FINANCES OF RUSSIA AGRARIAN COMPANIES: SCORING MODELING FOR ESTIMATING

Oleg Patlasov

K.G. Razumovski Moscow State University of technologies and management, Russia
Omsk Humanitarian Academy, Professor, Omsk, Russia

Olga K. Mzhelskaya

Omsk Humanitarian Academy, Omsk, Russia

The paper presents the authors' estimations according to the scoring modeling techniques; also, internationally spread models of bankruptcy forecasting are systematized. Advantages and disadvantages of dynamic modelling methods as applied to financial condition assessment are presented here. Methodological problems of financial modelling are explained here in detail. Regression, logit-regression and discriminant models are built on the basis of data on the Rosselkhozbank and Sberbank of Russia regulations, taking into account the agrarian specifics of organizations and regional specificity of the Omsk region. An attempt has been made to balance the simplicity of calculations and the accuracy of predictions. Graphs, to be used for express analysis, are constructed on the basis of two core financial indicators.

Keywords: credit analysis, financial modeling, credit risk, borrower

Oleg Patlasov

Doctor of economy, professor,
Chief- specialist of the Federal State Budget Educational Institution of Higher Education K.G. Razumovski Moscow State University of technologies and management; Omsk Humanitarian Academy
Research interests: Risk Management, Economic Analysis and Financial Management, Personnel Marketing

e-mail: opatlasov@mail.ru

Olga Mzhelskaya

head of the Humanities and Foreign Language department at Omsk Humanitarian Academy, Russia. She is PhD in Philological Sciencies.
Research interests: linguistics and humanitarian research of communication processes, sociology and management in education, business consulting. She has published 60 scientific papers, 2 monographs and 12 text books and manuals. Twice she has been a laureate of All Russia Best scientific book contest organized by Russian Fond of Education Development.

e-mail: omz82@rambler.ru

Introduction and Theoretical Background

Different methods of predicting bankruptcy forecast various types of crises and, accordingly, estimations obtained with their help are also very different. The choice of specific methods is prescribed and adjusted in accordance with the specifics of a particular industry/branch in which the organization operates. As a result, a large number of different models for bankruptcy forecasting have been developed.

Financial analysis models differ depending on the research principles and analysis priorities. The key of them are as follows:

1. Descriptive models. They are based on scientific, theoretical literature mostly and also on the accounting toolkit (vertical and horizontal analyses of financial statements, balances' system construction, analytical coefficients' calculation).

2. Normative models are used mainly for carrying out an internal financial analysis. They are based on the required calculated indicators that are are compared with the recommended (normative) value.

3. Predictive models are used to make forecasts about future financial results and future financial condition of a firm. The models of situational analysis, of dynamic analysis, critical models can be singled out here.

Several groups of bankruptcy forecasting models can be distinguished basing on the characteristics of the used modeling techniques: statistical models; artificial intelligence models; theoretical models.

The first two groups of models are characterized as positive ones, because they are focused on the symptoms of bankruptcy and are trying to explain, using inductive arguments, the reasons for some companies to become bankrupt. The last category (normative models) applies deductive argumentation to explain why a certain part of enterprises can become bankrupt.

Data obtained using various modeling techniques and their prediction accuracy indicate that the main studies in this field are mainly based on the statistical models of bankruptcy forecasting, and this can be explained by the chronology of various modeling technologies' emergence. However, these models show lower forecasting accuracy (84%) as compared to the models of artificial intelligence (88%) and theoretical ones (85%).

The adequacy degree of different types of models is determined by the errors in identifying the tested business entity. The following two types of basic errors are possible: the first type of error occurs when a financially unstable enterprise being on the verge of bankruptcy is defined as a financially secure one. And the second type of errors is connected with the erroneous classification of a financially stable company as a bankrupt organization. In foreign and domestic scientific literature the accuracy of forecasting among different types of models has been compared; high accuracy of the decision tree methods, multiple discriminate analyses, genetic algorithm etc. has been confirmed.

Currently, there are several key approaches to the theory of bankruptcy diagnostics. These methods are based on regression, discriminate factor models put forward by well-known Western economists.

