,147</u>	<u>47,450</u>	<u>52,733</u>	<u>57,430</u>	<u>60,708</u>	<u>61,426</u>
Average gross salary in mining	<u>55,835</u>	<u>61,226</u>	<u>69,582</u>	<u>80,605</u>	<u>89,521</u>	<u>96,051</u>	<u>97,900</u>
- Nominal Growth Index	14.00%	10.00%	13.60%	15.80%	11.10%	7.30%	1.90%
- Real Growth Index	0.40%	1.30%	6.30%	4.30%	3.10%	-0.50%	-1.00%

* Annual statistical journals

Graph with comparative overview the gross salaries in Serbian dinars (RSD) at

monthly level is shown in Figure 1.

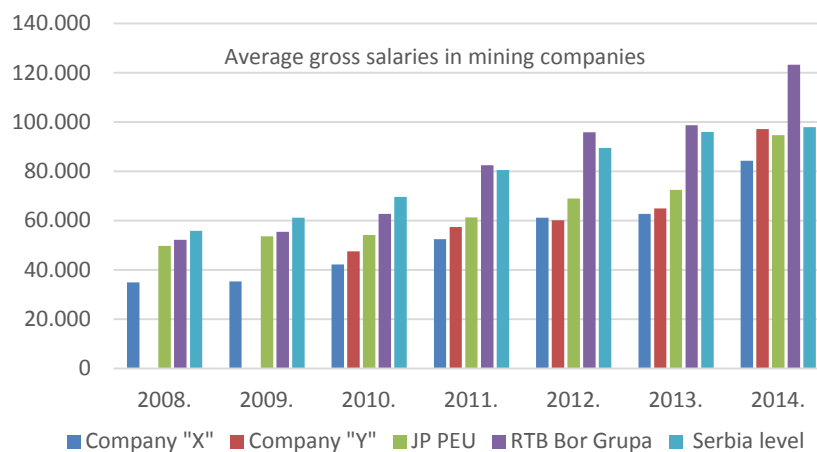


Figure 1 Average gross salaries in selected mining companies and national level

CONCLUSION

This paper provides one approach for forecasting the financial distress of mining companies, mainly based on their financial

indicators. Analysis was based on publicly available balanced sheets of companies and statistical information. Calculated indexes

and values can provide satisfactory presentation about the company, as well as the establishment of key performance indicators that have the importance in decision making process.

This work presents application of Altman Z' score model and sufficient accuracy for its application is shown in mining industry.

Analysis included two privatized mining companies "X" and "Y". Indicators of company "X" showed the business success with very high Z' value which means the financial stability. On the other hand, company "Y" had poor results, with Z' value below lower limit, thus confirming bankruptcy which happened in real world.

Such analysis raises the question why management of company "Y" did not notice the business problems and/or why they did not acknowledge it before it was too late?

As an answer to this issue is a fact that most commonly proper methods and techniques are not available, to provide the red flag on possible problems and upcoming business difficulties, threatening the overall business and generate to bankruptcy. Therefore, it is necessary to establish simple and reliable forecasting system of success or failure of mining company. Altman Z' score model surely can be used for this purpose.

Further research could include the analysis of numerous mining companies, as well as possible correlation of Z' value with some technical indicators and other internal and external factors which are not directly related to financial indicators.

REFERENCES

- [1] Kevorkijan V., Ownership Transformation and Restructuring of the Metallurgy Sector in the Countries in Transition, ZRVK, Maribor, Slovenia, Association of Metallurgical Engineers of Serbia and Montenegro,
- [2] Official Gazette of RS, No. 47/2015 - Decision on Determining the Subjects of Privatization of Strategic Importance http://demo.paragraf.rs/combined/Old/t/2015_09/t09_0193.htm
- [3] Zlatanović, D., PhD Dissertation, Definition of Consolidation Model for Underground Mines in Serbia, Faculty of Mining and Geology, Belgrade, 2010;
- [4] Zlatanović, D., Pezo, L., Milisavljević, V., Assessment Methodology for Determining Situation and Perspectives of Mines, II International Symposium: Mining 2011“, Proceedings, 1-10, Vrnjačka Banja, Serbia, May 2011.
- [5] Edward I. Altman, Predicting Financial Distress of Companies: Revisiting the Z-Score and Zeta® Models, July 2000; This paper is adapted and updated from E. Altman, “Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy,” *Journal of Finance*, September 1968; and E. Altman, R. Haldeman and P. Narayanan, “Zeta Analysis: A New Model to Identify Bankruptcy Risk of Corporations,” *Journal of Banking & Finance*, 1, 1977.