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### Models of Enterprise Bankruptcy Diagnostics: Theoretical and Practical Aspects of Application

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#### ABSTRACT

The article analyzes the theoretical approaches to the diagnostics of the bankruptcy probability of an enterprise. The financial condition of the particular enterprise was analyzed according to the data of the balance sheet and the report of the financial results of the enterprise. The length of the financial cycle was predicted in the perspective. The practice of application and the analysis of the results of use of domestic and foreign methods of estimation of the bankruptcy probability was represented (models of Altman, Zaytseva, Savitskaya, model of the Irkutsk State Economic Academy (hereinafter referred to as ISEA) as an example of the analyzed enterprise). The conclusions were made of the accuracy of the application results of the models of the bankruptcy probability prediction. The ratio between the types of diagnostics was determined according to the range of solved tasks and problems. The practicability of application of the probability estimations of the bankruptcy prediction to the analyzed enterprise as the main models was grounded.

**Keywords:** Bankruptcy, model, probability, prediction, bankruptcy probability, estimation model of bankruptcy risk, enterprise, analysis, balance, horizontal analysis, vertical analysis, tendency of time series.

#### 1. INTRODUCTION

Currently, in the non-stable economic and political conditions and also the serious competitiveness in the market, for the survival the enterprise needs to estimate and predict exactly its financial condition and competitive positions. All this allows the organizations to take maximally correct managerial and strategic decisions, to be a guarantor of the efficient realization of interests of the participants of the financial and economic activity of the enterprise and the potential partners and investors as well.

The Russian economy has not yet had time to overcome the consequences of the global crisis of 2008-2009 by that moment; there was a landslide decline in oil prices, one of the main export commodities of the country; Western countries have introduced economic sanctions against the country. These events have had a major negative impact on the Russian economy: inflation increased, the ruble fell, the government, businesses and people revenues declined, private capital outflows increased (Bondarenko et al., 2016).

In the conditions of turbulence and also when the financial difficulties occur, the value of financial analysis for making of managerial decisions increases several times. The economic crisis is characterized by a general decrease of the business activity in the country, which is connected directly to the incapability of the organizations to adapt to the quickly changing market situation, failure to mobilize the available resources and also to operate them efficiently. This financial and economic analysis of the condition of the enterprise allows to reveal the reasons of the crisis condition and also the ways of its negotiation.

To check the hypothesis, it is necessary to answer to the following questions:

1. What models are the most desirable for the more accurate prediction of the possible bankruptcy of an enterprise?
2. What methodological base shall be chosen by the commercial organizations for prediction of the bankruptcy probability so that the obtained data could be considered correct and adequate in the external environment?
3. What universal methods can be used by the enterprise to estimate the probability of bankruptcy taking into account the branch specific character during the period of instability?

## **2. METHOD**

Theoretical and methodological base of the research. When writing this article, the authors based upon the scientific works and applied developments of the Russian and foreign scientists and practitioners of the studied problems in the field of the anti-crisis management of the enterprise on the whole, and in the application of the prediction models of the bankruptcy probability of enterprises, in particular. The work uses the dialectic material of cognition and the systemic approach to the study of the problem; the general scientific and special methods of research were used: analysis, in particular, the comparative analysis, synthesis and also the historical and logical methods, table and graphic methods.

The information base of the work is the normative and legal acts of the Russian Federation regulating the activity of the commercial organizations. When writing the article, the official statistic foreign and Russian information resources were used, and also the data of the official sites of the research and information business portals, institutions and other organizations.

## **3. RESULTS**

### **3.1. Theoretical approaches to probability diagnostics of enterprise bankruptcy**

The problem of prediction of the possible bankruptcy was and still is critical because the internal and external counterparts are interested in it. The prediction problem of the bankruptcy probability for a particular enterprise is, on one side, in the absence of the generally accepted methods of bankruptcy prediction and, on the other side, the existing methods are oriented mainly on the determination of the act of insolvency when the feature of the bankruptcy of the enterprise are evident (Vysotskaya, 2013).

In the domestic theory and practice of the economic analysis, the financial condition of the organization is estimated by the level of its liquidity and financial solvency, economic feasibility, economic activity and financial stability (Nedosekin, & Ivanov, 2011).

One of the first and main models of estimation of bankruptcy probability is a five factor model of Altman (Sergeenko, 2006). Despite the advantages of the model from the point of view of the accuracy of prediction, which on the horizon of up to one year is up to 95% and for two years is up to 83%, this model does not reflect the real situation completely in which the Russian companies operate; therefore, later the represented model was modified to match the Russian environment.

