Classic Insolvency Prediction Models Tested On Romanian Insurance Companies

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Abstract

This paper aims to analyse the applicability of classical bankruptcy prediction models for the Romanian insurance companies. Using four models, the Altman model, the Z-factor model, the Springate model and the model used to determine insolvency probability for the emerging markets we have conducted a study to see if they apply to Romanian insurance companies' financial statements for the years between 2011 and 2013. We will present each model separately, analysing the indicators that led to the obtained results. In the end, we will combine the results to establish the applicability of these models to the Romanian insurance sector.

Keywords: insolvency prediction, models, insurance companies

Introduction

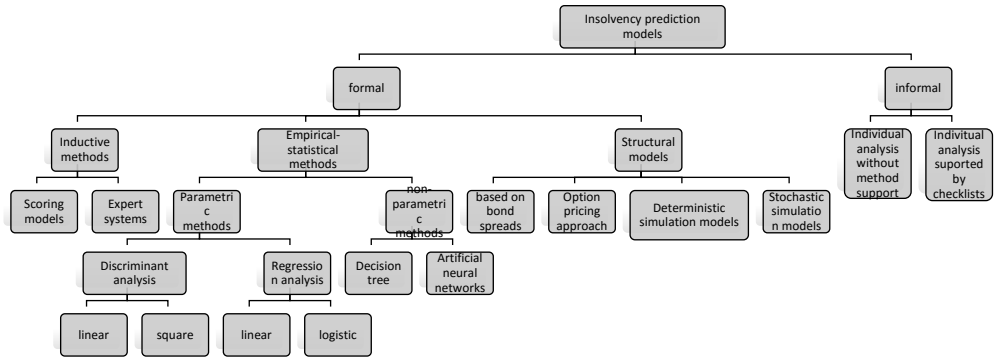
As even large companies are starting to become insolvent, the study of bankruptcy is becoming more and more relevant and important in trying to avoid social problems to the society. Using financial distress models to predict failure is, for most businesses, absolutely essential in their decision making process, more so when it comes to insurance companies, which play an important role for the stability of the financial system. This study aims to start an investigation in the applicability of the Altman (1968), Springate (1978) Z-score models and the Emerging Markets model in predicting financial distress in insurance companies in Romania.

The Altman and Springate models were however developed in a different economic environment, time horizon, industry and country. Testing these models in the Romanian context is important to determine the practical applicability and relevance of the models. The main objective of the study is to test the Altman and Springate models in determining practical predictive ability of failure in all Romanian insurance companies during a 3-year period of time and to comment on the models applicability according to the

empirical results. The study is designed into three sections. The first section will discuss the theoretical aspects of the study. The second part will be the discussion of the research results and finally the conclusion and recommendations of the study will be presented.

Insolvency prediction models

Figure 1. Overview of the known and analysed insolvency prediction methods



Source: Authors elaboration after M.Bemmann (2007)

Insolvency prediction can be divided into formal and informal insolvency prediction. In the case of informal procedures humans make credit decision insolvency predictions based on their intuition and personal experience. Here any appropriate checklists and (more or less detailed and precise) guidelines and procedures are available. Formal methods are based, on the other hand, on explicitly laid down procedural rules.

The multivariate linear discriminant analysis (MDA) is the first multivariate statistical method, which was used, for the first time in the late 1960s, to predict corporate defaults (Altman, 1968). It is the statistical procedure historically most commonly used in scientific insolvency prediction studies and in practice at banks, but, at comparable accuracy ratio increasingly displaced from the logistic regression method, since there are less restrictive demands on the data used and the model results can be interpreted directly cardinal, i.e. in the form of probabilities of default.

Altman's Z-score model is a linear analysis in which the five variables are objectively weighted and summed to provide a total score (score value), which is then used as the basis for the classification of companies in solvent and insolvent. In developing the model, Altman has selected 33 companies with financial problems. The sample included industrial enterprises (production companies). Based on the principle of similarity, for each bankrupt enterprise, Altman selected a corresponding (regarding size, branch etc.) healthy enterprise.