The essence of this approach is to identify the factors significantly affecting financial condition of the company, to determine the type and the extent of its dependence on these factors and also formation of a probabilistic criterion for company bankruptcy.

Among the bankruptcy risk models based on logistic regression are the ones by Baestaens et al. (1997), Laitinen et al. (1999), Postin et al (1994) and some others. Among other authors investigating the problems with accounting arrangement under the conditions of insolvency and bankruptcy we need to mention: Ooghe et al. (2002), Voronin (1994)

For the prediction of bankruptcies some of the contemporary authors have also used vector machines (for example, Lennox (1999), Patlasov & Vasina, (2008, 2009).

Linearly regression variants of LPM-models can give negative or exceeding estimated values for probabilities. Probit and logit models (respectively, with the standard normal and logistic transformation functions) are better in this sense because the transformation is monotonic, its output values are limited to zero and one, and tend to be zero and one on the distribution tails. All of the abovementioned is yet another confirmation that no event can be predicted with absolute certainty, even in the cases when probability is zero or one. Comparing logit methods with MDA, Collins and Green argue that, although the former give less error of the 1st kind, in general, their accuracy in terms of classification is not much better (Collins & Green, 1982).

The world-known rating agencies, such as Standard and Poor's, Moody's Investors Service and Fitch Ratings, made a special contribution to the development of the investment attractiveness assessment methods, although in recent years these agencies have lost independence in risk assessments and have become politically biased, especially when it comes to credit ratings' understatement for Russia (in 2014-2015, for example).

As it was noted above, the use of foreign and domestic methods for bankruptcy diagnostics have some drawbacks, in particular, the weight factors used in official methods require adjustments in relation to domestic, regional and sectoral conditions; the existing statistics does not fully reflect the actual situation of successful, average and underperforming enterprises in terms of their dynamics, structure of their equity and borrowed capital, current assets, liquidity etc. The main problem with data here is that it is rather complicated to collect all necessary financial information characterizing the actual financial situation from inside of an organization.

At present, on the one hand, the key problem with bankruptcy forecasting for individual enterprises is the absence of universally recognized effective methods to forecast bankruptcy and solvency of business entities. On the other hand, these techniques are oriented primarily to establish the fact of insolvency when the signs of bankruptcy are already too obvious.

Research Methodology

Due to the fact that there are no universal methods to assess legal entities' solvency, some of the commercial banks have been developing their own regulations, thus, the conclusions from testing results for the same organization may turn out to be very much different when analyzed using different methodologies. In this regard, combination of models for assessing the legal entities' solvency allows entrepreneurs to have more possibilities to obtain a bank loan.

We have set the task to build a number of models for agroindustrial enterprises of Russia, proceeding from the commercial banks' regulations (namely, specialised banks functioning specifically in and for agriculture), primarily OJSC Rosselkhozbank.

Thus, in accordance with the Methodology for the Analysis and Assessment of Financial Condition for Borrowers of the OJSC Rosselkhozbank and taking into account their industry-specific features and organizational and legal forms approved by the Resolution of the Management Board of the OJSC Rosselkhozbank (Protocol # 65 as of 25.11.2004), the following indicators are used as the criteria for assessing the borrowers' financial condition: financial soundness; liquidity (solvency); financial results (profit, loss); cash flow for the term of credit.

As the estimates of the current financial condition, the following three groups of indicators are used:

a) indicators of financial soundness (independence): financial independence ratio; own funds ratio;

b) liquidity indicators: current liquidity ratio; absolute liquid ratio; quick liquidity ratio (or critical evaluation);

c) indicators of business activity: turnover indicators; indicators of cost-efficiency (profitability).

In accordance with this Methodology the ratios are divided into:

- mandatory ratios - financial independence ratio (K1), own funds ratio (K2), current liquidity ratio (K3), quick liquidity ratio (or critical evaluation) (K4), indicators of cost-efficiency (profitability) (K5), turnover of current assets (K6);

- voluntary ratios (used for assessment if necessary) - absolute liquidity ratio, short-term receivables and payables; sufficiency of turnover in the bank.

