# BANKRUPTCY RISK FORECASTING FOR THE METALLURGICAL BRANCH IN ROMANIA

All investment decisions require a thorough analysis of the retrospective evolution of the entities from the concerned area, in order to estimate the long-term evolution perspectives. In this context, the present study analyzes the evolution of the entities from the Romanian metallurgical sector based on the accounting and financial information published for the period 2008 - 2012 and, in fact, it justifies the situation from the perspective of users (managers, investors, auditors) and of the economic environment specific to Romania. Starting from this premise we created a regression model particularly useful in forecasting the evolution of the ability to deal with debt for the entities from the Romanian metallurgical sector.

*Key words:* metallurgical branch, bankruptcy, audit services, corporate governance, regression model

## INTRODUCTION

The Romanian metallurgical industry went through a long period of restructuring and privatizations that have deeply changed its characteristics compared to what this sector represented before 1989 [1]. Even more, these changes were strongly followed by profound social drama, while the ensuring of the necessary competitiveness and effectiveness became a requirement absolutely mandatory, especially in the context of Romania's integration in the European Union [2]. Also, these negative effects were intensively felt because this process of restructuring was done without an explicit and well organized strategy of human resource management [1].

Currently, the most important entities in Romanian metallurgical industry became part of large international groups and they are adapting their strategies in order to counteract the challenges of the market, that is now facing with a major risk of bankruptcy and layoffs of capacity because of the consequences of the global economic crisis of 2008 - 2010 [1-3].

In this context, the authors appreciate that an analysis of the potential factors that might influence the risk of bankruptcy in metallurgical sector would be quite relevant, especially in the context of global economic crisis.

## EXPERIMENTAL WORK

For this study there were selected a number of 41 Romanian entities having as main object of activity the metallurgical sector: production of ferrous metals, pro-

duction of tubes, pipes and hollow profiles, production of precious metals and metal casting and which in the period of time 2004 - 2012 have been subjected to financial audit. From the official information published through financial statements for the period 2008 - 2012 by these entities there were extracted data regarding total assets, current assets, turnover, gross and net result and social capital. These data have been processed for each entity from the sample, for each financial year in order to calculate the variable Z based on the bankruptcy risk prediction model developed by Altman.

The bankruptcy risk calculation model is based on the following equation:

$$Z = 1{,}2X_1 + 1{,}4X_2 + 3{,}3X_3 + 0{,}6X_4 + 0{,}999X_5$$

The significations are:

$X_1$ Company's Flexibility;
$X_2$ Self-financing Rate of Total Assets;
$X_3$ Economic Profitability Rate;
$X_4$ Company's Debt Capacity;
$X_5$ Return on Assets.

The bankruptcy risk assessment is based on the values registered by the variable Z, as following:

$Z \geq 3$ The entity is solvent;
$Z \in [1{,}8; 3)$ The entity will face financial difficulties which it can surpass only if the management adopts adequate strategies;
$Z < 1{,}8$ The entity will imminently face bankruptcy.

By using this model the management could foresee in proportion of 75 % the bankruptcies of certain entities with an anticipation of 2 years [5].

In order to achieve this objective we considered that:

- all external resources attracted by the audited entities from the metallurgical sector were destined to finance short-term assets;

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• the analyzed entities have not been undercapitalized through distribution of dividends in the concerned period.

The purpose of calculating the variable Z was to:

▪ verify at national level the financial stability of the metallurgical sector;

▪ explain the situation from the perspective of managers, investors, auditors or other factors specific to the Romanian economic environment;

▪ establish a suitable and representative statistical model for the evolution of bankruptcy risk within the metallurgical sector in the last five years;

▪ foresee the evolution of bankruptcy risk for the next 10 years based on the above mentioned statistical model.