From an initial list of 22 indicators, the author elects the following 5 variables having the highest impact:

- X1 - Working Capital/Total Assets – as a measure of financial flexibility
- X2 - Retained Earnings/Total Assets – as a measure of active financing capacity
- X3 - Earnings Before Interest and Taxes/Total Assets – as a measure of the return of advanced resources
- X4 - Market Value of Equity/Book Value of Total Liabilities – as a measure of the firms debt level
- X5 - Sales/Total Assets – as a measure of the intensity of asset usage

After weighing the coefficients the model is finalized as follows:

$$\mathbf{Z = 1,2*X1 + 1,4*X2 + 3,3*X3 + 0,6*X4 + 1,05*X5 \quad (1)}$$

The obtained Z-Score is interpreted using the following evaluation method:

Table 1. Evaluation methods for the Z-score model

Evaluation	up to	1,81	Imminent insolvency
	between	2,99	Insolvency danger
	higher than	2,99	Solvent

Source: Author's elaboration after Altman's Z-Score model

The Z"-score analysis represents the second stage of the model development of Altman's Z-score. Since the initial model was limited by the X4 variable only to companies listed on the stock exchange, the author has reconsidered this financial indicator, replacing the denominator (the market value of equity) with the book value of equity, which is considered to be more representative. Also, the variable X5 (Sales/ Total assets) is considered to be industry-sensitive. To this end, the initial model could not be suitable to all branches specified by Altman (production, trade, services).

With this changes the formula of the improved model becomes:

$$\mathbf{Z" = 6,56*X1 + 3,26*X2 + 6,72*X3 + 1,05*X'4 \quad (2)}$$

Where:

- X1 - Working Capital/Total Assets
- X2 - Retained Earnings/Total Assets
- X3 - Earnings Before Interest and Taxes/Total Assets
- X'4 - Book Value of Equity/Book Value of Total Liabilities

The evaluation method for the results obtained by applying this model is the following:

Table 2. Evaluation methods for the Z"-score model

Evaluation	up to	1,1	Imminent insolvency
	between	1,1 - 2,6	Insolvency danger
	higher than	2,6	Solvent

Source: Author's elaboration after Altman's Z"-score model

Motivated by the same idea of the rating scores, Springate uses the multivariate discriminant analysis to choose from 19 well-known indicators 4 that he has studied in his model. In this context, the model is determined using the following equation:

$$Z = 1{,}03*A + 3{,}07*B + 0{,}66*C + 0{,}4*D \quad (3)$$

Where:

- A – Working Capital/Total Assets
- B – EBIT/Total Assets
- C – Gross Profit/Current Liabilities
- D – Sales/Total Assets

The method for evaluating the Z-Scores is the following:

Table 3. Evaluation methods for the Springate model

Evaluation	lower than	0,862	Insolvency danger
	higher than	0,862	Solvent

Source: Author's elaboration after Springate's model

All these models were built and carried out in countries such as Great Britain, Australia and the United States. The phenomenon of bankruptcy seems to be complicated in developing capital markets, perhaps because of the relatively short history of the companies and the increased likelihood of the disappearance of companies in the event of a situation characterized by high economic growth. Given these critical differences, one can argue that the existing consensus, which is found in the bankruptcy prediction literature, can be challenged.

Developing a verifiable prediction model has helped the identification of significant attributes of companies in less developed economies that were different compared to the previously examined failure prediction models in the developed economies. Furthermore, accounting and market information that can distinguish between discriminant insolvent and solvent companies of the emerging capital markets, may convey new insights into the insolvency proceedings that take place during the quite different stages of economic growth in emerging markets.

