



# FINANCIAL RISK STUDY AS A TOOL FOR EFFICIENT MANAGEMENT OF THE TRANSPORT ENTERPRISE

**Emiliya Vaysilova**

“Todor Kableshkov” University of Transport, Sofia, Bulgaria

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JEL Category: **C53**

## **Abstract**

*In post-crisis economic circumstances, the issue of financial stability of the Bulgarian transport enterprises is of great importance regarding their effective management. For the most part, these enterprises belong to the small and medium-sized business and it can be said that they are still experiencing significant financial difficulties. This creates a possibility they become insolvent and as a result of that to go bankrupt. To avoid these unfavorable situations, managers need to continually analyze and assess the level of financial risk. In this connection, the question arises as to what system of indicators should be formed so that the enterprise can be properly managed. This article studies one of the ways of assessing financial risk using the Z-score prognostic model. This method can forecast future problems and predict enterprise bankruptcy within two years period.*

**Keywords:** *transport enterprise, management, financial risk, solvency, bankruptcy forecasting, z-score model*

## **1 INTRODUCTION**

A significant part of the enterprises in the transport sector of the Republic of Bulgaria belongs to the small and medium business. Typical of this business is that it is particularly prone to financial difficulties. The reason for this is the lack of opportunities to adapt to rapidly changing market conditions. It is vital for this kind of businesses to carefully monitor their financial position, especially given that potentially serious problems are not always immediately noticed. It is necessary to diagnose the risk situations in a timely manner, i.e.

to be predicted and if there are symptoms of financial problems, it is imperative to act quickly and adequately.

The financial position of the transport enterprise is a subject of the financial analysis and it is an essential element of its financial management. The financial analysis solves a number of issues related to the interests of potential investors, creditors, owners of capital, financial managers, and so on. The significance of financial analysis is determined by the fact that the companies carry out their activities in a dynamic and difficult to be predicted market environment, accompanied by different risks - financial, currency, market, interest rate, etc. The analysis of financial situation enables to assess the economic health of the company as a whole or of some of its functional areas.

*Address of the author:*

**Emiliya Vaysilova**

 [emvais@abv.bg](mailto:emvais@abv.bg)

A major component of the financial position is a financial risk. The latter is usually associated with the level of indebtedness that results from the use of foreign capital in the company business. In this regard, financial risk is the probability of the enterprise to become insolvent. The latter occurs when the business entity is unable to meet its counter-payments. The reason for this is the insufficient amount of liquid assets as well as the expected cash receipts within a certain period.

When companies are insolvent, unless adequate remedial measures are taken, the likelihood of bankruptcy is high. Such undesirable situations can only be overcome if the financial risk, which can be realized in various ways, is continuously monitored and evaluated.

Different methods are used to detect the sources of risk – the sensitivity method, the scenario method, etc. The risk can also be analyzed by using groups of indicators such as: profit variability (profitability coefficient, profit variation coefficient, profit standard deviation); solvency (solvency coefficient, financial autonomy, financial indebtedness, liquidity); possibility to eliminate the risk by regulating the cash flow rate for different investment decisions. Over the past twenty years, in the international theory and practice, a method has been established that allows managers to fix the financial difficulties, risk of insolvency and bankruptcy of the firm. This is the so-called Z-score analysis model.

The purpose of this article is to present this currently proven method for forecasting financial difficulties and demonstrate its practical application. The information needed to analyze financial risk and predict the financial difficulties under this method is contained in the financial statement of the transport undertaking.

## 2 ESSENCE OF Z-SCORE MODEL

In 1968, Edward Altman, an Assistant Professor of Finance at New York University created the so-called Z-models for financial risk analysis and bankruptcy predicting. By their very nature, these models are formulas that can successfully assess the risk of bankruptcy. Altman's contribution is that he appropriately chooses comparatively independent financial coefficients. He also assigns appropriate weight (significance) to each of them. With the help of these models, possible

bankruptcy of the company can be successfully (and fairly accurate) predicted. This is a universal analysis tool that is applicable to any business. Based on a study by Edward Altman in 2000 and covering the period 1968-1999, it was found out that the model was about 80-90% accurate when assessing insolvency risk up to one year before the event. The studies conducted to evaluate the effectiveness of the method show that it provides 95% accuracy of the bankruptcy prediction for one year and 70% accuracy - up to two years (Jorion, 2003).

Edward Altman created several variations of the Z-model. The least known and with the most limited application is the two-factor model whose formula is as follows:

$$Z = -0.3877 - 1.0736F_1 + 0.0579F_2$$

where:

$F_1$  – coefficient of current liquidity, expressing the relationship between company current assets and liabilities. It determines the security of creditors. It is assumed that it is a more specific indicator of solvency than the absolute difference between short-term assets and short-term liabilities is (Fess, Ph., Warren, C. 1987), (Bafet & Klark, 2011). Its optimum value varies from 1.25 to 1.50;

$F_2$  – coefficient of financial indebtedness, expressing the relative share of liabilities in the total value of company capital. It shows the dependence on external sources of capital. Its relatively high values imply high-interest costs. Its optimal value varies between 0.30 and 0.35.