The following model is a six-factor model of prediction of the bankruptcy probability of Zaytseva that consists of the calculation of the bankruptcy complex coefficient and its comparison with the norm coefficient that is calculated on the base of the recommended minimal values of indicators (Bolshakov, 2006).

And, finally, one more estimation model of the bankruptcy probability of a company is an improved model of the Irkutsk State Economic Academy (hereinafter referred to as ISEA) which takes the binary variable as in the model of Savitskaya, where value of 1 is for bankrupt companies and 0 is for the stable companies (Vysotskaya, 2013).

### 3.2. Analysis and prediction of results of enterprise activity

Let us perform the analysis of the activity of a legal entity being one of the largest manufacturers of the mineral fertilizers in Russia.

The basic forms for the analysis of the financial condition of the enterprise are the balance sheet and Income Statement of the enterprise “Audex” (Table 15.1).

**Table 15.1**  
**Balance sheet on December 31, 2015 (Audex Ltd, n.d.)**

<i>Line item</i>	<i>Line code</i>	<i>On 31.12.2015</i>	<i>On 31.12.2014</i>	<i>On 31.12.2013</i>
<b>ASSET</b>				
<b>I. FIXED ASSETS</b>				
Invisible assets	1110	63,441	23,526	2,413
Capital assets	1150	22,447,916	14,488,801	11,426,003
Investments	1170	58,796,756	63,455,571	74,276,571
Deferred tax assets	1180	708,799	93,351	150,184
Other non-current assets	1190	1,454,632	2,443,056	378,420
<b>Total of the section I</b>	1100	83,471,544	80,504,305	86,233,591
<b>II. CURRENT ASSETS</b>				
Reserves	1210	4,345,851	3,971,666	4,303,937
Value-added tax on acquired assets	1220	529,719	474,157	432,113
Accounts receivable	1230	10,929,530	6,410,951	7,106,453
Investments (excluding financial equivalents)	1240	5,515,059	3,622,082	809,972
Cash and money equivalents	1250	3,687,875	2,126,635	3,509,370
Other current assets	1260	27,833	51,194	38,755

<i>Line item</i>	<i>Line code</i>	<i>On 31.12.2015</i>	<i>On 31.12.2014</i>	<i>On 31.12.2013</i>
<b>Total of the section II</b>	1200	25,035,867	16,656,685	16,200,600
<b>BALANCE</b>	1600	108,507,411	97,160,990	102,434,191
<b>LIABILITIES</b>				
<b>III. EQUITY</b>				
Authorized capital (reserve capital, authorized fund, contributions of partners)	1310	202,670	202,670	202,670
Treasury shares	1320	–	–	–64559
Re-evaluation of non-current assets	1340	985,672	998,058	1,011,114
Additional capital (without re-evaluation)	1350	3,399	1,383	360
Reserve capital	1360	30,401	30,401	30,401
Retained profit (unrecovered loss)	1370	20,696,132	34,778,952	40,263,968
<b>Total of the section III</b>	1300	21,918,274	36,011,464	41,443,954
<b>IV. LONG-TERM LIABILITIES</b>				
Borrowed funds	1410	31,612,640	24,282,205	31,807,125
Deferred tax liabilities	1420	3,531,103	4,265,715	6,202,400
Other liabilities	1450	333,284	–	–
Deferred tax liabilities	1420	3,531,103	4,265,715	6,202,400
Other liabilities	1450	333,284	–	–
<b>Total of the section IV</b>	1400	35,477,027	28,547,920	38,009,525
<b>V. CURRENT LIABILITIES</b>				
Borrowed funds	1510	48,469,228	30,531,260	20,294,899
Accounts payable	1520	2,438,664	1,933,835	2,375,857

Analyzing the balance of the enterprise, we can observe that the currency of the balance from 2013 till 2015 increased from 102,434,191 thousand rubles to 108,507,411 thousand rubles, which is 5.93% in relative terms. Retained profit, on the contrary, reduced by 19,567,836 thousand rubles or 48.6% due to its direction to the payment of dividends and loss recovery of the previous years. However, despite the significant decrease, the company has retained profit and that means the third clause is performed.

Let us consider in detail the values of the indicators contained in the Income Statement of the enterprise according to the structure and dynamics (Table 15.2).

