

BANKRUPTCY AND THE ALTMAN MODELS. CASE OF ALBANIA

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Abstract: *This paper examines the univariate models for predicting bankruptcy and the multivariate models of the best known researcher in this field, the Altman models, models that use the multivariate discriminant analysis. This paper is mainly focused on the application of two of the Altman models (the revised model of 1983 and the revised model of 1993) to firms that operate in Albania, to see how its models can predict the future of Albanian firms. To assess the accuracy and the possibility of applying these models in the case of Albania, the study includes 80 firms (large firms) that operate in the service sector. To classify bankrupt and non-bankrupt firms, this study is based on the Albanian legislation on bankruptcy (Law no. 8901), according to which bankruptcy proceedings may be opened in case of a state of insolvency, when the firm is overburdened with debts or when the earnings after tax of the firm is negative for a period of 3 years.*

According to the Albanian legislation on bankruptcy, 24 (from 80) firms involved in the study result legally bankrupt. The first revised model (The 1983 model) of Altman predicts accurately these firms by 75%. Regarding the non-bankrupt firms (according to Albanian legislation on bankruptcy) inaccuracy in the forecast is even higher than in the case of bankrupt firms. From 56 non-bankrupt firms involved in the study, 23 are classified as insolvent company under the first revised model of Altman, while these firms are not bankrupt.

In case of application of the second revised model of Altman (The 1993 model) the results are consistent with the results of the first model in terms of bankrupt firms. Meanwhile, what is striking is the significant reduction in the percentage of Type II error (from 41% to 23%).

Keywords: Altman model; bankrupt firms; non-bankrupt firms; type I error; type II error; Albanian legislation.

JEL classification: G33; K22.

1. Introduction

Every economic system needs special mechanisms to ensure the best use of the available resources. Bankruptcy is the main instrument for the redistribution of the manufacturing tools from inefficient firms to efficient ones.

Theoretically, bankruptcy jogs rotten apples from struggling sectors of the economy and allows profitable firms to thrive. However, without an efficient procedure of bankruptcy, financial crises last longer in time and are deeper.

The bankruptcy process allows the firm to be reorganized, often looking to sell a part of their assets, to make ownership changes, or even a part of the obligations to be forgiven by creditors. However, in other cases, bankruptcy leads to total liquidation, making the company cease to exist.

Given the importance of investigating such a phenomenon, many scholars, starting from the late nineteenth century, have undertaken research to discover more about the causes and factors of bankruptcy. Studies in this field were increased especially after the 60s of XX century. These researches are mainly empirical. Actually, after many years of studies by various authors, there is not a structured theory related to bankruptcy. Certain economic

environments in various countries and particular companies' features operating in various industries have become really difficult to draw a unified theory about the bankruptcy phenomenon. Therefore, the recent studies continue to be empirical.

In terms of our country, studies about the failure of the enterprises have been a few. Mostly, they are focused on the reasons that lead Albanian firms to failure and are mainly made in the context of research projects related to Albanian economic environment. Even by banks, which despite being institutions interested to perform risk analysis, were satisfied with the analysis of the loan (which is a different research field), there haven't been studies done to forecast the failure or bankruptcy. A single study in bankruptcy modeling in our country was made in 2007 by Prof. Assoc. Dr. Rezarta Perri. Part of this study were only state-owned enterprises, due to the perception that the quality of their financial statements is higher than those of private firms.

The remainder of this paper is organized as follows. In Section two is summarized the literature review. In the third section are given some statistics related to the closure of firms in our country (Albania), while the fourth section gives the results of the application of two of the Altman models for a sample of 80 firms operating in the service sector in Albania. Finally, in the fifth section, are given some conclusions on the issue of bankruptcy.

2. Literature Review

The first studies in the field of bankruptcy prediction were the univariate models, models with a single variable. These studies were focused on individual financial ratios and compared the values of these ratios for bankrupt and non-bankrupt firms. These studies have played an important role for stakeholders in this field and have served as a basis for further studies, for multivariate models, models that use more than one variable to predict the bankruptcy.

In 1930, the Bureau of Business Research published the results of a study related to the values of financial ratios of bankrupt industrial firms. This study analyzed 24 financial ratios, using data from 29 firms and aimed to determine similar characteristics of bankrupt firms. Results revealed eight financial ratios (Working Capital to Total Assets, Surplus and Reserves to Total Assets, Net Worth to Fixed Assets, Fixed Assets to Total Assets, the Current Ratio, Net Worth to Total Assets, Sales to Total Assets, and Cash to Total Assets), as indicators of "weakening" financial situation of a firm. Based on this study, the best indicator to express the weakness of a firm resulted ratio of working capital to total assets, and subsequently was the current ratio.