In this model, the Z-coefficient values are interpreted as follows:

- $Z > 0$  – the expectation of bankruptcy is greater than 50%, rising by increasing the value of  $Z$ ;
- $Z = 0$  – the probability of bankruptcy is 50%;
- $Z < 0$  – the probability of bankruptcy is small and with the decrease of  $Z$  this probability decreases.

The model presented in this way is too simple and uses only two key indicators - the current liquidity coefficient and financial indebtedness coefficient. The model is not very popular because it is not very accurate (it does not account for the impact of a number of significant indicators such as

profitability, economic activity, etc. on the financial state).

The most popular model for predicting financial difficulties is the five-factor Z model. The model has been developed in two versions - for public and for private non-financial enterprises.

The model applicable to public non-financial companies is expressed by the following formula:

$$Z = 1.2F_1 + 1.4F_2 + 3.33F_3 + 0.6F_4 + 0.999F_5$$

where:

- $F_1 = \frac{\text{net working capital}}{\text{total assets}}$ ,

It shows how much of the current assets are funded with long-term required (own and borrowed) capital. At low rates of  $F_1$ , there is an increased risk, because most part of the working capital is financed by short-term debts. This leads to difficulty in financing the company usual ongoing business activities - difficulties in paying salaries, difficulties in making supplies of raw materials and so on;

- $F_2 = \frac{\text{reinvested earnings}}{\text{total assets}}$ ,

It presents the portion of assets funded with reinvested earnings (retained earnings and reserves - excluding revaluating ones), i.e. the ability of the enterprise to self-finance. The low values are indicative of the fact that the company is unable to self-finance. In such a situation, it relies on funding from credit institutions or an additional contribution by the owners;

- $F_3 = \frac{\text{earnings before interest and taxes}}{\text{total assets}}$

It demonstrates the asset's profitability. The higher its value, the lower the risk. At low values of this indicator, the enterprise current business is inefficient;

- $F_4 = \frac{\text{market value of equity}}{\text{total liabilities}}$

It reveals the impact of financial markets on the financial sustainability of the enterprise, i.e. shows to what extent the market valuation of equity could be reduced before the enterprise becomes insolvent. There is a high financial indebtedness at low values of this indicator;

- $F_5 = \frac{\text{sales revenue}}{\text{total assets}}$

It determines the rate of return of the assets. High coefficient values imply small financial needs,

which have a favorable impact on the level of financial risk. Low values are an indicator that assets are not being used effectively.

The degree of financial risk is judged according to the value of  $Z$ . There are three risk assessment intervals:

- $Z < 1.8$  – there is a high level of financial risk with a high probability of bankruptcy;
- $1.8 < Z < 2.99$  – there is an increased level of financial risk but there is no risk of bankruptcy;
- $Z > 2.99$  – there is a low level of financial risk, i.e. there is no risk of bankruptcy for the company.

At a later stage, based on further in-depth research, Altman made a refinement of the five-factor model. As a consequence, the model changes and gets the type:

$$Z = 1.2F_1 + 1.4F_2 + 3.33F_3 + 0.6F_4 + 0.999F_5 - 2,675$$

In this version of the model, the following interpretation of  $Z$  coefficient is made:

- $Z < 0$  – the company financial position is unsustainable and there is a high probability of bankruptcy;
- $Z > 0$  – the company financial position is considered stable and insolvency is unlikely.

The model recommended for private and non-financial corporations is expressed by the formula:

$$Z^I = 0.717F_1 + 0.847F_2 + 3.107F_3 + 0.42F_4^* + 0.998F_5$$

where:

$F_4^*$ -Ratio: carrying a value of equity/total liabilities.

The indicator  $F_4^*$  is for the following enterprises:

1. whose shares are not marketable (they have no established market price);
2. those that are not joint-stock companies.

For the calculation of that indicator, the carrying value of equity is used.

The values  $Z^I$  are interpreted as follows:

- $Z^I < 1.23$  – the level of financial risk is high, and the company is facing bankruptcy;
- $1.23 < Z^I < 2.9$  – the financial risk is increased but there is no risk of bankruptcy;
- $Z^I > 2.9$  – there is no financial risk for the company, i.e. this is the so-called secure zone.

The threshold value of the  $Z$  coefficient in this version is 1.23. When  $Z < 1.23$ - the probability of bankruptcy is significant.