Financial condition of a borrower is assessed taking into account the score points calculated using mandatory ratios. In accordance with this technique the following condition states can be singled out:

Good financial condition - the number of scored points is equal to or more than 53.

Average financial state - the number of scored points is between 25 to 52 points.

Bad financial condition - the number of scored points is less than 25.

We have set a task to assess the solvency of 408 agroindusrial enterprises of the Omsk region on the basis of their annual accounting reports data for the period of 2003-2005 (369 organisations as of 01.01.2006, and 350 agricultural organizations in 2007). Moreover, the analysis has been carried out according to the natural and economic zones of the Omsk Region: steppe zone (9 districts, 86 organizations), Southern forest-steppe zone (8 districts, 80 organizations), Northern forest-steppe zone (9 districts, 121 organizations) and Northern zone (6 districts, 82 organizations). Regression equations and graphs have been constructed basing on the analysis results.

Authors' Models of Financial Condition Evaluation Aimed to Analyze Borrower's Solvency

At present, the most significant risk for the Russian banking sector is the credit one. Credit risk means the danger that a debtor will not be able to make interest payments or pay the principal amount of a loan in accordance with the terms specified in the loan agreement. Credit risk also means that payments can be delayed or not paid at all, which, in turn, may lead to the problems with cash flow and adversely affect bank's liquidity. Despite numerous innovations already implemented in the financial services' sector, credit risk is still the main cause of banking problems. More than 80% of the banks' balance sheets content is devoted to

this risk management aspect. Taking into consideration some potentially dangerous consequences of credit risk, it is important to conduct a comprehensive analysis of the banks' capacities to assess, administer, monitor, control, implement and repay loans, advances, guarantees and other credit instruments. An overview of credit risk management includes the analysis of banks' policies and practices. This analysis should also determine the adequacy of financial information received from borrower which is by then used by a bank when making the decision to grant a loan.

Regression, logit-regression and discriminant models assessing borrowers' solvency have been built basing on the regulations of commercial banks, mainly, Rosselkhozbank and using the data on 369 agricultural organizations of the Omsk region as our study object. Analysis of the organizations' financial condition, determination of significant factors affecting their solvency level allows credit institutions to determine correctly the lending capacity of a particular organization, and the organization itself, after such an assessment, become more capable to manage these factors so that to increase own opportunity of obtaining a bank loan. This, indirectly, also confirms the practical importance of econometrics and multidimensional statistical research in general.

Rosselkhozbank methodology

Having applied the data substitution method, we have experimentally determined the boundaries of the credit rating classes in points using the 100-point scale along with the Methodology for calculating financial condition indicators for agricultural producers (RF Government Decree # 52, as of January 30, 2003) as the basis: 1st class - 100 to 42,2 points (exclusive); 2nd class - from 42.2 (inclusive) to 26 points (inclusive); 3rd class - below 26 points (Patlasov & Vasina, 2008). Indicators of the annual accounting reports data on all the Omsk region agricultural organizations for 2005-2007 have been used for the modelling here. Six basic coefficients were calculated, applying the Rosselkhozbank method.

Table 1 - Final results of the regression model estimation for
the Omsk region as of 2007
(made by co-authors)

Regression Summary for the Dependent Variable: Var7
R= ,89176679 R^2= ,82689464 Adjusted R^2= ,82036802
F(6,343)=96,052 p<0,0000 Std.Error of estimations: 15,706

	Beta	Std. Err.	B	Std .Err.	t(343)	p-level
Intercept			29,57775	1,384764	21,35942	0,000000
K1	0,685505	0,034189	37,80690	1,885584	20,05050	0,000000
K2	0,061420	0,033320	0,17393	0,094354	1,84336	0,066139
K3	0,233361	0,046195	0,23402	0,046325	5,05165	0,000001
K4	0,012488	0,045083	0,05036	0,181809	0,27700	0,781946
K5	-0,048720	0,033090	-0,23071	0,156694	-1,47237	0,141837
K6	0,036888	0,033157	0,28494	0,256119	1,11251	0,266697

Legend: K1 is the financial independence ratio, K2 - own funds' ratio, K3 - current liquidity ratio, K4 - quick liquidity ratio, K5 – profitability ratio, K6 - turnover of current assets ratio.

