

ANALYSIS OF THE RISK OF BANKRUPTCY LLC "GROUP OF COMPANIES" RUSAGRO" BASED ON SOFTWARE PACKAGE



DOI:10.24411/2588-0209-2018-10037

A.A. Akimov,
E. M. Safin
Yu. S. Ermilova

Annotation. The paper presents the results of the development of a software package for assessing the risk of bankruptcy of an enterprise based on various methods of domestic and foreign authors. The article describes the capabilities of the developed program and its brief description. The testing of the developed program is shown on the example of the “Rusagro Group of Companies” company. All necessary coefficients for each method were calculated and the effect of these factors on bankruptcy analysis. Conclusions are made for each method used.

Keywords: bankruptcy, risk degree, analysis, model.

The process taken place in Russia economy over the latest decades prove conspicuously both economic and social stability of the society depends on financial stability of enterprises. The analysis of the most significant financial indices enables to evaluate of enterprise financial activities a stable scientifically proven economic processes control, providing for attainment of strategic goals set as well as to bring out the ability of an enterprise to move towards the stable functioning and growth under variable conditions of both external and internal ambiance. With the financial statement for the fiscal year or over several previously years on hand the shareholders of a company may estimate efficiency of application of the means invested by them profitability of organization assets financial solvency and prospects of development. In future as of now a good numbers of procedures has been developed to estimate prognostication of an enterprise bankruptcy, nevertheless each of procedures suffers from it's own advantages and disadvantages.

A great contribution into the analysis of the enterprise activities as well as that into development of various procedures for rating for enterprise bankruptcy risk has been made by both

foreign and russian scientists such as E. Altman, W. Beaver, I. A. Blank, R. S. Saifullin, G. G. Kadykov, G. V. Savitskaya, and others.

However efficiency of every developed model for evaluating bankruptcy does not only depend on how specific is the national system of market relationship, on peculiarities of its growth on the rules and standards as developed regulating inconsistency of economic subjects but also on a set of instruments, on possibility of revealing signs of bankruptcy at an early stage, on choice of most beneficial instruments out of their set.

In spite of availability of various models and procedures making it possible to predict the moment of the firms bankruptcy appearing round the corner with this or another degree of probability there is quite a good number of challenges of how to predict bankruptcy. Many procedures of bankruptcy prediction evoke various types of crisis, owing to which those estimates as obtained with the help can vary drastically. Yet however any type of crisis may be conducive to winding the organization up.

Apart from classical models, the probability of an enterprise bankruptcy risk emergence can be evaluated using a fuzzy logic. Using a fuzzy logic to process nondetermine data linguistic variables can be operated which in the most natural way for human comprehension describe the elements of economic system.

Lately fuzzy simulation is one of most active in promising trends of applying research in the field of management and decision making.

In addition to the classical models, the probability of the risk of bankruptcy of the enterprise can be estimated using fuzzy logic. Using fuzzy logic to process non-deterministic data, it is possible to operate on linguistic variables that most naturally describe human elements of economic systems for human understanding. Recently, fuzzy modeling is one of the most active and promising areas of applied research in management research and decision making.

Today, the problem of the choice and use of methods for diagnosing bankruptcy of an enterprise is among the most popular paramount questions of economic theory and modern economic practice, however, due to the fact that in Russia this issue is not enough studied, it is necessary to use both Western models and Russian developments, that is, to apply the full range of methods for comprehensive and thorough analysis.

The relevance of this topic is that for an enterprise to function successfully, and for its work to bring profit, regular forecasting of its financial condition is necessary, since it is much easier to prevent a crisis than to rather overcome it.

In accordance with the foregoing, the purpose of writing an article is to create a specialized software package designed to assess the risk of bankruptcy of an enterprise.

