CONTROVERSIES REGARDING THE UTILIZATION OF ALTMAN MODEL IN ROMANIA

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Abstract: *Altman model was built for U.S. companies, based on the characteristics of that economy. Promising results were obtained in other countries such as Britain, Australia, Canada, Finland, Germany, Israel, Norway, India, South Korea; the percentage is over 80% predictability. However, as can be seen, they have an Anglo-Saxon legal system and also the economic environment is highly developed. While there is no reason why this model can be applied to companies in the whole world, we recognize that each has its own peculiarities economic environment, therefore, local models forecast could be better than American models, at least in their testing phase. But the utilization of Altman model is suitable for the Romanian economy? Taking this into account, the purpose of this paper is to test the Altman model on the Romanian market.*
Keywords*: bankruptcy, prediction model, BSE*

Introduction

Altman is a name invariably cited in studies concerning the prediction models of bankruptcy. In 1968, the author uses a multiple discriminant analysis for bankruptcy prediction1. His study included a sample containing the original 66 companies, each 33 in each group. Bankrupt group recorded bankruptcy during 1946-1965; the average value of assets of sample firms was $ 6.4 million with a gap between 0.7 million$ and 25.9 million$. The non-bankrupt group includes firms with assets between 1 and $ 25 million, this continued the activity in 1966. The period considered for analysis was 1946 - 1965 (20 years) (Altman, 1968:591)

Source of information was the ''Moody's Industrial Manual''. The author has considered a number of potential variables 22 (based on annual reports of companies) grouped into five categories: liquidity, profitability, leverage, solvency and activity.

In the article published in 1968, Altman commented the traditional indicators and concludes research analysts were unable to give importance for an indicator to another.

He describes how to use statistical techniques and discriminant analysis to develop a model based on financial indicators that forecast enterprise bankruptcy.

In developing of his model, Altman selected the group of 33 companies from them with the financial problems; the sample is included the industrial enterprises (production). The healthy business group was selected on the principle of similarity, each of bankrupt enterprises (size, industry) corresponding a healthy company. From the original list of 22 indicators, the author reported five, with the highest importance.

Altman, based on five indicators, built the following function score:

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

where:

X1 = $\frac{working\_capital}{total\_assets}$ measures the degree of flexibility of the entity and the percentage of working capital in total assets

X2 = $\frac{reinvested\_profit}{total\_asstes}$ reflect the entity's own contribution to the financing of investments

X3 = $\frac{gross\_profit}{total\_assets}$ measure the performance of the assets

X4 = $\frac{equity\_market\_value}{long\_term\_debt}$ measure the indebtedness

X5 = $\frac{turnover}{total\_assets}$ express the return of the total assets

The mean values of financial ratios included by Altman in his study confirm sensitive differences between the two groups of firms. To make the model operational, the two groups of companies were analyzed and classified by size Z score, setting the two limits and uncertainty area (the area between the two limits).

The analysis and classification of examined firms by the value of Z score determined a minimum, a maximum and an area of uncertainty as:

- Z <1.8: impending bankruptcy;
- 1.81 ≤ Z ≤ 2.675: The financial situation is difficult, the uncertainty at high risk of bankruptcy;
- 2.67 ≤ Z ≤ 2.99: the low risk of bankruptcy;
- Z> 2.99: the good zone, unseated under bankruptcy spectrum.

Starting from the idea that its models include a variable sensitive to the type of industry (X5 = Turnover / Assets) and so the model cannot be applicable in principle to all areas specified by Altman (production, trade, services), the author reconsidered the score function retaining only four variables as follows (Altman, 2006:79):

Z'' = 6,56 XI + 3,26 X2 + 6,72 X3 + 1,05 X4

Where:

XI = Working capital / Total assets (The rate measures the flexibility of the company and shows the share of working capital in total assets; the more with the result of this report is as high, the more as the permanent allocation of resources is optimal exploitation coverage)
X2 = Reinvested profit / Total assets (Measure the internal financing capacity of the enterprise and therefore it is recommended that the reported value is higher)
X3 = Profit before interest tax and / total assets (The rate signifies the economic profitability or asset utilization efficiency; it is desirable to be higher)
X4 = equity / total debt (Express the indebtedness of the company by long-term loans, also is good that the report be higher)

Critical points and limits, lower and upper, of the model are as follows:

Z"<1.10	Bankruptcy
1.10 <Z"<2.60	Area of uncertainty
Z"> 2.60	Viability

Methodology

Taking this into account, the purpose of this paper is to test the Altman model on the Romanian market.