While developing a model for the emerging markets, Zulkarnain, Nor-Aziah, and Karbhari (2006) tested three groups of possible variables. Finally, the group with the highest accuracy has been selected. The F-test was used as an additional means of interpretation of the relative discriminative power of the independent variable. The final estimated function derived from the analysis is the following:

$$Z = 2.34744 + 1.75130 * X1 - 0.98102 * X2 + 0.14104 * X3 \quad (4)$$

Where:

• Z - Z-score, as the "overall index"
• X1 - Total Liabilities /Total Assets

• X2 - Capital turnover of current assets (Sales/Current assets)
• X3 - Cash/Current Liabilities

The results of the model can be interpreted using the following three evaluation methods:

Table 4. Evaluation methods for the emerging markets model

Evaluation 1	lower than	-1,1168	Solvent
	between	0	Small risk
	between	1,1168	Insolvency danger
	higher than	1,1168	Imminent insolvency
Evaluation 2	lower than	-1,1168	Solvent
	between	1,1168	Grey Area
	higher than	1,1168	Imminent insolvency
Evaluation 3	lower than	0	Solvent
	higher than	0	Insolvency danger

Source: Author's elaboration after Zulkarnain, Nor-Aziah, and Karbhari's model

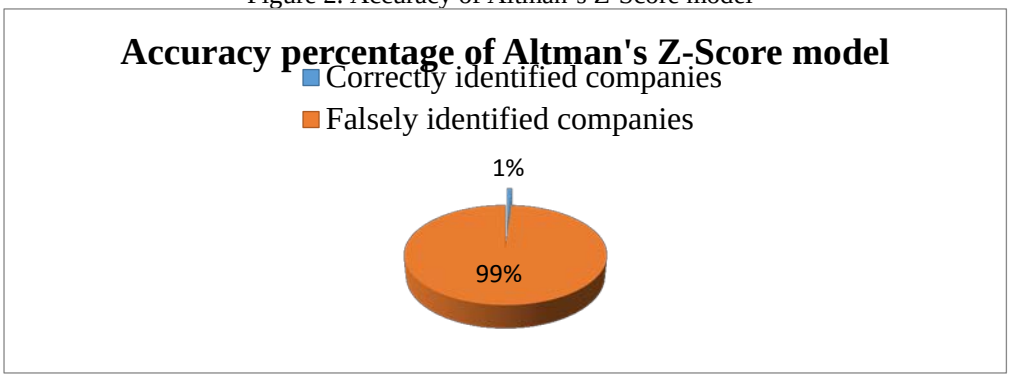
All four models were put to the test during a period of 3 years, between 2011 and 2013, to see if they could accurately predict the failure of Romanian insurance companies and, in case they failed to do so, see which were the main reasons for obtaining different results.

Testing the 4 models on Romanian insurance companies

The analysis was conducted on all 37 insurance companies in Romania, over a period of 3 years, between 2011 and 2013. The ratios were calculated for all firms using the financial statements in order to better compare the results.

Following the previous table and the above-mentioned formula, we calculated the values for Altman's Z-Score. According to the results of this model, all insurance companies from Romania should have been insolvent since 2011. Since it is not the case, this model is not suitable for Romanian insurance companies, it's accuracy being close to 0%.