To achieve this goal, the following tasks were set:

- to consider the theory of classical models and the theory of fuzzy sets, and their application for analyzing the degree of risk of bankruptcy;
- identify the relationship between the performance of the company and the magnitude of the risk of bankruptcy;
- to analyze the financial condition of the enterprise under study using various financial ratios;
- assess the likelihood of risk of bankruptcy in quantitative terms.

In order to identify the most important parameters of the activities of enterprises, a software package for assessing the financial states has been developed, which includes:

1. analysis of the risk of bankruptcy on the basis of a comprehensive financial analysis proposed by A. O. Nedosekin;
2. analysis of the risk of bankruptcy of an enterprise on the basis of the domestic method proposed by Saifullin and Kadykov;
3. analysis of the risk of bankruptcy of an enterprise based on the models of foreign authors: Altman, Taffler and Tishou, Liss.

The software package is implemented in the Delphi programming language, it is quite simple, convenient and easy to use even for novice users. The program provides for calculating the risk of bankruptcy according to the financial statements of the company under investigation.

A convenient user interface allows you to easily add, delete and edit data. The program can work, as well as using the Delphi environment as well as an independent application [7].

The main task of the program is to promptly provide the most accurate indicators of the risk of bankruptcy of the enterprise. Via

This software product can successfully perform the following actions:

- Evaluate future spending and revenue projections;
- monitor the financial condition of the company at any time;
- perform financial and economic analysis of the enterprise;
- based on the results of the program to carry out the preparation of materials for meetings;
- determine the best ways for the effective development of the company, profit growth;
- to analyze the activities of the enterprise.

The convenient and simple interface of the software does not require additional time from the user to study and master the program.

Initially, when you start the software packages, all fields for entering values of financial statements are empty. For the users not have any questions about the classification of this or

another method to determine the bankruptcy risk degree, the software package includes all the necessary theory for each method that the user can use during the analysis. The interface of one of the methods when launching the program is shown in Figure 1.

Fig. 1. Interface of the implemented method of E.Altman at program launch

The classical methods of bankruptcy risk assessment implemented in the program do not carry any serious complexity. The main task of such models is the calculation of all necessary coefficients and the calculation of the total value of the “Z-account” or rating number R.

It should be noted that the method proposed by A. O. Nedosekin is rather difficult for unprepared users to understand its essence and requires complicated calculations. In this regard, the natural condition for the convenience of users is the automation of this method. Also, an additional advantage of this method is the ease of use of the graphic interface, using which the user can select the membership function of interest.

The interface of the method implemented by A. O. Nedosekin in the program is presented in Figure 2.

Fig. 1. Interface of the implemented method of A.O. Nedosekin at program launch

Analysis of bankruptcy by the method A.O. Nedosekin provides software package of the following functions:

- formation of linguistic variables that describe the degree of risk of bankruptcy;
- construction of the membership functions of terms of linguistic variables;
- input of clear values of input variables;
- classification of the partition of indicators into subsets based on preliminary expert analysis;
- calculation by the algorithm of fuzzy logical deductive output of the values of output variables.

Thus, a bankruptcy assessment method based on the use of the theory of fuzzy logic does not require users to have knowledge of fuzzy methods and allows for analysis, hiding complex calculations from users.

Testing of the program was carried out on the basis of the accounting statements of Rusagro Group of Companies LLC (ROS AGRO PLC) for 2017. Data was taken from the site of this company: <https://www.rusagrogroup.ru/en/>

We show the calculations of the risk of company failure of the Rusagro Group of Companies LLC by the method of E. Altman using the developed software package. To do this,

it is necessary to enter into the program all the necessary initial data of the firm accounting statements (figure 3).

The screenshot shows the 'Enterprise bankruptcy risk analysis' window with the 'E. Altman Model' selected. The interface includes input fields for financial data, a calculation button, and a results section.