The working hypotheses are: Altman model was built for the U.S. market; the Romanian market is substantially different from the U.S.; Altman model cannot be applied in Romania.

For this study, the public financial information for 2006-2010 were collected from the sites of Bucharest Stock Exchange and the Ministry of Finance. The sample consisted of 100 companies listed on the Stock Exchange and RASDAQ, which have similar characteristics, is included approximately in the same market category. The choosing the sample of all companies listed on stock and RASDAQ was made in order to have two equal groups of companies bankrupt and viable, like most previous studies of bankruptcy prediction.

The sample of 100 companies includes companies that belong to 17 branches of national economy. The companies were selected on a random basis, without previously known name, but their symbols from the BSE and enterprise branch code.

A company with financial difficulties indicates that the obligations to its creditors are paid with difficulty or not at all, and may later even lead to bankruptcy. Therefore, a company was considered bankrupt, if was initiated against it the insolvency procedure. Following this classification rules, there were 65 Romanian companies in difficulty in 2009-2010 on the BSE, of which 5 have all the necessary information for all years 2006-2010. To summarize, to have two equal groups of companies in difficulty and viable for this study were chosen 50 companies in difficulty, for which financial information was available and other 50 companies viable, similar in terms of asset size and scope of activities, which were chosen at random.

Table 1 The size of the two groups of Romanian companies analyzed in the model Altman

Group	Assets	Number of	Turnover

				employees					
	Total	Average	Stdev	Total	Average	Stdev	Total	Average	Stdev
Viable	23004550345	460091006.9	340301028 3	17027	340.54	471.55	29781874422	595637488.44	207774865 8
Bankrupt	21021914535	420438290.7	119794110.7	14066	281.32	594.88	15194760168	303895203.36	730874803.07
Total	44026464880			31093			44976634590		

Source: own calculations according to financial data submitted to the Ministry of Finance and BSE

The considered sample has minimum levels between 0.7% and maximum 6.8% of capital invested in the aforementioned sectors, which permit assessment of representativeness in the economic sectors evaluated. Total assets of sample volume (for 2008) is 44426234880 lei (in which viable companies 21021914525 lei and 23001455345 lei the bankruptcy ones), the cumulative turnover of 44976634590 lei (for viable companies 29781874422 lei and 15194760168 lei for bankruptcy), the total number of employees for the 100 companies is 31093 employees (17027 for viable and 14 066 for bankruptcy ones) in 2008.

The structure of the two sample groups (viable and bankrupt) confirms their comparability in size, meaning that the median volume is 460091006.9lei assets for the group of viable companies, respectively 420438290.7lei for bankrupt group. The number of employees (median) is 340.54 people for the group of viable companies, namely 281.32 for bankrupt group. There is a significant difference in median turnover, explained the extent that this variable is not only the size of the business, but success-failure component on the market. Turnover is 595637488.44lei for the group of viable firms, respectively 303895203.36lei for bankrupt group.

Results and discussion

Next, we test the viability of Altman model in our country. Under these conditions, we apply the model for 100 Romanian companies. They are divided into 2 groups: 50 bankrupt and 50 viable. The data used are the balance sheet submitted by companies to the Ministry of Finance and BSE. For each company is calculated Z score to categorize firms according to the Altman model.

We consider the last model proposed by Altman, applied in principle to all sectors of activity (production, trade, services), and critical limits, lower and higher, the model are:

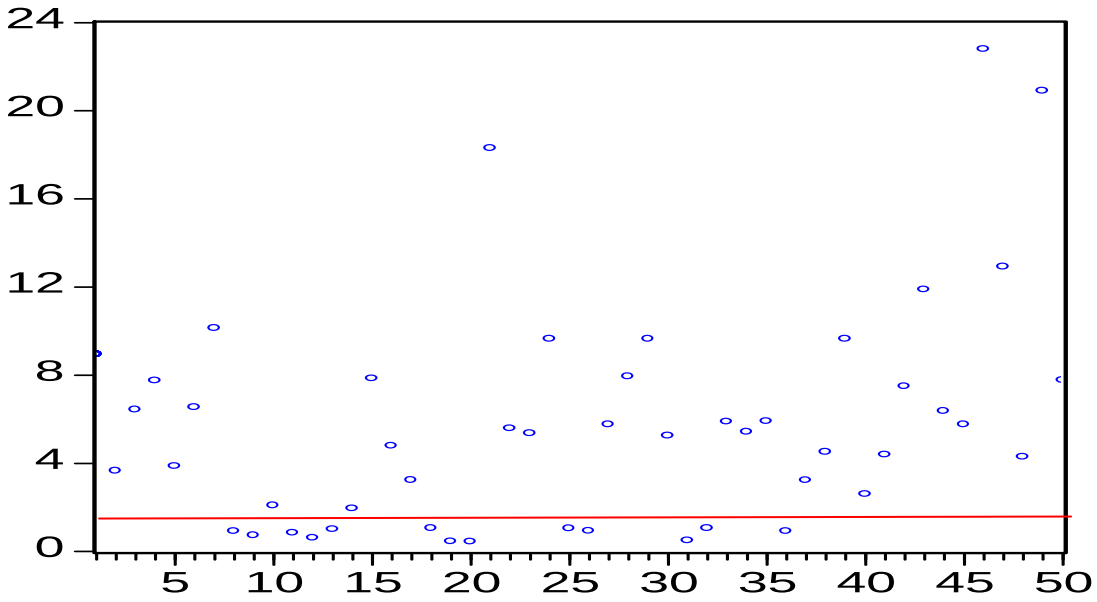
Z"<1.10 (Bankruptcy), 1.10 <z"<2.60 (area of uncertainty), Z"> 2.60 (non-bankruptcy).

Thus, for viable companies, that score must be greater than 2.6. The study results are presented in Table nr.2 from the annex.

The registered score of the 50 firms in the sample falls within 0.437 (bottom) and 22.7883 (top). Thus, as shown in Table nr.2, the Altman score for the viable companies is correct in 37 cases of 50, which implies a rate of 74%. The analysis of priori prediction for Altman function revealed that the type II error (viable firms classified as bankrupt)

shows a failure rate of 26%. The average Altman scores for the 50 companies studied is 5.73, which exceeds the viability threshold value of 2.6.

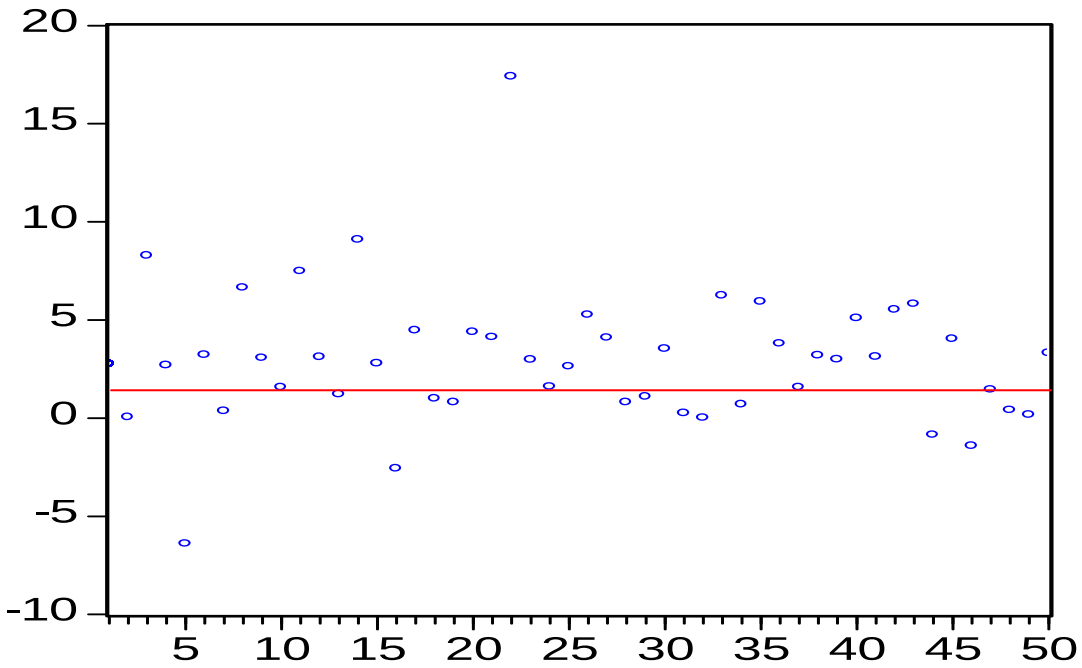
Figure 1 The Altman model results for viable businesses



For bankrupt companies, that score must be smaller than 1.1. The study results are presented in Table nr.3 from the annex.