FitzPatrick (1932) compared 13 financial ratios for 19 bankrupt firms and 19 non-bankrupt firms. He discovered that in most of the cases, non-bankrupt firms showed favorable ratios compared to the standard level while insolvent firms showed unfavorable ratios. Results showed that two most significant ratios were Net Worth to Debt and Net Profits to Net Worth. Also, according to FitzPatrick should be paid less attention to current ratio and quick ratio of firms with long-term liabilities.

Smith and Winakor (1935) analyzed the financial ratios of 183 firms operating in different industries. From the study, Smith and Winakor concluded that the ratio of Working Capital to Total Assets was a better indicator for predicting financial problems than the ratio of Cash to Total Assets and the Quick Ratio (the Acid Test). Also, they showed that with the approaching of the moment of bankruptcy, firms had a falling ratio of current assets to total assets.

Another study for predicting bankruptcy of firms is the one made by Merwin (1942), which is focused on small producers. According to Merwin, bankrupt firms showed signs of weakness 4 or 5 years before failure. According to the study, three ratios resulted significant in the bankruptcy of a firm: Net Working Capital to Total Assets, the Current Ratio, and Net Worth to Total Debt.

In 1962, Jackendoff compared the financial ratios of firms with profit in their financial statements and firms with loss. He concluded that the Quick Ratio and the Net Working Capital to Total Assets were higher for firms with profits than for firms with losses. Also, profitable firms had a lower ratio of Liabilities to Net Value than firms with losses.

The most important study with a single variable (the univariate model) for predicting the bankruptcy is the study carried out by Beaver in 1966. In this study, the firm is seen as a "reservoir of liquid assets", which is filled by cash inflows and emptied by cash outflows. Insolvency of the firm can be defined as the probability that the reservoir is emptied, a situation in which a firm would not be able to repay the maturing liabilities. The study conducted by Beaver found four situations:

- The bigger the reservoir, the lower is the probability of failure of the firm;
- The larger is the net inflow of liquid assets from the operating activity, the lower is the probability of failure;
- The higher the debt ratio, the higher is the probability of failure;
- The larger is the outflow from the operating activity, the higher is the probability of failure.

Beaver (1966), which is the most knowledgeable researcher of the univariate analysis, estimated the average value of 29 financial ratios from a sample of bankrupt firms for 5 years before their bankruptcy and compared these ratios with the average values from a sample of non-bankrupt firms for the same years of the study. His aim was to identify among them the ratio which best distinguish bankrupt firms from the non-bankrupt ones, as well as to understand how many years before bankruptcy began to notice differences between firms.

From the 29 financial ratios observed by Beaver, he concluded that six ratios with the best discriminatory power were (according to their predictive ability):

- Net income before amortization, depreciation and depletion / total liabilities.
- Net income / total assets
- The total debt / total assets
- Net working capital / total assets
- Short-term Assets / short-term liabilities
- Cash, short-term investments and receivables / Operating expenses without depreciation, depreciation and depletion.

The first study with more than one variable to predict the bankruptcy is the study made by Altman (1968), which used multivariate discriminant analysis. He built a model with five variables to predict the bankruptcy of manufacturing firms, model which was 95% accurate in predicting the bankruptcy of firms a year before. However, the ability of the model to predict the bankruptcy two, three, four and five years before the bankruptcy, was respectively 72%, 48%, 29% and 36%. While, when the model is used to firms that were not included in the initial sample, the model accuracy was 79%.

The multivariate discriminant function of Altman takes the following form:

$$Z = 0.012 * X1 + 0.014 * X2 + 0.033 * X3 + 0.006 * X4 + 0.999 * X5$$

In this equation, five variables represent the following ratios:

- X1 = working capital / total assets
- X2 = retained earnings / total assets
- X3 = earnings before tax and interest / total assets
- X4 = market value of equity / book value of total debt
- X5 = sales / total assets

In 1983, Altman built a revised model "Z-score" for unquoted firms in the financial markets. In this model, on X4 ratio, market value of equity is replaced by the book value of equity.

The revised Model "Z-score" had the following form:

$$Z = 0.717 * X1 + 0.847 * X2 + 3.107 * X3 + 0.420 * X4 + 0.998 * X5$$

Once concluded in the above result, Altman found that all firms with Z level higher than 2.90 were non-bankrupt firms, but all firms with a Z level less than 1.23 were bankrupt firms. While, for firms with a Z level between 1.23 and 2.90 was impossible to have accurate results; this area was called the zone of indifference or "gray zone", because it had a high likelihood for possible errors of firm classification.

