

## SCTMG 2020

### International Scientific Conference «Social and Cultural Transformations in the Context of Modern Globalism»

## ECONOMETRIC MODELS FOR FORECASTING THE BANKRUPTCY OF A CONSTRUCTION COMPANY

Magomed-Ramzan Buvaysarovich Khadisov (a)\*, Said-Emi Saidalievich Daurbekov (b), Lala Shamsutdinovna Datsaeva (c), Kharzan Pashaevna Matasheva (d), Maydat Sadulaevna Yusupova (e), Sayd-Magomed Sultanovich Abdulkhamidov (f)

\*Corresponding author

(a) Grozny State Oil Technical University named after Academician M.D. Millionschikov, 100 Av. n.a. Kh.A. Isaev, Grozny, 364051, Russia, umoggni@yandex.ru,

(b) Complex Research Institute n.a. Kh.I. Ibragimov, RAS,

21a Staropromyslovskoe highway, Grozny, 364051, Russia, kniiran@mail.ru,

(c) Grozny State Oil Technical University named after Academician M.D. Millionschikov, 100 Av. n.a. Kh.A. Isaev, Grozny, 364051, Russia, umoggni@yandex.ru,

(d) Grozny State Oil Technical University named after Academician M.D. Millionschikov, 100 Av. n.a. Kh.A. Isaev, Grozny, 364051, Russia, umoggni@yandex.ru,

(e) Grozny State Oil Technical University named after Academician M.D. Millionschikov, 100 Av. n.a. Kh.A. Isaev, Grozny, 364051, Russia, umoggni@yandex.ru,

(f) Grozny State Oil Technical University named after Academician M.D. Millionschikov, 100 Av. n.a. Kh.A. Isaev, Grozny, 364051, Russia, umoggni@yandex.ru

### *Abstract*

The article analyzes financial activities of a construction company (using the example of INE-Interservice LLC) for 2018. The dynamics of the performance indicators is characterized by high volatility, reflecting industry-wide dynamics: a low growth until 2016 and a significant decrease in key indicators in 2017, a rapid growth in 2018. It is quite difficult to ensure the effective use of resources, since the production mechanism has to be transformed. However, according to forecasts, in 2019, the situation is going to change, since the company has concluded agreements for construction and installation works. The analysis of the probable bankruptcy of INE-Interservice company was carried out. The analysis was based on the econometric models: the Z-score of Altman, Tuffler-Tishou, Sayfullin-Kadykova. In 2018, the net assets exceeded the authorized capital. This was a positive aspect of the financial situation, as it complied with legislative requirements for the net assets of the enterprise. At the same time, having determined the current state of this indicator, the net assets increased by 4.7 % per year. The excess of net assets over the authorized capital and their increase over the period indicate a good financial state of the company.

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**Keywords:** Profit, forecast, revenue, balance sheet, bankrupt, econometric model.



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## 1. Introduction

INE-Interservice LLC provides construction and design services, constructs public and residential buildings, industrial complexes.

## 2. Problem Statement

According to the data for 2018, INE-Interservice LLC increased the sales up to 652 thousand rubles, which is equivalent to 0.8 % of sales. Compared to the same period of 2017, the sales profit decreased by 14,063 thousand rubles or 95.6 %. Compared to the previous period, income and expenses decreased by 736 936 and 722 873 thousand rubles, respectively (Altman et al., 1977).

The transition to the market economy requires to increase production efficiency, competitiveness of products and services through the scientific and technological progress, effective forms of management and production management (Tsakayev & Khadisov, 2017).

The problem of forecasting crisis situations, in particular bankruptcies is crucial for company management. Russia has a developing economy which determines the instability of many processes and factors that make up the "external environment" of their activities. As a result, to ensure effective management, it is necessary to determine its condition at a given stage of development, but also to conduct early diagnostics for possible bankruptcy. Thus, the identification of adverse trends in the development of the company, forecasting of the crisis and bankruptcy are of paramount importance (Daurbekov & Khadisov, 2015).

## 3. Research Questions

Studying the costs of traditional activities, it should be noted that the company did not use the opportunity to take into account general business expenses as conditionally constant, including their monthly cost of production (works performed, services delivered). This caused to the absence of the indicator "Management expenses" for the reporting period.

There are no other income and expenses. It is almost impossible to avoid expenses even in the absence of activities; therefore, inaccuracies are possible.