**Table 15.2**  
**Income Statement for 2015 (AKK Audex Ltd, n.d.)**

<i>Line item</i>	<i>Line code</i>	<i>2015</i>	<i>2014</i>
<b>Income (net) from sale of goods, products, works, services (minus the value added tax, excise duties or similar compulsory payments)</b>	2110	39,404,335	33,420,510
<b>Prime cost of sold goods, products, works, services</b>	2120	–19,609,768	–19,503,191
<b>Gross profit (loss)</b>	2100	19,794,567	13,917,319
Selling costs	2210	–2,182,960	–2,346,013

<i>Line item</i>	<i>Line code</i>	2015	2014
Managerial costs	2220	-2,398,031	-2,349,379
<b>Income (loss) from sales</b>	2200	15,213,576	9,221,927
Income from participation in other organizations	2310	158,233	576,842
Interests receivable	2320	858,831	967,724
Interests payable	2330	-3,247,637	-3,100,297
Other incomes	2340	5,337,892	6,474,616
Other losses	2350	-27,605,699	-17,342,431
<b>Income (loss) before tax</b>	2300	-9,284,804	-3,201,619
<b>Current income tax</b>	2410	–	-1,582,128
<i>Including permanent tax liabilities (assets)</i>	2421	506,901	207,821
Change of deferred tax liabilities	2430	734,612	1,936,685
Change of deferred tax assets	2450	615,448	-56,834
Other	2460	-461	–
<b>Net income (loss)</b>	2400	-7,935,205	-2,903,896

The vertical analysis of the financial results of the company allowed to make the following conclusions: there was a loss in the amount of 9,285 mln rubles before tax in the accounting year, in 2014 the loss was 3,202 mln rubles. Regarding 2014, the loss increased by 6,083 mln rubles and this is stipulated by the growth of the negative exchange rates difference due to the re-estimation of the promissory notes nominated in currency.

The horizontal analysis of the Income statement allowed to reveal that the income from the sales of products, works and services in 2015 increased, the growth by 2014 was 17.9% or 5,983 mln rubles. Such factors as decrease of prices for the finished products (-0.6 bln rubles), increase of sale volumes (+0.5 bln rubles.), increase of exchange rate of dollar (+6.1 bln rubles) influence the change of income. This increase is stipulated, first, by the high share of the currency expenses in these items.

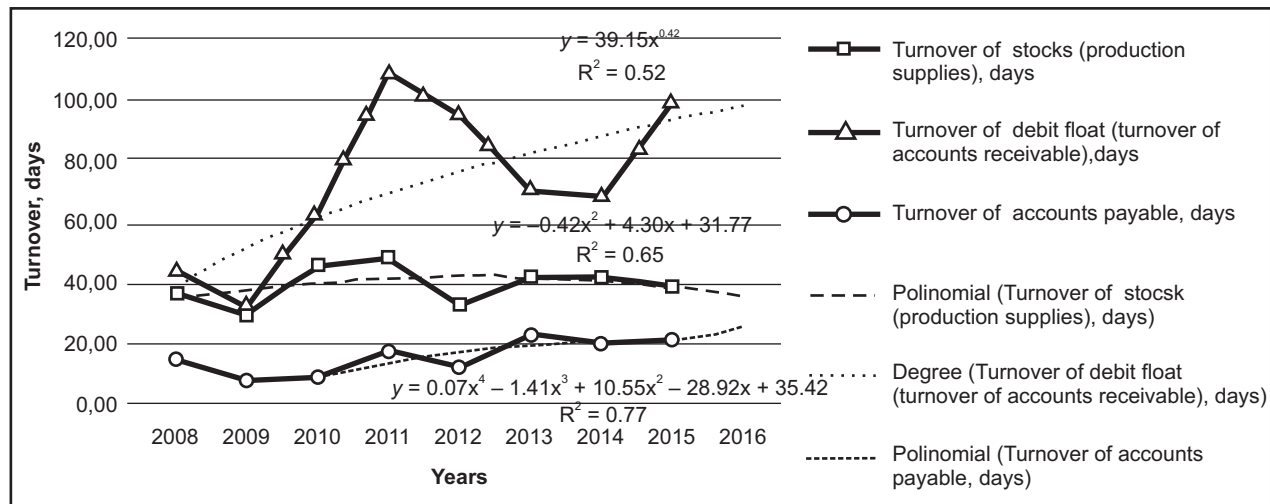
**Table 15.3**  
**Indicators of business activity for the period from 2008 to 2015, days. (AKK Audex Ltd, n.d.)**

<i>Line item</i>	2008	2009	2010	2011	2012	2013	2014	2015
Turnover of stocks (production supplies)	37.72	30.87	46.71	49.42	33.88	42.97	42.78	39.70
Turnover of debit float (turnover of accounts receivable)	44.99	33.18	63.48	109.28	95.54	70.95	69.06	99.85
Turnover of accounts payable	15.99	8.76	10.25	18.52	13.42	23.72	20.83	22.28
Length of cash cycle	82.71	64.05	110.19	158.70	129.42	113.92	111.84	139.56
Length of financial cycle	66.72	55.29	99.94	140.18	115.99	90.20	91.01	117.28

All above-stated reasons led to the fact that according to the results of 2015 the net loss was 7,935 mln rubles.