## RESULTS AND DISCUSSIONS

In fact, the situation is revealed by the data published in the financial statements for the period 2008 - 2012 by the audited entities from the Romanian metallurgical sector. According to these data statistically processed in Table 1, the average variable Z of the Altman model registers every year values below the maximum limit at which the financial difficulties are estimated to be rectified by a fitted strategy. In 2008, which marks the beginning of the financial and economic crisis, the variable Z registered a medium value (1,75) close to the range [1,8; 3], which according to the model could create the premises for a possible financial recovery.

In 2009 the number of solvent audited entities (with low risk of bankruptcy) from the metallurgical sector has significantly decreased (66,7 %) compared to 2008, while the number of audited entities with high risk of bankruptcy increased (22,2 %). The next three years (until 2012) are characterized by a increasing tendency (by 99,9 %) of the number of solvent entities, but nevertheless

they represent a small percentage from the total of audited entities (maximum 14,63 % in 2012). The number of audited entities which face the risk of imminent bankruptcy also registers a favorable evolution (decreases in the period of time after 2009 until 2012 by 3,7 %). Therefore it can be concluded that despite of this this slightly favorable trend the average of Altman variable for the audited entities from the Romanian metallurgical sector, in each of the five financial years remains below the critical value of 1,8 which indicates the existence of certain guarantees for financial recovery.

This study aims to explain this situation by reference to the policies adopted by management, the existence or lack of foreign investments, the auditor's category or the evolution tendency of the Romanian economic environment in general. In particular it makes reference to the metallurgical sector as revealed by the statistics presented in Table 2 concerning the correlation between the level of bankruptcy risk and the category of the financial auditor (Big Four or not), the existence of foreign management and foreign investments within the Romanian metallurgical sector.

It can be noticed that during the period of time 2008 - 2012, 29,27 % of the audited entities from the Romanian metallurgical sector are audited by Big Four, 60,98 % have foreign management and foreign participation to social capital. Regardless of the category of auditors, managers or investors, one can observe a certain constant proportion between audited entities - solvent, in financial difficulty or facing imminent bankruptcy. Thus, approximately 8 % of the entities are solvent whether they are audited or not by auditors from the Big Four category, whether they have foreign man-

Table 1 **The evolution of bankruptcy risk for the audited entities from the Romanian metallurgical sector in the period of time 2008 - 2012**

| Year | Significance of bankruptcy forecast interval according to Altman model | Percent audited entities | Average of values for variable Z |
|---|---|---|---|
| 2012 | Solvent | 14,63 % | 0,68 |
| | Financial difficulty | 21,95 % | |
| | Imminent bankruptcy | 63,42 % | |
| 2011 | Solvent | 9,76 % | 0,81 |
| | Financial difficulty | 19,51 % | |
| | Imminent bankruptcy | 70,73 % | |
| 2010 | Solvent | 9,76 % | 1,25 |
| | Financial difficulty | 17,07 % | |
| | Imminent bankruptcy | 73,17 % | |
| 2009 | Solvent | 7,32 % | 0,56 |
| | Financial difficulty | 12,20 % | |
| | Imminent bankruptcy | 80,48 % | |
| 2008 | Solvent | 21,95 % | 1,75 |
| | Financial difficulty | 12,20 % | |
| | Imminent bankruptcy | 65,85 % | |

**Source:** Statistical processing performed by the authors

Table 2 **The significance of the bankruptcy risk forecast interval according to Altman model for the audited entities from the metallurgical sector (average for 2008 - 2012) differentiated according to the type of auditors, management and type of investment**

| Explanation | | Variable according to Altman model (Crosstabulation) | |
|---|---|---|---|
| Auditor's category | Auditor Big Four | Yes (29,27 %) | No (70,73 %) |
| | Solvent | 8,33 % | 10,34 % |
| | Financial difficulty | 16,67 % | 13,79 % |
| | Imminent bankruptcy | 75,00 % | 75,86 % |
| | Total | 100,00 % | 100,00 % |
| Local management | Foreign management | Yes (60,98 %) | No (39,02 %) |
| | Solvent | 8,00 % | 12,50 % |
| | Financial difficulty | 12,00 % | 18,75 % |
| | Imminent bankruptcy | 80,00 % | 68,75 % |
| | Total | 100,00 % | 100,00 % |
| Foreign investment | Foreign investment | Yes (60,98 %) | No (39,02 %) |
| | Solvent | 8,00 % | 12,50 % |
| | Financial difficulty | 16,00 % | 12,50 % |
| | Imminent bankruptcy | 76,00 % | 75,00 % |
| | Total | 100,00 % | 100,00 % |