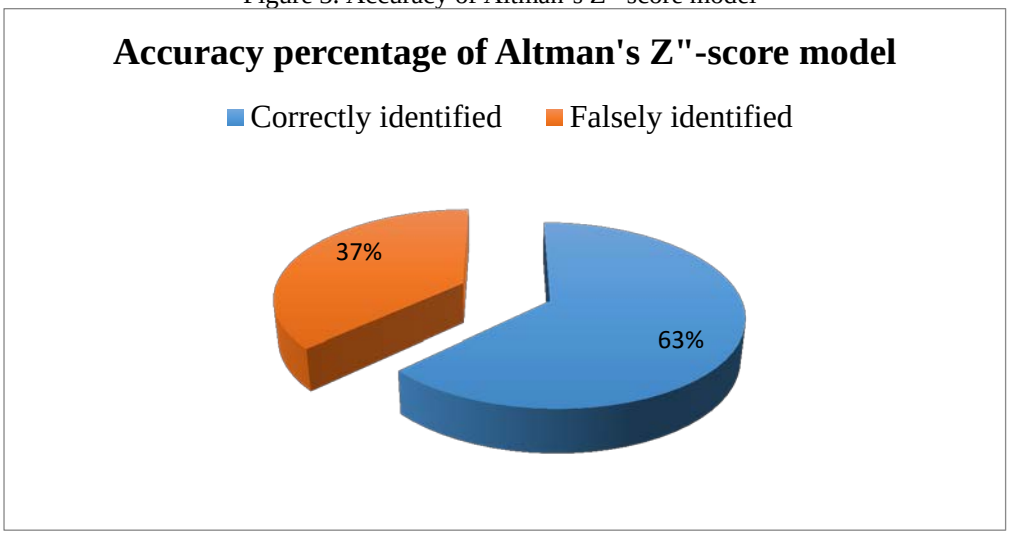
Figure 2. Accuracy of Altman's Z-Score model



Source: Author's own elaboration

The second version of the model, however, the Z”-score model, was dramatically improved. When applied to our 37 firms, the model had an accuracy of 63%. The following figure presents an overview of the results for this model. The significant difference was found in eliminating the variable Sales/Total Assets, as it was considered to be industry-dependent.

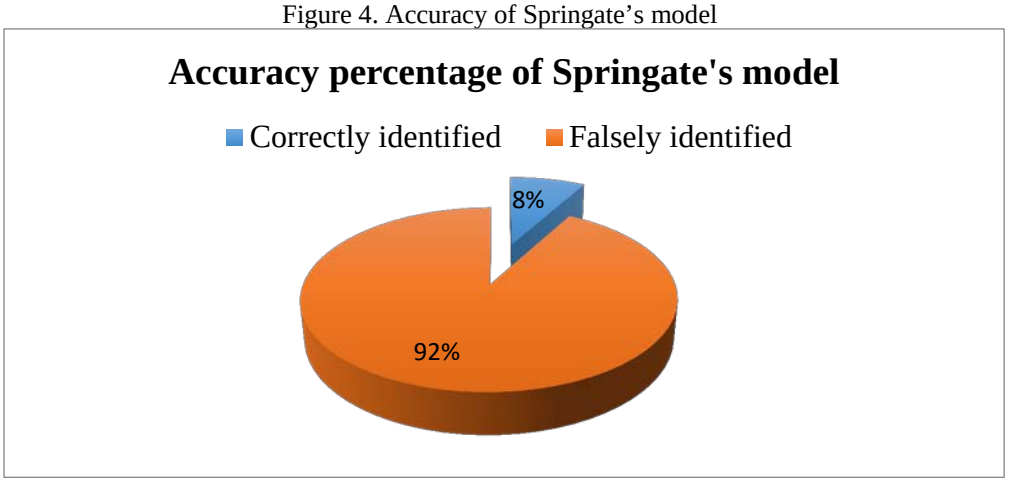
Figure 3. Accuracy of Altman’s Z”-score model



Source: Author’s own elaboration

Springate’s model returned the same low accuracy results as the first Altman model. With only 8% of insurance companies correctly identified, the model is also not suitable for the Romanian insurance industry. The results of the tested model can be seen in Figure 4.