**Table 01.** Key financial results of INE-Interservice LLC for 2018

Indicator	The value of the indicator, thousand rubles		Indicator change		Average annual value, thousand rubles.
	2017	2018	thousand roubles.	± %	
1	2	3	4	5	6
1. Revenue	816 284	79 348	-736 936	-90.3	447 816
2. Expenses for traditional activities	801 569	78 696	-722 873	-90.2	440 133
3. Sales profit (loss)	14 715	652	-14 063	-95.6	7 684
4. Other income and expenses, except for interests payable	–	–	–	–	–
5. EBIT (earnings before interest and taxes)	14 715	652	-14 063	-95.6	7 684
6. Interests	–	–	–	–	–

7. Changes in tax assets and liabilities, income tax, etc.	-2 943	-131	+2 812	↑	-1 537
<b>8. Net income (loss)</b>	11 772	521	-11 251	-95.6	6 147
The total financial result of the period	11 772	521	-11 251	-95.6	6 147
Changes in the retained earnings (uncovered losses) according to the balance sheet					
	x	-10 790	x	x	x

The comparison showed that in 2018 the net profit was 11,311 thousand rubles.

The company does not apply PBU 18/02 “Accounting for income tax calculations”, which is permissible if the company is a small business and may apply simplified accounting methods.

All three profitability indicators shown in Table 1 have positive values, since the organization received both sales profit and profit from financial and economic activities.

For 2018, the organization gained sales profit from each ruble. Nevertheless, there is a negative dynamics in the profitability of ordinary activities compared to this indicator for the same period of the last year.

The profitability ratio calculated as the ratio of EBIT to the revenue amounted to 1.8 %. This means that in each ruble, there was a profit before taxation and interest payment.

As one of the indicators reflecting the efficiency of labor resources, labor productivity is calculated as a ratio of sales revenue to the average number of employees.

The labor productivity amounted to 782 thousand rubles / person.

The most important indicators of the financial situation and the results of activities of INE-Interservice LLC for 2018 were summarized.

Only one indicator has a good value – net assets exceed the authorized capital, moreover, they increased over the analyzed period.

The results of INE-Interservice LLC are positively characterized by the following indicator – profit from financial and economic activities amounted to 521 thousand rubles.

The significant indicator is the sales profit (652 thousand rubles); however, its negative dynamics was observed compared to the same period of the last year (-14,063 thousand rubles).

The following indicators negatively characterize the financial situation of INE-Interservice LLC:

- a low value of equity relative to the total value of assets;
- a low return on assets;
- a significant drop in sales profitability;
- a negative change in equity relative to the total change in the assets of the company;
- the normal ratio of assets to liquidity and liabilities is not respected;
- a significant negative dynamics of EBIT per ruble of the revenue.

During the analysis, the following critical indicators of the financial situation of the organization were obtained:

- as of 2018, the value of the equity coefficient does not comply with the normative one;
- the current (total) liquidity ratio is much lower than the normal one;

- the quick (intermediate) liquidity ratio is much lower than the standard value;
- the absolute liquidity ratio is significantly lower than the standard value;
- the investment coverage ratio is much lower than the norm (normal value for this industry is 65 % or more);
- the critical financial situation by the amount of working capital.

Therefore, the company can obtain a bank loan.

#### 4. Purpose of the Study

The article analyzes the probability of bankruptcy of a construction company (using the example of INE-Interservice LLC).

#### 5. Research Methods

The analysis was based on the econometric models by Altman, Tuffler-Tishou, Sayfullin-Kadykov.

#### 6. Findings

The probable bankruptcy of the construction company INE-Interservice will be analyzed (Table 01). The Altman's z-account is calculated as one of the indicators of the bankruptcy probability (for INE-Interservice LLC, the four-factor model was used):

$$z\text{-account} = 6,56t_1 + 3,26t_2 + 6,72t_3 + 1,05t_4, \text{ where}$$

**Table 01.** The indicators of the bankruptcy probability (for INE-Interservice LLC, four-factor model)

Coefficient	Calculation	Values for 2018	Factor	Product
1	2	3	4	5
t <sub>1</sub>	Working capital to the total assets ratio	-0,83	6,56	-5,47
t <sub>2</sub>	The ratio of retained earnings to the value of all assets	<0,01	3,26	<0,01
t <sub>3</sub>	EBIT to total assets ratio	<0,01	6,72	0,01
t <sub>4</sub>	Ratio of equity to borrowed capital	0,03	1,05	0,03
Altman's z-account:				-5,42

The estimated probability of bankruptcy depending on the value of Altman's z-account is:

- 1 and less – high probability of bankruptcy;
- 1.1–2.6 – average probability of bankruptcy;
- 2.6 and higher – low probability of bankruptcy.