**Source:** Statistical processing performed by the authors

agement or foreign investments. On the other hand, the percentage of entities with bankruptcy varies very slightly (6,25 %) between 75 % and 80 %, which indicates that the above mentioned variables do not significantly influence the entities from this category. Therefore, we came to the conclusion that solvency or financial difficulties of the audited entities from the Romanian metallurgical sector are not influenced by factors such as the auditor's category, the existence of a foreign management or foreign investments.

In order to statistically substantiate this hypothesis we made the concordance test (Chi-Square Test) as shown in Table 3. This test has the role to determine whether the hypothesis according to which the type of auditors, management and investors is independent from the average values registered for the variable Z of Altman model in the period of time 2008 - 2012 by the audited entities from the Romanian metallurgical sector can be rejected or not.

Table 3 **Chi Square Test application**

| Tested correlation | Auditor-Z Management-Z Investor-Z |
|---|---|
| Calculated Chi-Square value | 41 |
| Number of freedom degrees | 40 |
| p-Value | 0,4265 |
| Conclusion of independence hypothesis testing | Acceptance |

**Source:** Statistical processing performed by the authors

Since the calculated p-Value (0,4265) is higher than the value of 0,10 we cannot reject the null hypothesis according to which the two categories of variables are independent. Therefore, the risk of bankruptcy of the audited entities from the Romanian metallurgical sector does not depend on the nature of management (local or foreign), of foreign investments or auditors (belonging to Big Four). Consequently, the relatively high risk of experiencing financial difficulties or bankruptcy can be caused by factors specific to the Romanian economic environment.

Since the period taken into consideration (2008 - 2012) for processing the data extracted from the financial statements is extended, we consider that it is relevant to test certain regression models in order to provide forecasts concerning future evolution of solvency for the entities from the Romanian metallurgical sector according to the data in Table 4.

The Reciprocal-Year regression model presented in Table 5 registers the highest value of Pearson's correlation coefficient. A value of this coefficient above 0,75 denotes a moderate-strong intensity correlation between the dependent variable (variable Z of Altman model) and the independent variables (financial years). The financial years explain 56,71 % from the variation of variable Z of Altman model.

Graphically, the evolution of bankruptcy risk in correlation with the established regression model is presented in Figure 1.

Table 4 **Comparison of alternative models for risk of bankruptcy forecasting for the Romanian metallurgical sector**

| Regression models | Correlation coefficient | R-Squared |
|---|---|---|
| Reciprocal-Year | 0,7531 | 56,71 % |
| Logarithmic-Year | -0,6867 | 47,16 % |
| S-curve | 0,6509 | 42,37 % |
| Square root-Year | -0,6473 | 41,90 % |
| Linear | -0,6085 | 37,02 % |
| Multiplicative | -0,5832 | 34,01 % |
| Square root-Z | -0,5650 | 31,92 % |
| Double reciprocal | -0,5325 | 28,35 % |
| Exponential | -0,5137 | 26,39 % |
| Reciprocal-Z | 0,3935 | 15,48 % |

**Source:** Statistical processing performed by the authors

Table 5 **The equation of the Reciprocal-Year regression model established for predicting the bankruptcy risk for the Romanian metallurgical sector**

| Regression Model - Reciprocal-Year | |
|---|---|
| General | Particular |
| $Y = a + b/X$ | $Z = 0,490559 + 1,13308/Year$ |

**Source:** Statistical processing performed by the authors

The usefulness of this regression model is that it provides the possibility of substantiating certain forecasts concerning the evolution of bankruptcy risk in future financial years as shown in Table 6.