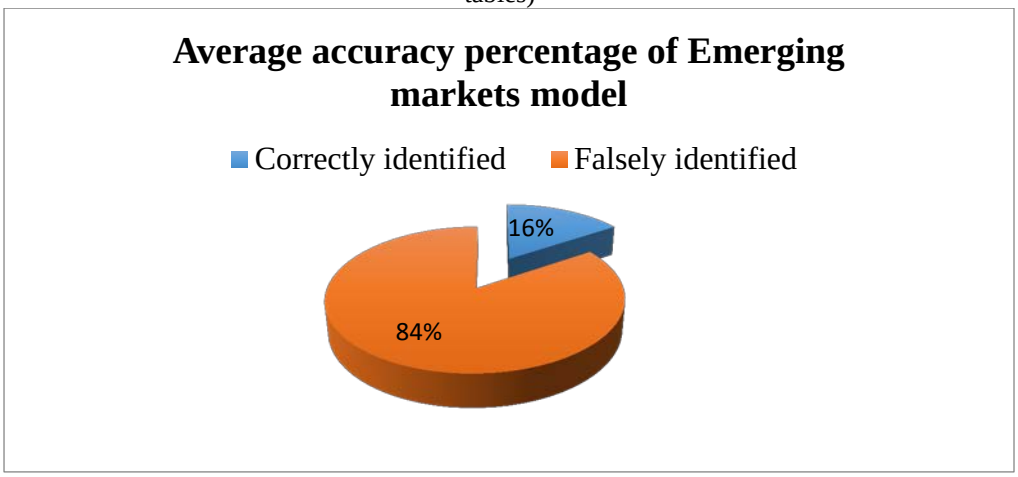
Figure 4. Accuracy of Springate’s model



Source: Author’s own elaboration

Before conducting the study, the most promising model of the four seemed to be the emerging markets model since it was developed on companies operating in different accounting, legal, and economic environment found in a developing economy. Using three different evaluation methods the obtained average accuracy was of approximately 16%. Figure 5 provides an overview of the analysis.

Figure 5. Average accuracy of the Emerging markets model (considering the 3 evaluation tables)



Source: Author's own elaboration

Out of all the four tested models, Altman's Z"-score model performed the best on Romanian insurance companies. The other three models had accuracy ratios lower than 16%. Lets have a look at all utilized ratios and see the differences between models that led to such large discrepancies.

Interpretation of the results

Profitability, liquidity measurement and productivity of assets are the main aspects of a firms financial statement that concern stakeholders. Table 5 presents a comparison of the ratios utilised by the 4 analised models.

Table 5. Comparison of the four analysed models' ratios

Altman's Z-Score	Altman's Z"-Score model
Working Capital/Total Assets	Working Capital/Total Assets
Retained Earnings/Total Assets	Retained Earnings/Total Assets
EBIT/Total Assets	EBIT/Total Assets
Market Value of Equity/Book Value of Liabilities	Book Value of Equity/Book Value of Liabilities
Sales/Total Assets	
Springate model	Emerging market model
Working Capital/Total Assets	Total Liabilities/Total Assets
EBIT/Total Assets	Sales/Current Assets
Gross Profit/Total Assets	Cash/Current Liabilities
Sales/Total Assets	

Source: Author's own elaboration

The most popular ratio of the four models is the one measuring the net liquid assets of the company relative to the total capitalization – Working capital/Total Assets. Liquidity ratios are highly considered when analysing bankruptcy probability. Generally, a firm which is experiencing consistent operating losses will inevitably have decreasing current assets relative to the total assets.

The Retained Earnings/Total Assets ratio measures the company's cumulative profitability over time as a proportion of total assets. Whilst time is an important factor in the outcome of this ratio, some find that it discriminates against younger companies, since the incidence of failure is higher in the first five years of a firm's existence. Altman notes that retained earnings are subject to "manipulation" via corporate quasi-reorganizations and stock dividend declarations. Since Romanian insurance companies are not market-listed as are other companies, this risk is avoided. Corporate quasi-reorganizations, however, could require further adjustments.

The best ratio for measuring the true productivity of the firms' assets is the Earnings before Interest and Taxes/Total Assets ratio. Any firm's ultimate existence is based on the earning power of its assets. Therefore, it is an important variable and it's considered especially appropriate for studies regarding insolvency prediction.

The next two ratios are responsible for the big accuracy difference of the two models developed by Altman. First, let's discuss the Market Value of Equity/Total Liabilities. This ratio shows how much a firm's assets can decline in value before the liabilities exceed the assets and the firm becomes bankrupt. The equity market value is a popular variable in insolvency prediction models since it can serve as a representative for the company's asset values. In our case, however, the market value of equity is not relevant since none of the insurance companies are market-listed.