From the obtained results it can be concluded that the solvency degree and the factors included in the model are closely related (the correlation ratio is equal to 0, 8917), and that the obtained regression equation is rather significant and cannot be the result of random sampling (the coefficient of determination is 0.82, and the calculated value of the Fisher test is higher than the tabulated value) (Table 1).

According to the analysis results, the following regression equations were obtained (Patlasov-Vasina regression model) (Patlasov & Vasina, 2009).

In 2007: Omsk region:
$B = 29,57 + 37,80K_1 + 0,17K_2 + 0,23K_3 + 0,05K_4 - 0,23K_5 + 0,28K_6$
Steppe zone:
$B = 8,91 + 70,66K_1 + 1,47K_2 + 0,37K_3 - 0,53K_4 - 0,32K_5 + 4,91K_6$.
Southern forest-steppe:
$B = 19,63 + 50,11K_1 + 1,17K_2 + 0,08K_3 + 0,61K_4 + 2,07K_5 - 6,21K_6$.
Northern forest-steppe:
$B = 33,52 + 26,04K_1 + 0,11K_2 + 0,45K_3 - 0,30K_4 - 0,06K_5 - 1,03K_6$.
Northern zone:
$B = 16,71 + 53,77K_1 + 1,83K_2 + 0,28K_3 - 0,36K_4 - 0,02K_5 + 0,19K_6$.

The research thus shows that the assessment can be carried out on the basis of two indicators that have the most significant impact on the financial condition of agricultural producers:
- own funds ratio (K4) with the error probability (p-level) being 0.0000;
- the current liquidity ratio (K3) for which the p-level is also equal to 0.0000.

During the research, the discriminant models assesing borrowers' solvency have been also constructed on the basis of data obtained from Omsk region agricultural enterprises and farms. The Methodology for calculating the indicators of the agricultural producers' financial condition (RF Government Decree # 52, as of January 30, 2003) is also the basis for the discriminant factor model here. This made it possible to classify the research objects into three groups according to their solvency level (financial condition) (see Table 3 for more details).

Table 2 - Discriminant analysis results for the agroindustrial enterprises
of the Omsk region in 2007
(Source: Rosselkhozbank Methodology)

Discriminate Function Analysis Summary
# of vars in model: 6; Grouping: Var9 (3 grps)
Wilks' Lambda: ,37760 approx. F (12,684)=35,760 p<0,0000

	Wilks' Lamda	Partial Lamda	F-remove	p-level	Toler.	1-Toler. (R-Sqr.)
Var1	0,863778	0,437144	220,1754	0,000000	0,972505	0,027495
Var2	0,392288	0,962546	6,6539	0,001462	0,995686	0,004314
Var3	0,378736	0,996989	0,5163	0,597161	0,538042	0,461958
Var4	0,380443	0,992516	1,2894	0,276761	0,543796	0,456204
Var5	0,385852	0,978601	3,7392	0,024750	0,993623	0,006377
Var6	0,384719	0,981484	3,2260	0,040930	0,994793	0,005207

Table3- Initial data for the equations by groups and for the Omsk region as of 2007
(Source: Rosselkhozbank Methodology)

Classification Functions for Var9
Sigma-restricted parameterization

	1	**2**	**3**
Intercept	-4,04859	-3,50311	-1,69006
Var1	8,90478	4,14748	-0,87928
Var2	0,00755	-0,07138	-0,01675
Var3	0,00007	-0,00812	0,00334
Var4	0,06836	0,03775	-0,00420
Var5	0,02896	0,12736	0,06012
Var6	-0,01276	-0,15009	-0,01466

Thus, the system of equations (the discriminant model) is expressed in the following way:

Omsk Region:
$$G_1 = -4,05 + 8,90K_1 + 0,01K_2 + 0,001K_3 + 0,07K_4 + 0,03K_5 - 0,01K_6$$
$$G_2 = -3,50 + 4,15K_1 - 0,07K_2 - 0,01K_3 + 0,04K_4 + 0,13K_5 - 0,15K_6$$
$$G_3 = -1,69 - 0,88K_1 - 0,02K_2 + 0,003K_3 - 0,004K_4 + 0,06K_5 - 0,01K_6$$