According to the Reciprocal-Year model it can be observed (with a probability of 97 %) that in the following years the bankruptcy risk of the entities from the Romanian metallurgical sector will not get worse, it will be relatively constant. The average maximum level that the Altman variable can take will be below 1,8 which according to Altman model it ensures the ability of recov-
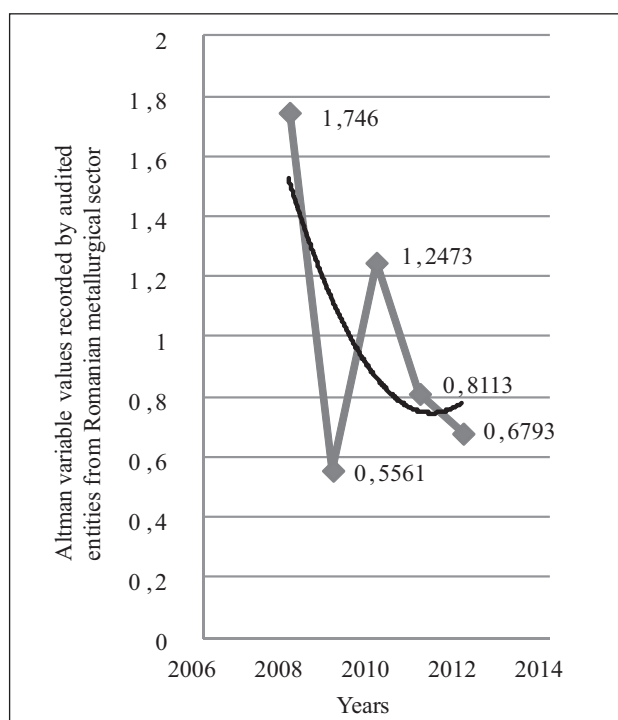


**Figure 1** Altman variable: evolution an regression model

Table 6 **Predicted values for the bankruptcy risk of the entities from Romanian metallurgical sector**

| Year | Predicted Z | 97 % | | 97 % | |
|---|---|---|---|---|---|
| | | Prediction limits | | Confidence limits | |
| | | Lower | Upper | Lower | Upper |
| 2014 | 1,05 | -0,53 | 2,64 | 0,40 | 1,71 |
| 2016 | 0,77 | -0,87 | 2,42 | -0,02 | 1,57 |
| 2018 | 0,68 | -1,03 | 2,39 | -0,23 | 1,59 |
| 2020 | 0,63 | -1,11 | 2,38 | -0,35 | 1,61 |
| 2022 | 0,60 | -1,17 | 2,37 | -0,42 | 1,63 |

**Source:** Statistical processing performed by the authors

ery when faced with financial difficulties. Therefore, in Romania, this sector will remain with a high risk in terms of ability to deal with debts, risk which is maintained by the current economic difficulties.

## CONCLUSIONS

Based on the information published in the financial statements, we can conclude that the Romanian metallurgical sector is facing financial difficulties. Statistically speaking this situation is not related to the type of investors, managers or auditors. The explanation may be related to a general economic situation less favorable for this sector. In order to illustrate the evolution of bankruptcy risk within the Romanian metallurgical sector, the Reciprocal-Year regression model proved to be the most fitted model. It was selected by statistically

analyzing Pearson's correlation coefficient and R-squared indicator starting from a total of 10 models of regression analysis. The usefulness of this statistical model lies in the existence of the possibility of forecasting the bankruptcy risk for the entities from the Romanian metallurgical sector. Thus, it is reliably estimated that in coming years the bankruptcy risk of this sector in Romania will maintain and it will not face an increasing trend, but yet it remains a risky sector considering the conditions of the current economic environment.

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**Note:** The responsible translator for English language is the lector from Babeş-Bolyai University, Cluj-Napoca