The score recorded for the 50 bankrupt companies in the sample falls within -6.3961 (lower) and 17.4089 (top). Thus, as shown in Table 3, the Altman score for bankrupt companies are correct only for 15 cases of 50, only 30% predictability rate. Priori prediction of whether Altman function revealed that the type I error (failed firms classified as viable) shows a 70% failure rate. Average scores for the 50 companies Altman studied is 2.976452, which is superior viability threshold value of 2.6, in this case it must be lower than 1.1. The analysis of priori prediction for Altman function revealed that the type I error (failed firms classified as viable) shows a 70% failure rate. The average Altman scores for the 50 companies studied is 2.976452, which is superior viability threshold value of 2.6, in this case it must be lower than 1.1.

Figure 2 The Altman model results for the bankrupt firms



The table 4 presents the average values of the considered variables using financial statements for the financial year before the onset of insolvency proceedings. As can be seen, the four indicators considered into Altman model, for viable firms are significantly different to that of bankrupt firms. Thus, the indicator XI, reported working capital to total assets, the value for viable firms are 0.375761 and 0.032427 for the bankruptcy one. The correlation between the two indicators is negative -0.074, differences between variables in the two groups was highly significant p-values for the variables X1 viable and bankrupt firms is 0.012.

The indicator X2, reinvested profit reported to total assets, have significantly different values for viable companies, 0.280348 (positive) than the bankrupt, -0.078579 (negative). P-values for variables X2 viable and bankrupt firms is 0.043, the correlation between two indicators indicate that the differences between variables in the two groups are important, being -0.210.

Table 2 Statistical results obtained for the rates of the Altman model applied

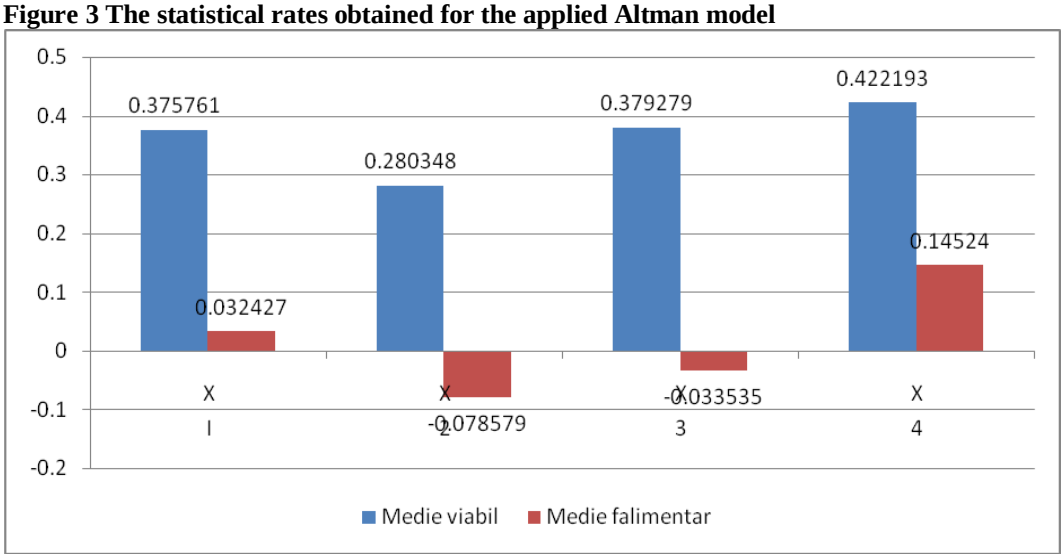
	Average viable	Average bankrupt	Stdev viable	Stdev bankrupt	Correlation	Sig.
XI	0.375761	0.032427	0.260575	0.028326	-0.074	.012
X2	0.280348	-0.078579	0.067474	4.023169	-0.210	.043
X3	0.379279	-0.033535	0.216436	0.100211	0.028	.048
X4	0.422193	0.14524	0.283271	3.855056	-0.131	.034

Source: own calculations according to financial data submitted to the Ministry of Finance and BSE

Thus, for the indicator X3, profit before interest and tax reported to total assets, the value for viable firms is 0.379279 (positive) and for the bankruptcy of -0.033535 (negative). The correlation between the two indicators is positive for 0.028; the difference between

variables in the two groups was highly significant; p-values for the variables X3 viable and bankrupt firms is 0.048.