The second version of Altman's model replaces the Market Value of Equity with the Book Value of Equity making the ratio much more suitable for non-manufacturers and companies in emerging economies. This change is useful also in an industry where the type of financing of assets differs greatly among companies, as is the insurance sector. This can be one of the reasons for the notably higher accuracy percentage of the second Altman model.

The second reason lies in the capital turnover ratio. Sales/Total Assets is an indicator illustrating the sales generating ability of a company's assets. In the development of the original model, the ratio itself is the least significant ratio on an individual basis. Nevertheless, the variable ranked second in it's contribution to the overall discriminating ability of the model because its unique relationship to other variables in the model. The ratio is an industry-sensitive variable, so in order to minimize the potential industry

effect, Altman decided to remove it from the second model. These two changes led to an increase of the model accuracy by 63%, making it more suitable for the Romanian insurance sector.

Two of the three ratios used in the emerging markets model represent the ability of the company to cover their debt in a timely manner. Financial risk is a particular problem when a business is located in a highly cyclical industry like the insurance sector. The Total Liabilities/Total Assets ratio should be evaluated over time to help assess whether the company's financial risk profile is improving or deteriorating.

The Cash ratio (Cash/Current Liabilities) evaluates a company's liquidity and refines both the current ratio and the quick ratio by measuring the amount of cash, cash equivalents or invested funds there are in current assets to cover current liabilities.

The cash ratio is the most rigorous of the three short-term liquidity ratios. It only looks at the most liquid short-term assets of the company and ignores inventory and receivables, as there are no assurances that these two accounts can be converted to cash in a timely matter to meet current liabilities. It is also seldom used in financial reporting since it is not realistic for a company to purposefully maintain high levels of cash assets to cover current liabilities. The reason being that it's often seen as poor asset utilization for a company to hold large amounts of cash on its balance sheet, as this money could be used to generate higher returns. While providing an interesting liquidity perspective, the usefulness of this ratio is limited.

Sales/Current Assets ratio measures how well a company is making use of its assets in generating sales. The validity of this ratio is mostly seen in industries where companies hold the majority of their own inventories in-house. As in the case of the liquidity ratios, it is best measured over several periods and needs to be compared to industry averages, as the amount of Current Assets varies widely among companies and industries.

Conclusion

When dealing with insurance companies, it is hard to find models that are suitable for their unique financial profile. Most insolvency prediction models are developed for manufacturing companies since they are vastly spread throughout the economic industry. These models aim to help identify the companies who are facing financial risks.

Out of the four analysed models, Altman's Z"-Score model performed the best on insurance companies, with an accuracy ratio of 63%. This is why:

- The model is an improved version of an already tested and highly functioning Z-Score model, especially developed to cater to the needs of companies in less developed countries.

- One of the most important ratios of the original model, Sales/Total Assets was eliminated because it was considered industry-sensitive and not individually relevant for the model.
- The model became more suitable for Romanian insurance companies when the Market Value of Equity was substituted with the Book Value of Equity since Romanian insurance companies are not market listed, therefore the initial ratio was 0.

It is clear that choosing the suitable ratios for a bankruptcy prediction model that helps foresee insolvency in case of insurance companies is not an easy task and it's especially significant to firstly determine the needs of the model, since it is targeted to such a distinct industry. In case of Romanian insurance companies, it is not enough to just consider the fact that the country is a developing country, but also take into account the particularities of the insurance sector.

Applying the classic models, Altman's Z-Score and Z"-score, Springate's model and the emerging markets model by Zulkarnain, Nor-Aziah and Karbhari, on Romanian insurance companies with the corresponding obtained results, draws attention to their limits for the insurance sector and the need to use other models to assess exposure to the insolvency situations of insurers, models that highlight their particularities, especially regarding solvency, liquidity and profitability.

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