The accuracy of the first revised model was almost at the same level with the first model built in 1968 (90.9%). According to Altman, firms with Z level greater than 2.90 had 97% chance to continue their activity in a healthy way (Altman, 1993).

To reduce the industry effect, Altman built in 1993 a new model, from which it is removed the assets turnover ratio (X5 - sales / total assets). Four other variables remained the same with those that were included in the first revised model of Altman. The 1993 model has the following form:

$$Z = 6.56 * X1 + 3.26 * X2 + 6.72 * X3 + 1.05 * X4$$

According to this model, firms with a value of less than 1.10 were bankrupt firms and firms with a value greater than 2.60 were non-bankrupt firms.

The accuracy of the model with four variables was at the same level as the first revised model of 1983 (90.9%).

3. The Closure of Albanian Firms

In Albania there are no official data about the rate of bankrupt firms. In our country there is not such an information center. Moreover, there isn't any indicator that measures the level of firms closure due to financial difficulties. The only possible statistics available are those collected by INSTAT, which reports the number of active firms and new established firms. Thereby, we are able to calculate the number of closed firms, but we are still not able to obtain information about the reasons of their closure. Noting that a firm could close its activity due to many other reasons (often reasons other than economic difficulties, e.g. fulfillment of the company aim, their partners decision, the fulfillment of the operating period predicted in the statute, the change of their geographical area, their merger or acquisition by another company, etc.), it is admitted that these statistics are not representative of the real rate of bankrupt firms in Albania. However, considering that no other data are available, are chosen the following statistics about the active firms and the rate of new established firms in Albania.

Until 2011, the number of active firms has been increasing, while in 2012 their number decreased, because in this year the number of closed firms was higher than the number of new established firms. The rate of new established firms is different over the years, and is characterized in 2008 by a growth rate of 21 percent.

Table 1: Number of active, new and closed firms

	2005	2006	2007	2008	2009	2010	2011	2012
Active firms	62162	73672	80077	94533	94953	103038	109039	106837
New firms	10607	14568	14010	19884	13081	16469	12905	12828
New firms rate	17.1%	19.8%	17.5%	21%	13.8%	16%	11.8%	12%
Closed firms	3354	3058	7605	5428	12661	8384	6904	15030

Source: INSTAT

From 2008, we have a more stable state, where the average rate of new established firms is estimated at 12-16 percent. By the analysis of firms closure phenomenon in years, we found that in 2005-2006 the closure of firms is in its lowest levels during the past eight years, while the highest number of them appeared to be in 2009, which is the year after the financial crisis, that affected almost all countries, and in 2012, the year when the real GDP growth decreased to + 1.6%.

Referring to the above data (Table 1), it is found a high rate of firms closure in Albania during the years 2009-2012. Although the high percentage, we cannot speculate and conclude that the reason of all these closures has been their bankruptcy. As stated above, the reasons of their closure might have been other than financial difficulties. However, there are not a few reasons for failure in view of the tough Albanian economic environment and probably a large number of these closed firms could have been closed due to economic difficulties.

4. The Application of Altman's Models to Albanian Firms

The sample to be studied in this paper consists of 80 firms (large businesses) that operate in the service sector. Because of the fact that our country doesn't have a financial market, and therefore it is difficult to have information about the market value of the company's equity, in this section we will evaluate the accuracy of the bankruptcy prediction for two revised models of Altman (the 1983 model and the 1993 model), using the data from the financial statements of 80 Albanian firms.

To distinguish bankrupt firms from non-bankrupt firms, this study is based on the Albanian legislation on bankruptcy (Law no. 8901), according to which the causes of opening the bankruptcy proceedings are as follows:

- The state of insolvency. The debtor is considered insolvent if it is unable to pay liabilities on the maturity date.
- Overburdened with debts. The debtor is overburdened with debts when it is verified that its assets are lower than the liabilities that company has to third parties, and assessing that the debtor has no longer the possibility to continue the activity.
- In the case of legal entities, bankruptcy proceedings may initiate with the request of tax authorities, when the firm results with losses for a period of 3 years continually.

What is worth mentioning is that the total percentage of correct predictions given by a statistically predictive model is not a valid criterion of model accuracy. Evaluation of a classification model is not complete if there are not taken into account the costs and benefits of accurate estimates versus incorrect ones. There are two types of errors of "classification":

1. Type I Error refers to misclassification of a non-bankrupt firm when in fact the firm bankrupts.
2. Type II Error refers to misclassification of a firm as a bankrupt one when the firm does not actually bankrupt.