We shall predict the length of the financial cycle in 2016 and for this it is necessary to determine its components. The data for analysis are shown in Table 15.3.

The models describing the trends of time series of turnover of the stocks, account receivable and accounts payable are shown in Figure 15.1.



Source: Composed by the authors.

**Figure 15.1: Models describing the tendencies of the time series of turnover**

The turnover of the stocks is maximally accurately (determination coefficient is 0.65) described by the parabolic function:  $y = -0.42x^2 + 4.30x + 31.77$ . The turnover of the accounts receivable is described by the exponential function:  $y = 39.15x^{0.42}$ , and the accounts payable are described by the polynomial function of the fourth degree with  $y = 0.07x^4 - 1.41x^3 + 10.55x^2 - 28.92x + 35.42$  with the accuracy 0.77 (Zhurova, & Shekhtman, 2011).

Predicted values of the studied indicators on 2016 can be obtained by substitution of the value  $t = 9$  into the obtained equations and the length of the cash and financial cycles can be obtained according to the arithmetic actions (Table 15.4).

**Table 15.4**  
**Predicted values of the indicators of business activity, days**

Line item	2016
Turnover of stocks (production supplies)	36.77
Turnover of debit float (turnover of accounts receivable)	98.52
Turnover of accounts payable	25.29
Length of cash cycle	135.29
Length of financial cycle	110.00

Source: Composed by the authors

Thus, in 2016 the decrease of the cash and financial cycles are expected that is considered as a positive fact.

Then we come to the estimation of the company profitability. However, at the beginning let us consider such indicator as EBITDA (Korol, 2011; Aziz, & Dar, 2006), which allows to estimate roughly the cash flow excluding such “non-finance” expenditure item as depreciation. In the accounting year, the indicator EBITDA grew more than one and a half time from the level of 2014 and was 16,140 mln rubles (Table 15.5).

**Table 15.5**  
**Calculation of the indicator EBITDA**

<i>Indicator</i>	<i>2015</i>	<i>2014</i>	<i>2013</i>
Profit from sales	15,213,576	9,221,927	14,111,115
Depreciation (production costs) (code 5640)	926,850	581,585	531,751
EBITDA	16,140,426	9,803,512	14,642,866

Source: Composed by the authors.

Profit margin before tax, interests calculations and depreciation allowances (profitability according to EBITDA, EBITDA margin), characterizing the profitability of the business was 41% (Table 15.6). The dynamics of the indicators shows that the efficiency of sales grew.

**Table 15.6**  
**Profitability indicators, %**

<i>Indicator</i>	<i>2013</i>	<i>2014</i>	<i>2015</i>
Economic profitability (assets profitability)	8.35	-2.99	-7.31
Output profitability	64.29	38.11	62.89
Profitability of capital assets	74.86	-20.04	-35.35
Profitability of production assets	89.71	49.96	56.78
Profitability of sales	39.13	27.59	38.61
Profitability from ordinary activity	30.63	-9.58	-23.56
Net margin	23.72	-8.69	-20.14
Gross margin	52.66	41.64	50.23
Return on equity	20.64	-8.06	-36.20
Profitability of continuous assets	10.77	-4.50	-13.83
Profitability according to EBITDA	40.61	29.34	40.96

Source: Composed by the authors.

The indicators of profitability of assets and financial profitability in 2015 as well as last year became negative because according to the results of the year the enterprise had a loss. The reason of loss as it was in case with the financial profitability is a negative dynamics of the market value of the long-term investments of the enterprise and the re-estimation of the currency commitments of credits and loans due to the decrease of the ruble exchange rate.

To predict the main indicators of profitability, we will base our calculations upon the predicted values of the net profit for 2016 and 2017 in the amount of 1,083,620.63 thousand rubles and 5,949,573.14 thousand rubles correspondingly and also already obtained values of profit and income (loss) from sales, the first of which in 2016 will be 54,000,000.00 thousand rubles, in 2017 – 65,414,550.10 thousand rubles and the second will be 30,335,233.99 thousand rubles and 43,833,524.71 thousand rubles correspondingly.