Input Field	Value
Working capital	5219200000
Amount of assets	157409985000
Unallotted profit	64758965000
Profit before tax	5981011000
Market value of capital	171520000000
Carrying amount of liabilities	64682046000
Revenue	79057860000
Value of assets	152972970000

Assessment of the probability of bankruptcy according to the five-factor model Of E. Altman:

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

If $Z < 1.81$ - the probability of bankruptcy is from 80% to 100%.
 If $Z = 1.81-2.77$ - average probability of company collapse (from 35% to 50%).
 If $Z = 2.77-2.99$ - the probability of bankruptcy is not high (from 15% to 20%).
 If $Z > 2.99$ - the situation at the enterprise is stable, the risk of insolvency within

Calculate

3.19615614640025

Result

The risk of bankruptcy is extremely small

The name of the coefficient:

Coefficient	Value
X1 - the amount of liquid net assets:	0.331567276370683
X2 - financial leverage of the company:	0.411403158446397
X3 - efficiency of activity:	0.0390984825619846
X4 - the ratio of the costs:	2.65174048452333
X5 - capital productivity:	0.502241709761932

Fig. 3. Analysis of bankruptcy by Altman method

Having calculated the risk of bankruptcy of Rusagro Group of Companies LLC based on the developed program, they obtained very positive results. The calculations obtained by the program indicate an insignificant probability of a company failing.

Next, we will conduct a bank bankruptcy risk assessment using the R. Taffler and G. Tishou model (Figure 4).

The screenshot shows the 'Enterprise bankruptcy risk analysis' window with the 'Model Taffler R. and G. Tiso' selected. The interface includes input fields for financial data, a calculation button, and a results section.

Input Field	Value
Sales income	58115770000
Current liability	8863525000
Current asset	60956432000
Long term liabilities	44909359000
Assets	157409985000
Revenue	79057860000

Four-factor Taffler model:
 $Z = 0.53 \times X1 + 0.13 \times X2 + 0.18 \times X3 + 0.16 \times X4$, where:
 $X1$ = Profit from sales / Short-term liabilities
 $X2$ = Current assets / (Short-term obligation + Long-term obligated)
 $X3$ = Long-term liabilities / total assets
 $X4$ = total assets / sales Revenue

If Z is greater than 0.3, the probability of bankruptcy is low,
 if $0.2 < Z < 0.3$, the probability of bankruptcy is average,
 if the value is less than 0.2, the probability of bankruptcy is high.

Calculate

3.71292965537154

Result

Low degree of bankruptcy

The name of the coefficient:

Coefficient	Value
X1 - degree of fulfilment of obligations:	6.55673335382932
X2 - the state of working capital:	1.13359052863893
X3 - measure of financial risk:	0.0563085308724221
X4 - ability of the company to settle its liabilities:	0.502241709761932

Fig. 4. Analysis of bankruptcy by the method of Taffler and Tishou

The developed program showed the result $Z = 3.713$, which confirms that Rusagro Group of Companies LLC has a low probability of bankruptcy.

The financial condition of the Rusagro Group of Companies LLC can be considered stable.

Let us proceed to assessing the risk of bankruptcy of Rusagro Group of Companies LLC using the Lis method (Figure 5).

The screenshot displays the 'Enterprise bankruptcy risk analysis' window. The 'Lis model' tab is selected. The interface includes input fields for financial data, a calculation button, and a result display area.

Input Field	Value
Working capital	5219200000
Amount of assets	157409985000
Sales income	58115770000
Unallotted profit	64758965000
Equity capital	92551923000
Borrowed capital	7170752000

Lis model:
 $Z = 0,063 \cdot K_1 + 0,092 \cdot K_2 + 0,057 \cdot K_3 + 0,001 \cdot K_4$
 $X_1 = \text{Working capital} / \text{Assets};$
 $X_2 = \text{Gain on disposal} / \text{Assets};$
 $X_3 = \text{Retained earnings} / \text{Assets};$
 $X_4 = \text{Equity} / \text{Debt capital}.$
 If $Z < 0,037$ - the probability of bankruptcy is high.
 If $Z > 0,037$ - the probability of bankruptcy is small.