Table 2: Type I and Type II Error

The model forecast	The actual outcome	
	Bankruptcy	Non-bankruptcy
Bankruptcy	Accurate estimate	Type II Error
Non-bankruptcy	Type I Error	Accurate estimate

Source: Literature Review

The both types of errors have different costs. Type I error cost is many times higher than the Type II error cost. This is because, in the first case the creditor can lose up to 100 percent of his investment in the company. While in the second case, the cost is limited up to the amount of the difference between the rate of return that investors would earn if they had invested in the company with the current return ratio they get from alternative investments.

Let's have a look to the percentages of the Type I and Type II error when we apply the two revised models of Altman in firms that operate in the service sector in Albania.

4.1. The first revised model of Altman (1983)

In the following table (Table 3) are shown the results of the application of the first revised model of Altman.

Table 3: Results of the first revised model of Altman for 80 Albanian firms

The model forecast	Actual outcome	
	Bankrupt firm (24)	Non-bankrupt firm (56)
Bankrupt firm	18	23 (41%)
Non-bankrupt firm	6 (25%)	33

Source: Financial statements of firms. Data processing by author.

According to the Albanian legislation on bankruptcy, 24 (from 80) firms result legally bankrupt. The first revised model of Altman predicts accurately these firms by 75%, which means 18 of these firms will go bankrupt within one year of application of this model. While the other 6 firms involved in the study sample, the Altman model predicts that they will continue their activities in the following year, while these firms are legally bankrupt. Regarding non-bankrupt firms (according to the Albanian legislation on bankruptcy) inaccuracy in the forecast is even higher than in the case of bankrupt firms. From 56 non-bankrupt firms included in the study, 23 are classified as insolvent firms under the first revised model of Altman, while these firms are not bankrupt.

As mentioned above, the Type I errors have higher cost than Type II errors for shareholders of the firm. Although the percentage of Type I error is lower than the percentage of Type II error, we can say that the percentage of Type I error is relatively in high levels (25%) compared with the results provided by Altman. Due to the large uncertainty in predicting the future of the firm, we can say that the first revised model of Altman cannot be used for Albanian firms.

4.2. The second revised model of Altman (1993)

In the following table (Table 4) are shown the results of the application of the second revised model of Altman.

Table 4: Results of the second revised model of Altman for 80 Albanian firms

The model forecast	Actual outcome	
	Bankrupt firm (24)	Non-bankrupt firm (56)
Bankrupt firm	18	13 (23%)
Non-bankrupt firm	6 (25%)	43

Source: Financial statements of firms. Data processing by author.

In the Table 4 we see that the results of the second revised model of Altman are the same with the results of the first revised model in terms of bankrupt firms. Even in this model, the percentage of Type I error is 25%. Meanwhile, what is striking is the significant reduction in the percentage of Type II error. Under the second revised model of Altman, 43 non-bankrupt firms according to Albanian legislation are accurately predicted by the model, while 13 firms (23%) were assessed as bankrupt firms.

5. In conclusion

The first studies in the field of bankruptcy prediction were studies that used one variable for prediction (the univariate studies). These studies focus on individual financial ratios and compare the values of ratios of bankrupt firms with non-bankrupt firms. Limitation of

these models is that they measure the impact of each ratio, not taking into account the impact of other ratios and assuming that their impact is zero. Although these models have shortcomings, their importance was great for the time in which they were used and served as a basis for further studies, for multivariate studies.

The effort, which has left more traces and had more influence in subsequent studies, was the effort of the American professor, E. Altman. Precisely in this paper is given a description of three models developed by him for predicting the bankruptcy. This paper is mainly focused on the application of two of the Altman models (The 1983 model and the 1993 model) to firms that operate in Albania, to see how his models can predict the future of the Albanian firms. The first model is not used in this paper, because in our country does not exist an organized financial market, and therefore, we have no data on market value of equity of firms included in the study.

According to the Albanian legislation on bankruptcy, 24 firms included in this study (from 80) are legally bankrupt. The first revised model of Altman (1983) predicts accurately these firms by 75%. Regarding non-bankrupt firms (according to Albanian legislation on bankruptcy) inaccuracy in the forecast is even higher than in the case of bankrupt firms. From 56 non-bankrupt firms involved in this study, 23 are classified as insolvent firms under the first revised model of Altman, while these firms are not bankrupt.

In case of application of the second revised model of Altman (1993), the results are consistent with the results of the first model in terms of bankrupt firms. Even in this model, the percentage of Type I error is 25%. Meanwhile, what is striking is the significant reduction in the percentage of Type II error (from 41% to 23%).

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