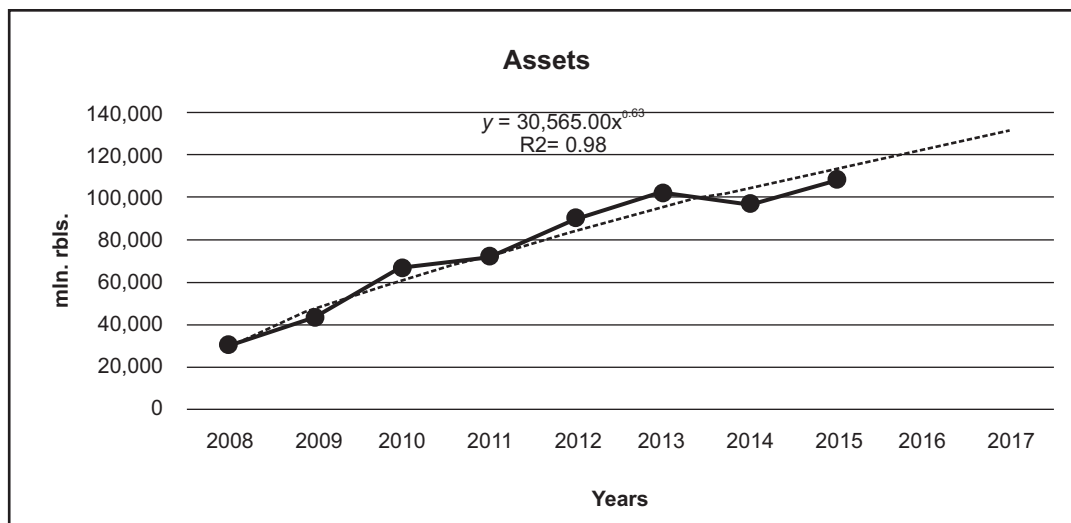
The data of two other indicators necessary for the prediction are inserted into Table 15.7.

**Table 15.7**  
**Values of assets and equity capital for 2008-2015, mln rubles**

Item	2008	2009	2010	2011	2012	2013	2014	2015
Assets	30,486	43,898	66,696	72,244	90,490	102,434	97,161	108,507
Equity capital	22,649	17,968	34,383	37,582	44,276	41,444	36,011	21,918

Source: Composed by the authors.

We will extrapolate the values of lines “Assets” and “Equity capital” (Figure 15.2, Figure 15.3).



Source: composed by the authors.

**Figure 15.2: Model describing the tendencies of time series for the indicator “Assets”**

The models were chosen with a high degree of accuracy. So, for the first indicator it was decided to take the power function with the determination coefficient equal to 0.98 and for the second – the polynomial function of the fourth degree with the determination coefficient equal to 0.94.

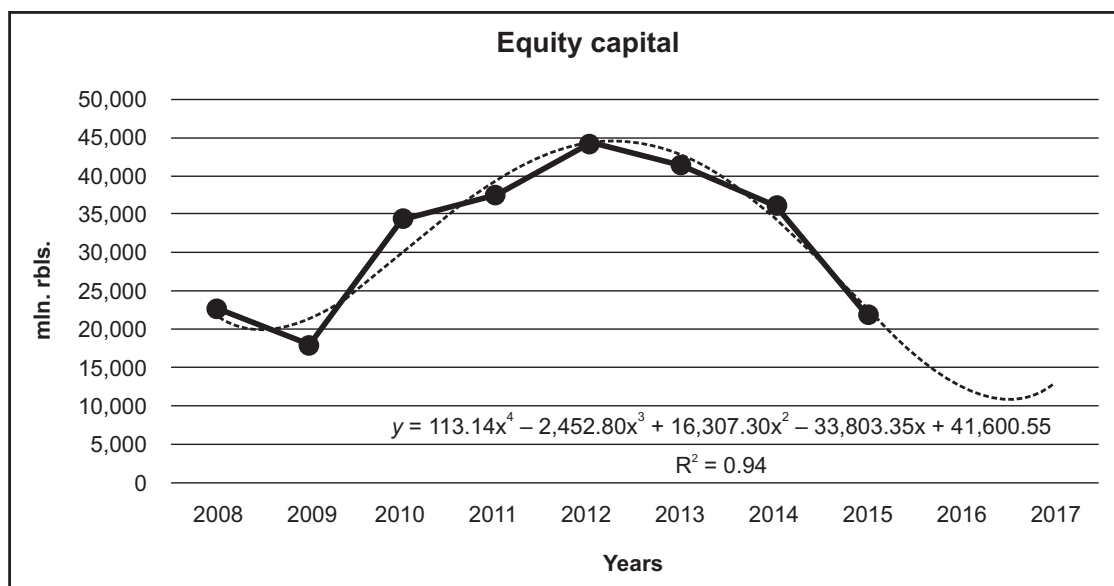
As a result, the following predicted values were obtained (Table 15.8).