Figure 3 The statistical rates obtained for the applied Altman model



Source: own calculations according to financial data submitted to the Ministry of Finance and BSE

The indicator X4, equity reported to total debt, have significantly different values for viable companies, 0.422193, against the bankrupt, 0.14524. P-values for variable X4 of viable and bankrupt firms is 0.034; the correlation between two indicators indicate that the differences between variables in the two groups are important, being -0.131.

Thus, cumulating the two categories of score in Altman model, for viable and bankrupt businesses, it reaches to relevant results only for 52 companies of 100; so the percentage is 52% predictability. This percentage is extremely small for a model which is still widely used both in academia and in the banks.

Conclusion

The importance of bankruptcy prediction and understanding the causes of economic failure is ultimately a pragmatic matter. The direct costs of insolvency or bankruptcy (legal, accountants, auditors and lawyers fees) are low compared to the losses that can record shareholders / creditors due to lower firm value. Also, the indirect costs such as losses for managers, business partners, and financial institutions, state are considerable. All these have been fully felt on the Romanian market in recent years. Any progress in identifying causes and bankruptcy prediction can minimize the discussed costs.

In our opinion, the main limit to the application by the Romanian companies of Altman diagnostic model based on score function developed in other countries is linked to the national character of this model. Taffler shows in 2003 that ''each country requires its own model'' (Taffler, 2003:41).

In practice, it is widely accepted the idea of limiting the conclusions and the applicability of scoring functions only for economic space in which it was built, even if it turned out that some models have a high degree of universality (Altman score function has been applied successfully both in highly developed economies - the U.S., Japan, Canada - and in developing countries - Brazil). This is because the model was built under a stable economy while, as a particular case, the Romanian economy is facing a prolonged period of transition, characterized by a sharp economic instability. This makes the Romanian companies cannot use, with acceptable risk of error predictability, the models recognized worldwide.

Regarding the main limitations of the application of developed models based on the score function in our country, they are given by the following coordinates:

a) the selection of the sample underlying the construction of score functions is not based on a statistically relevant population, the sample selected for analysis does not necessarily reflect the situation of bankrupt - non bankrupt in the Romanian economy. This is due to the fact that Romania has a high number of bankruptcies in fact, but a relatively small number of legal bankruptcies and therefore, taking or not taking into account those companies that are bankrupt (insolvency, consecutive losses over a period of time), but were not declared as such can have a direct impact on the accuracy of model predictability itself.

b) the lack of a longer period for analysis before the bankruptcy - may be a cause of a reduction of predictive ability than that stated by the authors of these models. This is due to the short period from the date of transition to market economy principles and the high degree of economic instability that characterizes the Romanian economy.

c) the general nature of developed scoring functions - the last concern on this issue revealed attempts to set up a function to be applied throughout the Romanian economy, however, beyond the merits of such tests, is widely recognized that, in general, bankruptcy prediction model is limited to industry or industries on which it was built;

d) the failure to take into account the ''non-financial'' indicators in the background score function - the results of research conducted in developed countries shows that non-financial indicators include the models Z - score in Romania should be noted that there is always a company closure result of poor management, but in many cases may be due, economic and social environment in which operating company involves taking into account other variables than financial ratios. The limit to be considered is the inclusion of such variables (which expresses the characteristics of industry and economic environment) generates models with a limited geographic and temporal, but more pronounced than models based solely on financial ratios.

Also other possible causes regarding the inapplicability of this model in Romania could be:

frequent changes in the bankruptcy law;

long periods to obtain failure comparative with the aforementioned countries;

characteristics of the Romanian economy;

market exit of Romanian companies is not always subject to economic criteria

State involvement in supporting companies;

masked failure of state companies;

long period of transition and economic and financial instability;
political influences on economic and financial area.

A prerequisite to the successful construction in Romania of bankruptcy prediction models is to strengthen the discipline of bankruptcy law, which happened in 2006 when bankruptcy law was repealed and replaced by the insolvency law, thus creating those tools at the state level, enable more rapid take those measures requiring initiation of insolvency and default procedure of bankruptcy, considered as a mandatory practice for those in this situation.

Also, the establishment of such models should start from the idea of inclusion and non-financial indicators representative of industry or industries concerned, in order to consider the main factors of economic and social character of the business environment, which may influence its results, thus increasing the accuracy of predictability.

Finally, it should use the maximum-minimum limits in the making of indicators used to determine the score function in order to counterbalance the negative effect induced by specific transition period and the absence of credible and relevant information for a long period of time.

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