Calculate
 0,0912119848116034

Result
 the probability of bankruptcy is small

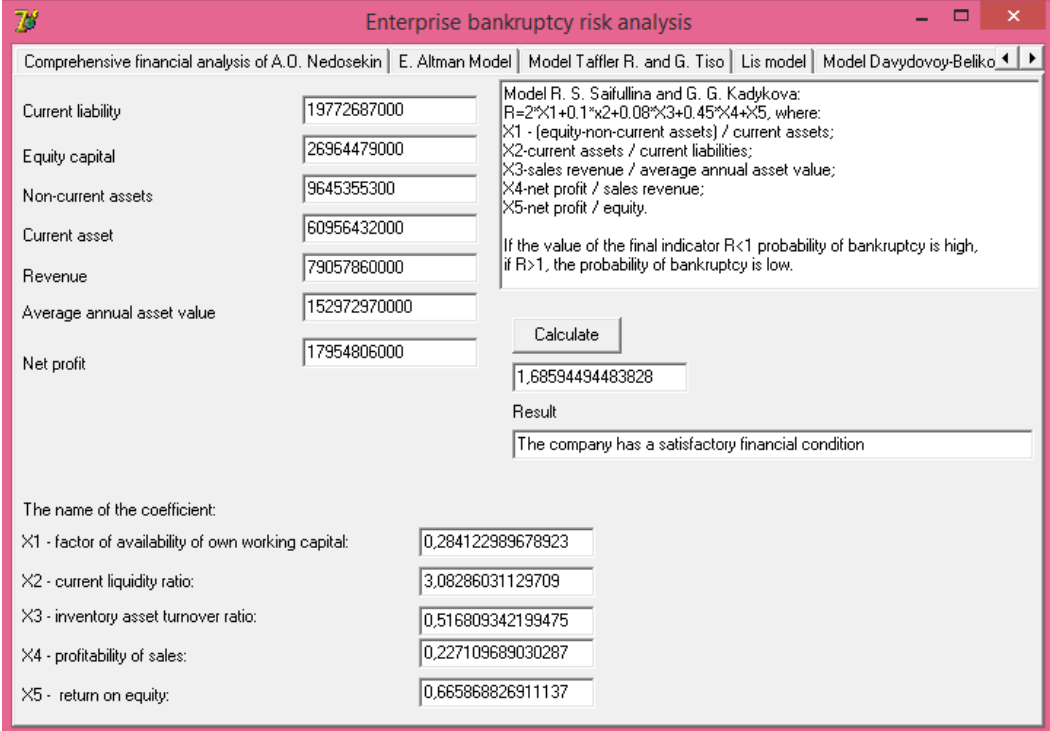
The name of the coefficient:

Coefficient Name	Value
X1 - share of working capital in the asset:	0,331567276370683
X2 - the profitability of assets profit from the sale of:	0,369200022476338
X3 - return on assets on retained earnings:	0,411403158446397
X4 - the coverage ratio of equity capital:	12,9068643009827

Fig. 5. Analysis of bankruptcy method Lis

When calculating the risk of bankruptcy by this method, it should be noted that X_4 is high. This coefficient shows how many times equity exceeds loan capital. The obtained value of this indicator once again makes it possible to make sure of the solvency and credit worthiness of the enterprise. The final result of the "Z-account" indicates that the financial stability of the Rusagro Group of Companies LLC is not in doubt.

Finally, we turn to assessing the risk of enterprise failure by the R.S. Saifullin and GG Kadykova (Figure 6).