**Table 15.8**  
**The predicted values of assets and equity capital, thousand rubles**

Years	Assets	Equity capital
2016	54,000,000.00	19,324,900.06
2017	65,414,550.10	17,341,773.97

Source: Composed by the authors





Source: Composed by the authors.

**Figure 15.3: Model describing the tendencies of time series for the indicator “Equity capital”**

Performing the actions similar to the one made before, we can get the values of profitability for 2016 and 2017 (Table 15.9).

**Table 15.9**  
Values of profitability indicators for 2016-2017, %

Indicator	2016	2017
Economic profitability (profitability of assets)	-0.89	4.56
Profitability of sales	56.18	67.01
Net margin	-2.01	9.10
Return on equity	-8.67	46.05

The interpretation of the indicators shows that their values grew by 2017. The improvement of the situation at the enterprise under analysis can be observed. If in 2016 the profitability of assets will remain negative, in 2017 the enterprise can get 4.56% of profit from every ruble invested into assets. The profitability of sales has the similar tendency to grow and according to the plan in 2017 it shall reach 67.01%. Regarding the net margin, in 2017 the company will get 9.1% of the net profit from every ruble of income. The last of the analyzed indicators had rather big changes in dynamics due to the significant changes of the net profit and small changes in the values of the equity capital for 2016-2017.

Thus, the main reasons of the low profitability of the company are the negative dynamics of the market value of the long-term financial investments of the company and re-estimation of the currency liabilities of the credits and loans because of the decrease of the ruble exchange rate. On the other side, the company improved its competitiveness in the global context, and its profitability grew by 11.63% in 2015 according to EBITDA.

### 3.3. Calculation of bankruptcy probability of enterprise

Beginning from 2009, two largest international rating agencies Fitch Ratings and Moody's Investors Service awarded the credit to the analyzed enterprise. The first agency awarded the rating from B to B+, the second one – B1. In the middle of 2015 the agency Fitch Ratings reviewed its prediction for the positive one. The agency Moody's Investors Service left the rating unchanged and maintained the stable prediction for it despite the wave of decrease of rating of the Russian Federation and Russian emitters. By the end of 2015 the following ratings were obtained: from Fitch Ratings – B+ positive, from Moody's Investors Service – B1 stable.

On the whole, these ratings mean that the organizations is rather vulnerable in the conditions of the unfavorable business, financial and economic situation, it is also subjected to the risk of deterioration of the creditability although today it can fulfill its financial liabilities.

There is a particular connection between the credit scores and the bankruptcy probability that are shown in Table 15.10.

**Table 15.10**  
**The ratio between the credit score and bankruptcy probability (Lavrushin, 2014)**

<i>Credit score</i>	<i>Bankruptcy probability, %</i>
D	75.0
C	60.0
CC	52.5
CCC	46.6
B–	32.5
B	26.4
B+	19.3
BB	12.2
BB+	7.3
BBB	2.3
A–	1.4
A	0.5
A+	0.4
AA	0.3
AAA	0.0

Thus, according to the credit scores obtained from Fitch Ratings and Moody's Investors Service, the bankruptcy probability varies in a range from 19.3% to 26.4% and on the whole it is an acceptable value and that means the bankruptcy probability should be low.

Let us consider the assumption made according to the models of Altmann (Table 15.11), Savitskaya (Savitskaya, 2014) (Table 15.13), Zaytseva (Table 15.14) and the improved model of the Irkutsk State Economic Academy (hereinafter referred to as ISEA) (Table 15.15) (Tuktarova, & Tuktarov, 2013).

According to the foreign method of prediction of Altman, the bankruptcy probability of the considered company was very high during the whole analyzed period.