In 2018, for INE-Interservice LLC, the value of the z-account was 5.42. This indicator value indicates a high probability of bankruptcy. However, conclusions obtained on the basis of Altman's z-account cannot be considered unconditionally reliable – they are influenced by various factors, including economic conditions of the region.

An improved alternative to the Altman’s model is the bankruptcy forecast formula developed by R. Tuffler and G. Tishou (Fedorova et al., 2013). The Tuffler’s model is described by the following formula:

$$z = 0,53x_1 + 0,13x_2 + 0,18x_3 + 0,16x_4, \text{ where}$$

**Table 02.** The indicators of the bankruptcy probability (for INE-Interservice LLC, Tuffler’s model)

Coefficient	Calculation	Values for 2018	Factor	Product
1	2	3	4	5
x <sub>1</sub>	Profit / current liabilities	<0,01	0,53	<0,01
x <sub>2</sub>	Current assets / liabilities	0,14	0,13	0,02
x <sub>3</sub>	Current liabilities / assets	0,97	0,18	0,17
x <sub>4</sub>	Revenue / Assets	0,11	0,16	0,02
Total Tuffler’s Z-account:				0,21

The probability of bankruptcy according to the Tuffler’s model:

- z is more than 0.3 – low probability;
- z is less than 0.2 – high probability.

In this case, the value of the final coefficient was 0.21; therefore, it is not possible to draw an unambiguous conclusion about the threat of bankruptcy (Table 02).

Another method for diagnosing a probability of bankruptcy of Russian companies adapted to the conditions of the Russian economy is the RS model by Sayfullin and G.G. Kadykov. This five-factor model is as follows:

$$R = 2k_1 + 0,1k_2 + 0,08k_3 + 0,45k_4 + k_5, \text{ where}$$

**Table 03.** The indicators of the bankruptcy probability (for INE-Interservice LLC, Sayfullin-Kadykov’s model)

Coefficient	Calculation	Values for 2018	Factor	Product
1	2	3	4	5
k <sub>1</sub>	Equity coefficient	-6,16	2	-12,32
k <sub>2</sub>	Current liquidity coefficient	0,14	0,1	0,01
k <sub>3</sub>	Asset turnover coefficient	0,18	0,08	0,01
k <sub>4</sub>	Commercial margin (return on sales)	0,01	0,45	<0,01
k <sub>5</sub>	Return on equity	0,02	1	0,02
Total (R):				-12,28

In the Sayfullin-Kadykov’s model (Table 03), the final indicator (R) is interpreted as follows (Khadisov, 2016; Tsakayev, 2011). If R is less than 1, the probability of bankruptcy is high; if R is greater than 1, it is low. The table above shows that the value of the final indicator was – 12.28. This indicates the volatile financial situation of the company, the existing probability of bankruptcy. However, it should be

noted that this is a simplified model that does not take into account industry specifics. Given a larger number of factors, the result may be different; the more in-depth analysis is required.

## 7. Conclusion

In conclusion, it is worth summarizing the main conclusions:

1. According to the Altman's model, the Z-score amounted to 5.42. This value indicates a high probability of the bankruptcy of INE-Interservice LLC. However, it should be noted that the conclusions from Altman's Z-model cannot be considered reliable, since, among other things, they are affected by economic conditions in the region.

The probability of insolvency according to the Tuffler's model:

- z greater than 0.3 – the probability of bankruptcy is small;
- z less than 0.2 – the high probability of bankruptcy.

In this case, the value of the final coefficient was 0.21. Therefore, it is impossible to draw a clear conclusion about the impending bankruptcy.

2. In the Sayfullin-Kadykov's model, the value of the final indicator was – 12.28. This shows the unstable financial position of the company, the probability of bankruptcy. However, it should be noted that this is a simplified model that does not take into account industry characteristics. Results may vary.

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