Enterprise bankruptcy risk analysis

Comprehensive financial analysis of A.O. Nedosekin | E. Altman Model | Model Taffler R. and G. Tiso | Lis model | Model Davydovoy-Beliko

Current liability: 19772687000

Equity capital: 26964479000

Non-current assets: 9645355300

Current asset: 60956432000

Revenue: 79057860000

Average annual asset value: 152972970000

Net profit: 17954806000

Model R. S. Saifullina and G. G. Kadykova:
 $R = 2 \times X1 + 0.1 \times X2 + 0.08 \times X3 + 0.45 \times X4 + X5$, where:
 $X1$ - (equity-non-current assets) / current assets;
 $X2$ - current assets / current liabilities;
 $X3$ - sales revenue / average annual asset value;
 $X4$ - net profit / sales revenue;
 $X5$ - net profit / equity.

If the value of the final indicator $R < 1$ probability of bankruptcy is high, if $R > 1$, the probability of bankruptcy is low.

Calculate

1.68594494483828

Result

The company has a satisfactory financial condition

The name of the coefficient:

$X1$ - factor of availability of own working capital: 0.284122989678923

$X2$ - current liquidity ratio: 3.08286031129709

$X3$ - inventory asset turnover ratio: 0.516809342199475

$X4$ - profitability of sales: 0.227109689030287

$X5$ - return on equity: 0.665868826911137

Fig. 6. Analysis of bankruptcy by the method of R. S. Saifullin and G. G. Kadykova

The implemented method of Saifullin Kadykov showed the value of $R > 1$, namely $R = 1.6859$, which once again confirms that the financial condition of the Rusagro Group of Companies LLC can be considered satisfactory.

After analyzing the risk of bankruptcy of Rusagro Group of Companies LLC using four classical methods, it is worth noting that each model showed a result of an insignificant degree of bankruptcy risk, which means that the enterprise is successfully operating and liable for its obligations.

It should also be noted differences in the models themselves, which basically comes down to the number of factors used, that is, the coefficients (baseline values).

Based on the results of the analysis of the bankruptcy of ROS AGRO PLC by classical methods, it can be concluded that bankruptcy is not threatened by this enterprise in the near future, and its financial condition is considered stable and stable.

Next, using the apparatus of the theory of fuzzy logic, we analyze the risk of bankruptcy of Rusagro Group of Companies LLC by the method of complex financial analysis. The result of calculating the risk of bankruptcy by the method of A. O. Nedosekin is shown in Figure 7.

Enterprise bankruptcy risk analysis

Comprehensive financial analysis of A.O. Nedosekin | E. Altman Model | Model Taffler R. and G. Tiso | Lis model | Model Davydovoy-Belkova | Model Saifullin-Kadykov

Equity capital	92551923000
Balance currency	96608150000
Working capital	52192000000
Current asset	60956432000
Money resources	4860335000
Receivables	3196315000
Short-term liabilities	8863525000
Revenue	79057860000
Value of assets	152972970000
Net profit	2976169000

The name of the coefficient:

X1 - autonomy ratio:	0,958013614793369
X2 - the ratio of:	0,856218093604954
X3 - interim liquidity ratio:	0,90896680496755
X4 - absolute liquidity ratio:	0,54835237673499
X5 - turnover of all assets:	0,516809342199475
X6 - return on total equity:	0,0194555221095596

Membership function:

The risk of bankruptcy is insignificant ($0 < G < 0.2$)
 Low degree of bankruptcy ($0.2 < G < 0.4$)
 Average risk of bankruptcy ($0.4 < G < 0.6$)
 High risk of bankruptcy ($0.6 < G < 0.8$)
 Ultimate risk of bankruptcy ($0.8 < G < 1$)

Calculate

G 0,2171

Result

Low degree of bankruptcy

The method proposed by A. O. Nedosekin is very different from the classical models, since it is based on the theory of fuzzy logic. The theory of fuzzy logic is the most mathematically adequate for solving the problem of enterprise risk assessment. The applying of fuzzy logic to calculate the risk of bankruptcy makes it possible to use non-standardized indicators for evaluation and to take into account the specifics of the financial and economic activities of the analyzed company. The proposed methodology for the integrated assessment of the financial condition of an enterprise, in fact, reproduces human thinking processes based on subjective judgments [9].