**Table 15.11**  
**Calculation of the bankruptcy probability according to the model of Altman**

<i>Indicator</i>	<i>Calculation method</i>	2010	2011	2012	2013	2014	2015
X1	$\frac{\text{line 1200} - \text{line 1500}}{\text{line 1600}}$	0.06	0.08	0.16	-0.07	-0.16	-0.24
X2	$\frac{\text{line 2400}}{\text{line 1600}}$	0.25	0.07	0.15	0.08	-0.03	-0.07
X3	$\frac{\text{line 2300}}{\text{line 1600}}$	0.31	0.10	0.19	0.11	-0.03	-0.09
X4	$\frac{\text{market value of shares}}{\text{line 1400} + \text{line 1500}}$	1.26	1.57	1.37	0.93	0.74	0.87
X5	$\frac{\text{line 2110}}{\text{line 1600}}$	0.28	0.31	0.37	0.35	0.34	0.36
Z-account	$1.2 \cdot X1 + 1.4 \cdot X2 + 3.3 \cdot X3 + 0.6 \cdot X4 + X5$	2.48	1.79	2.21	1.30	0.44	0.21
Bankruptcy probability	Z < 1.81 – very high; 1.81 < Z < 2.675 – average; Z = 2.675 – equal to 50%; 2.675 < Z < 2.99 – low; Z > 2.99 – null.	Average	High	Average	High	Very high	Very high

Source: Composed by the authors according to the data of (Kirichenko, 2013; AKK Audex Ltd, n.d.)

The values of the market price of shares of the analyzed enterprise necessary for the calculation of the indicator X4 are shown in Table 15.12.

**Table 15.12**  
**Market capitalization of the company, thousand rubles**

<i>Indicator</i>	2010	2011	2012	2013	2014	2015
Market capitalization	40,666 078	54,515 034	63,286 214	56,788 134	45,402 133	74,987,900

Source: Composed by the authors

Besides, the analysis of the financial status showed that the enterprise is rather successful in its activity and this indicates that this method does not describe correctly those circumstances that are typical for the Russian enterprises, including those for the analyzed enterprise.

According to the model offered by Savitskaya, the bankruptcy probability of the analyzed enterprise is rather low (Table 15.13).

**Table 15.13**  
**Calculation of bankruptcy probability by method of Savitskaya**

<i>Indicator</i>	<i>Calculation method</i>	2010	2011	2012	2013	2014	2015
X1	$\frac{\text{line 1200}}{\text{line 1600}}$	0.21	0.22	0.27	0.16	0.17	0.23
X2	$\frac{\text{line 2110}}{0.5 \cdot (\text{line 1300}_{\text{acc. years}} + \text{line 1300}_{\text{last years}})}$	0.73	0.63	0.81	0.84	0.86	1.36
X3	$\frac{\text{line 1300}}{\text{line 1700}}$	0.52	0.52	0.49	0.40	0.37	0.20
X4	$\frac{\text{line 2400}}{0.5 \cdot (\text{line 1300}_{\text{acc. years}} + \text{line 1300}_{\text{last years}})}$	0.63	0.14	0.34	0.20	-0.07	-0.27
Z	$1 - 0.98 \cdot X1 - 1.8 \cdot X2 - 1.83 \cdot X3 - 0.28 \cdot X4$	-1.63	-1.34	-1.72	-1.47	-1.38	-1.97
Bankruptcy probability	$Z \leq 0$ – financially sustainable organization; $Z \geq 1$ – organization refers to the high risk group.	$\frac{\text{line 1300}}{Z}$	$\frac{\text{line 1300}}{Z}$	$\frac{\text{line 1300}}{Z}$	$\frac{\text{line 1300}}{Z}$	$\frac{\text{line 1300}}{Z}$	$\frac{\text{line 1300}}{Z}$

Source: Composed by the authors according to the data of (Savitskaya, 2014; AKK Audex Ltd, n.d.)

Model of Zaytseva also reveals that the bankruptcy probability of the analyzed enterprise was low during the whole period of analysis (Table 15.14).

**Table 15.14**  
**Calculation of the bankruptcy probability by method of Zaytseva**

<i>Indicator</i>	<i>Calculation method</i>	2010	2011	2012	2013	2014	2015
X1	$\frac{\text{line 2300}}{\text{line 1300}}$	0.60	0.19	0.38	0.27	-0.09	-0.42
X2	$\frac{\text{line 1520}}{\text{line 1230}}$	0.16	0.17	0.14	0.33	0.30	0.22
X3	$\frac{\text{line 1500} - \text{line 1530}}{\text{line 1240} + \text{line 1250}}$	1.31	1.91	0.88	5.32	5.67	5.55
X4	$\frac{\text{line 2300}}{\text{line 2110}}$	1.09	0.32	0.51	0.31	-0.10	-0.24
X5	$\frac{\text{line 1500} + \text{line 1400}}{\text{line 1300}}$	0.94	0.92	1.04	1.47	1.70	3.95