As for companies in the service sector (such as transport companies), specific modification of the model has been developed. In this case, the  $Z$ -coefficient is calculated on a four-parameter basis and is as follows:

$$Z^{II} = 6.56F_1 + 3.26F_2 + 6.72F_3 + 1.05F_4^*$$

The reason that the fifth indicator not to be included in the formula is that the turnover of assets of the enterprises in the different sectors of the economy is very different. This makes this indicator not a very reliable assessment criterion.

In this case, the interpretation of values  $Z^{II}$  is as follows:

- $Z^{II} < 1.1$  – high level of financial risk and forthcoming bankruptcy of the company;
- $1.1 < Z^{II} < 2.6$  – excessive financial risk, without risk of bankruptcy;
- $Z^{II} > 2.6$  – the company is safe, i.e. it is in good a financial position.

What is specific for that method is that weights of the indicators included in the formula are determined empirically. These weights are different and give a different degree of significance to the different indicators. It is noteworthy that the

indicator  $F_3$  has the highest weight with values of 3.33; 3.107; 6.72 for the three formulas, which means that the assets profitability indicator is most important. The least weight has the indicator of financial autonomy ( $F_4$  with weight 0.6).

The above-mentioned indicators  $F_1$  to  $F_5$  express the financial position of the company from various aspects. In their totality, they give a clear and accurate idea of whether the financial stability of the company is at risk.

In author opinion, when examining the probability of financial difficulties regarding transport sector companies, both versions of  $Z$ -model (five-factor and four-factor) can be used.

### 3 EXEMPLARY APPLICATION OF Z-SCORE MODEL

To demonstrate the practical application of the  $Z$ -score model let us consider a hypothetical private transport company "XYZ" Ltd. The data needed to calculate the financial indicators included in the company financial analysis equation using Altman's model are presented in Table 1. The data presented covers a period of four consecutive years – 2014, 2015, 2016, and 2017. The values of indicators from  $F_1$  to  $F_5$  participating in the models are calculated and presented in Table 2.

Table 1 Information for XYZ Ltd by years

Indicators (Thousand Levs)	Year			
	2014	2015	2016	2017
1. Total assets	181,234	183,934	178,005	184,987
2. Current assets	65,585	74,356	64,873	56,936
3. Current liabilities	30,987	29,795	31,275	29,484
4. Net current assets (2-3)	34,598	44,561	33,598	27,452
5. Retained earnings	8,993	7,998	7,495	6,039
6. Accounting profit	10,945	11,587	11,003	9,270
7. Interest on loans	3,543	4,867	3,693	4,109
8. Earnings before interest and taxes (6+7)	17,899	19,846	19,321	13,379
9. Carrying amount of equity	124,318	113,547	113,459	109,231
10. Amount of liability (Amount of liabilities)	111,239	112,569	113,999	115,235
11. Sales revenue	363,956	358,674	353,007	350,721

Table 2 Indicator values by years

Indicators (Thousand Levs)	Year			
	2014	2015	2016	2017
$F_1$ – Net current assets/Total Assets	0.19	0.24	0.19	0.15
$F_2$ – Retained earnings/Total Assets	0.05	0.04	0.04	0.03
$F_3$ – Earnings before interest and taxes/Total Assets	0.10	0.11	0.11	0.07
$F_4$ – Carrying amount of equity/Amount of liability	1.12	1.01	1.00	0.95
$F_5$ – Sales revenue/Total Assets	2.01	1.95	1.98	1.90

Calculation of Z-coefficient values with the application of the four-factor model is realized by the following formula:

$$Z_{14}^{II} = 6.56 \times 0.19 + 3.26 \times 0.05 + 6.72 \times 0.10 + 1.05 \times 2.01 = 3.25$$

$$Z_{15}^{II} = 6.56 \times 0.24 + 3.26 \times 0.04 + 6.72 \times 0.11 + 1.05 \times 1.01 = 3.52$$

$$Z_{16}^{II} = 6.56 \times 0.19 + 3.26 \times 0.04 + 6.72 \times 0.11 + 1.05 \times 1.00 = 3.15$$

$$Z_{17}^{II} = 6.56 \times 0.15 + 3.26 \times 0.03 + 6.72 \times 0.08 + 1.05 \times 0.96 = 2.60$$

The Z-coefficient values with the application of the five-factor model by years are as follows:

$$Z_{14}^I = 0.717 \times 0.19 + 0.847 \times 0.05 + 3.107 \times 0.10 + 0.42 \times 1.12 + 0.998 \times 2.01 = 2.96$$

$$Z_{15}^I = 0.717 \times 0.24 + 0.847 \times 0.04 + 3.107 \times 0.11 + 0.42 \times 1.01 + 0.998 \times 1.95 = 2.92$$

$$Z_{16}^I = 0.717 \times 0.19 + 0.847 \times 0.04 + 3.107 \times 0.11 + 0.42 \times 1.00 + 0.998 \times 1.98 = 2.91$$

$$Z_{17}^I = 0.717 \times 0.15 + 0.847 \times 0.03 + 3.107 \times 0.08 + 0.42 \times 0.96 + 0.998 \times 1.91 = 2.66$$

Table 3 summarizes the values of Z-coefficients by years calculated for the four-factor model ( $Z^{II}$ ) for service enterprises (including transport undertakings) and for the five-factor model ( $Z^I$ ) referring to private and non-financial companies.