Based on the obtained results of the analysis performed using the method based on the theory of fuzzy logic, it can also be concluded that the financial condition of Rusagro Group of Companies LLC should be assessed as satisfactory.

Analysis of all data obtained indicates the presence of uniform conclusions. Evaluations of the threat of bankruptcy of Rusagro Group of Companies LLC, carried out according to foreign methods of E. Altman, R. Taffler and G. Tishou, Lisa, domestic methods: R. S. Saifullin and G. G. Kadykov, and also according to the model proposed by A. O. Nedosekin, based on the use of the theory of fuzzy logic, allow us to state that the enterprise has a stable financial condition and a high level of solvency.

The use of the finished product has greatly simplified the computational process, even an knowledgeable user can work in this program due to a fairly simple and simple interface.

Summing up, it can be noted that each enterprise can have its own level of acceptable risk, in accordance with which the planning and analysis of the enterprise's activity is carried out.

Bankruptcy is a widespread problem faced by individual entrepreneurs and legal entities. A large number of organizations each year are subject to bankruptcy in our country. In this regard, the timely identification of adverse trends is of paramount importance. Diagnosis of the probability of bankruptcy in the enterprise is a system of targeted financial analysis aimed at identifying possible trends and negative consequences of the crisis development of enterprises.

Based on the analysis, it can be judged that Rusagro Group of Companies LLC has an insignificant risk of bankruptcy, which indicates the financial stability and reliability of the bank.

1. Abryutina M. S. Analiz finansovo-ehkonomicheskoy deyatel'nosti firmy. ucheb. –prakt. posobie // M. S. Abryutina, A. V. Grachev. M. Delo i servis. 2010. 256 s.

2. Baykina S. G. Uchet i analiz bankrotstva ucheb posobie// S. G. Baykina. M. Dashkov i Ko. 2012. 220 s.

3. Baranova M. A. Analiz riska bankrotstva predpriyatiya na osnove klassicheskikh modeley // M. A. Baranova Integratsiya mirovyykh nauchnykh processov kak osnova obshchestvennogo progressa. 2015. S. 53-57.

4. Baranova M. A. Analiz deyatel'nosti predpriyatiya v sisteme antikrizisnogo upravleniya// M. A. Baranova. Teoriya i praktika menedzhmenta. 2016. S. 239-240.

5. Baranova M. A. Analiz riska bankrotstva predpriyatiya OOO Himsnab s ispolzovaniem razlichnykh metodik// M. A. Baranova, E. A. Bochkareva, G. R. Galiaskarova. Ekonomika i predprinimatel'stvo. 2015. 8. S. 494-499.

6. Vahrushina M. A. Kompleksnyy ehkonomicheskiy analiz hozyaystvennoy deyatel'nosti. ucheb posobie// M. A. Vahrushina, M. Vuzovskiy. Uchebnik. 2008. 462 s.

7. Galiseev G. V. Programmirovaniye v srede Delphi 7 .Samouchitel uchebnik. // G. V. Galiseev M. Izdatelskiy dom Vilyams. 2006. 288 s.

8. ZHurov V. A. Process razrabotki modeley dlya prognozirovaniya bankrotstva predpriyatiy // V. A. ZHurov. Finansovyy menedzhment. 2007. 1. S. 23-27.

9. Nedosekin A. O. Ocenka riska biznesa na osnove nechetkiykh dannyykh // A. O. Nedosekin. Audit i finansovyy analiz. 2008. 4. S. 68 – 72.

10. Nedosekin A. O. Identifikatsiya i analiz riskov biznesa s ispolzovaniem metodov teorii nechetkiykh mnozhestv // A. O. Nedosekin K. E., Pavlov L. A., Volkova Banki i Riski. 2006. 2. S. 44 – 50.