<i>Indicator</i>	<i>Calculation method</i>	2010	2011	2012	2013	2014	2015
X6	$\frac{\text{line 1600}}{\text{line 2110}}$	3.51	3.18	2.72	2.84	2.91	2.75
$K_f$	$0.25 \cdot X1 + 0.1 \cdot X2 + 0.2 \cdot X3 + 0.25 \cdot X4 + 0.1 \cdot X5 + 0.1 \cdot X6$	1.15	0.93	0.79	1.67	1.58	1.64
$K_n$	$K_n = 1.57 + 0.1 \cdot X6$ , where X6 is X6 of the last period	1.72	1.92	1.89	1.84	1.85	1.86
Bankruptcy probability	$K_f > K_n$ – High; $K_f < K_n$ – Low.	Low	Null	Null	Low	Low	Low

Source: Composed by the authors according to the data of (Kirichenko, 2013; AKK Audex Ltd, n.d.)

**Table 15.15**  
**Calculation of the bankruptcy probability according to the improved model of ISEA**

<i>Indicator</i>	<i>Calculation method</i>	2010	2011	2012	2013	2014	2015
X1	$\frac{\text{line 2400}}{\text{line 1600}}$	0.25	0.07	0.15	0.08	-0.03	-0.07
X2	$\frac{\text{line 1200}}{\text{line 1600}}$	0.21	0.22	0.27	0.16	0.17	0.23
X3	$\frac{\text{line 2400}}{\text{line 1300}}$	0.48	0.14	0.32	0.21	-0.08	-0.36
X4	$\frac{\text{line 2400}}{\text{line 2120} + \text{line 2330} + \text{line 2350}}$	-0.33	-0.24	-0.61	-0.35	0.07	0.16
P	$0.841 - 0.194 \cdot X1 - 0.883 \cdot X2 - 1.126 \cdot X3 - 0.337 \cdot X4$	0.18	0.56	0.42	0.57	0.76	1.01
Bankruptcy probability	$P \leq 0$ – financially sustainable organization; $P \geq 1$ – organization refers to the high risk group.	Null	Average	Low	Average	Average	High

Source: Composed by the authors according to the data of (Vysotskaya, 2013, AKK Audex Ltd, n.d.).

The model ISEA showed the most reliable results that describe maximally correctly the financial condition and the bankruptcy probability of the company during the analyzed period. Certainly, the value of the last year cannot be considered as critical; however, this should become a particular signal for the company for attention and control of the financial condition and also for taking measures to decrease the negative consequences.

Thus, when using the domestic models, the results similar to each other were achieved that can be considered as a positive fact and also that these methods match more to the specific character of the studied enterprise.

#### 4. DISCUSSION

As a result of the performed research, it was proved:

Firstly, any enterprise is not protected from the bankruptcy. To get an adequate and reliable result when choosing the method of analysis of the bankruptcy probability, one shall take into account the set of factors including: a sector profile of the organization, the level of taxation, the legislation base of the country and other aspects of production and financial activity of the studied enterprise.

Secondly, the credit score obtained from the international rating agencies is a rather accurate indicator of the bankruptcy probability the enterprise can rely on.

Thirdly, the results obtained when using the foreign model of prediction of bankruptcy probability – Altmann's model cannot be considered correct. They should be subjected to the correction taking into account the peculiarities of the Russian enterprises, branches where they function and the Russian legislation.

Fourthly, as there is no single and universal method of bankruptcy prediction in the practice, it is necessary to follow the resulting indicators of some of them in dynamics. The choice of different models is determined by the specific character of the branch where the enterprise functions and also by the size of the enterprise. The domestic methods such as models of Savitskaya, Zaytseva and the improved model of ISEA can estimate rather accurately the bankruptcy probability of the considered enterprise. It was revealed that the bankruptcy probability is rather low and this is confirmed by the obtained rating score of this enterprise.

#### 5. CONCLUSION

In the modern conditions, the normal functioning of the enterprise requires a thorough and systemic complex approach to the diagnostics of the bankruptcy of the enterprise.

The necessity of the bankruptcy diagnostics of the enterprises is stipulated by the development regularities of the system of market relations. Complicating of all types of activity, and functioning in the complicated economic conditions contribute to the development and improvement of the bankruptcy prediction methods. In the modern conditions, due to the existing dynamics of the increase in the number of bankruptcies among the legal entities, the use of these methods is reasonable and useful for the enterprises and their contractors as well.

In the foreign and domestic economic science and practice, a lot of models of bankruptcy estimations are used that are based upon the various principles and methods. The efficiency of one or another bankruptcy model depends upon the specific character of the national system of market relations, peculiarities of its development, developed rules and norms regulating the bankruptcy of the economic entities, a set of tools, possibility of the early reveal of the bankruptcy signs.

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