As a result of the values of Z, obtained by the usage of the four-factor model, the following conclusions can be drawn:

- In 2014, 2015 and 2016 year -  $Z^{II}$  the coefficient is above 2.6, indicating that the transport company operates in a safe environment. It can be said that the enterprise is in a good financial state;

- in the 2017 year -  $Z^{II}$  coefficient decreases to 2.56, which is very little below the safety margin. This is well above the threshold of 1.1 below which there is a risk of bankruptcy. However, it is a signal to the company management that the financial risk has increased, and adequate measures should be put in place to reduce this trend.

Table 3 Z-coefficient values by years

Coefficient Year	$Z^I$	$Z^{II}$
2014	3.25	2.96
2015	3.52	2.92
2016	3.15	2.91
2017	2.56	2.65

When applying the five-factor model, things are almost identical. For the first three years, the value of  $Z^I$ -coefficient is above 2.9, indicating that the enterprise operates in a safe environment without financial risks. Again, in the 2017 year, the indicator falls below the threshold of the safe zone but with little difference.

As a result of the financial risk study, it can be concluded that for all years the company is in good financial state, i.e. the results are in the safe zone (for  $Z^{II} > 2.6$  and for  $Z^I > 2.9$ ), except in the 2017 year when the Z-coefficient is very little below the limit. When applying the four-factor Z analysis, the results are slightly more positive. This is indicative that when predicting financial difficulties using the Z-model, it is good to combine it with other means of analysis to ensure greater accuracy.

## 4 CONCLUSIONS

Undeniable is the fact that Altman's model has been applied by auditors, accountants and bankruptcy risk experts over 50 years which is a

proof of great advantage and possession of many positive qualities. This model for forecasting future financial difficulties, as already mentioned above in the paper, is a very useful analysis tool. However, it should be applied in combination with other methods (Roupska, 2016), (Stoyanov & Savova, 2015). When performing a Z-score analysis, the Z-coefficient should be calculated as for the reported accounting information and based on forecast information.

At the same time, in order to manage the financial risk, the factors that determine it must be explored. These factors are two types - objective and subjective. The management of the enterprise

cannot influence the objective factors (level of economic development of the country, rate of inflation, level of competition). It must comply with them. Influence of company management can only be on the subjective factors (capital, financial, property structure, qualification of financial specialists) that need to be continually studied and analyzed. Continuous monitoring of financial risk in all its diversity is required.

Only such a multi-dimensional approach can establish a reliable system of analysis and assessment of the financial stability of enterprises within dynamically changing conditions and continuous financial risk.

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Received for publishing: 14.03.2018  
Revision received: 16.05.2019  
Accepted for publication: 10.07.2019

### **How to cite this article?**

Style – **APA Sixth Edition:**

Vaysilova, E. (2019, July 15). Financial Risk Study as a Tool for Efficient Management of the Transport Enterprise. (Z. Cekerevac, Ed.) *MEST Journal*, 7(2), 87-93. doi:10.12709/mest.07.07.02.11

Style – **Chicago Sixteenth Edition:**

Vaysilova, Emiliya. 2019. "Financial Risk Study as a Tool for Efficient Management of the Transport Enterprise." Edited by Zoran Cekerevac. *MEST Journal (MESTE)* 7 (2): 87-93. doi:10.12709/mest.07.07.02.11.

Style – **GOST Name Sort:**

**Vaysilova Emiliya** Financial Risk Study as a Tool for Efficient Management of the Transport Enterprise [Journal] // *MEST Journal* / ed. Cekerevac Zoran. - Belgrade – Toronto : MESTE, July 15, 2019. - 2 : Vol. 7. - pp. 87-93.

Style – **Harvard Anglia:**

Vaysilova, E., 2019. Financial Risk Study as a Tool for Efficient Management of the Transport Enterprise. *MEST Journal*, 15 July, 7(2), pp. 87-93.

Style – **ISO 690 Numerical Reference:**

*Financial Risk Study as a Tool for Efficient Management of the Transport Enterprise. Vaysilova, Emiliya.* [ed.] Zoran Cekerevac. 2, Belgrade – Toronto : MESTE, July 15, 2019, *MEST Journal*, Vol. 7, pp. 87-93.