Steppe zone:
$$G_1 = -15,66 + 40,82K_1 - 0,39K_2 - 0,19K_3 + 0,54K_4 - 0,19K_5 + 4,94K_6$$
$$G_2 = -7,98 + 24,02K_1 - 0,46K_2 - 0,15K_3 + 0,42K_4 - 0,03K_5 + 4,09K_6$$
$$G_3 = -3,05 + 9,83K_1 - 0,73K_2 - 0,04K_3 + 0,10K_4 - 0,05K_5 - 0,19K_6$$

Southern forest-steppe zone:
$$G_1 = -10,75 + 22,42K_1 + 0,59K_2 + 0,004K_3 - 0,16K_4 + 2,13K_5 - 2,99K_6$$
$$G_2 = -4,80 + 11,04K_1 + 0,18K_2 + 0,001K_3 - 0,12K_4 + 1,31K_5 - 1,36K_6$$
$$G_3 = -2,80 - 1,00K_1 + 0,19K_2 + 0,01K_3 - 0,04K_4 + 1,32K_5 - 0,19K_6$$

Northern forest-steppe zone:
$$G_1 = -2,84 + 4,26K_1 + 0,03K_2 + 0,05K_3 + 0,01K_4 + 0,54K_5 - 0,64K_6$$
$$G_2 = -3,36 + 1,56K_1 - 0,05K_2 + 0,005K_3 + 0,01K_4 + 0,49K_5 - 0,33K_6$$
$$G_3 = -1,72 - 0,81K_1 + 0,01K_2 + 0,01K_3 - 0,02K_4 + 0,46K_5 - 0,25K_6$$

Northern zone:
$$G_1 = -29,26 + 62,70K_1 + 1,64K_2 - 0,10K_3 + 0,22K_4 + 1,99K_5 + 0,06K_6$$
$$G_2 = -11,51 + 21,98K_1 + 0,51K_2 - 0,05K_3 + 0,12K_4 + 0,69K_5 - 0,47K_6$$
$$G_3 = -5,17 + 13,12K_1 - 0,66K_2 - 0,02K_3 + 0,07K_4 + 0,26K_5 + 0,02K_6$$

Table 4 - Statistics of errors for the Omsk region as a whole in 2007
(Source: Rosselkhozbank Methodology)

Statistics for each case of incorrect classifications are marked with *
Analysis sample N = 350

	Observed	1	2	3	Highest	Second	Third
1	1	0,961004	0,035578	0,003419	1	2	3
2	1	0,981859	0,016702	0,001440	1	2	3
3	1	0,972165	0,025803	0,002032	1	2	3
4	1	0,979272	0,018116	0,002612	1	2	3
*5	2	0,532218	0,216568	0,251214	1	3	2
*6	3	0,479990	0,238672	0,281338	1	3	2
7	1	0,962986	0,033553	0,003462	1	2	3
*8	2	0,397159	0,250741	0,352100	1	3	2
*9	2	0,861896	0,103902	0,034202	1	2	3
10	1	0,939756	0,054205	0,006038	1	2	3
	etc.						
348	1	0,706537	0,165445	0,128018	1	2	3
349	3	0,056942	0,138546	0,804511	3	2	1
350	1	0,985607	0,013601	0,000792	1	2	3

Conclusion

Financial condition of any organization is characterized by a system of indicators reflecting the process of financial resources' formation and further use. Financial resources in this case include the aggregate of own money, income, raised and borrowed funds intended for the performance of financial obligations, financing of current costs and expenses associated with activities' expansion. The task of comprehensive analysis of organization's financial condition is not limited by establishing the solvency level according to official methods. It is necessary to conduct in-depth financial diagnostics taking into account sectoral and regional specifics. To determine the direction of indepth analysis, a preliminary express analysis is first conducted. The key advantages of the indicators' system are systemic and integrated approaches, while the major disadvantage is higher degree of decision-making complexity.

In addition to the officially approved methods, there are other methods of analyzing financial and economic activities developed by scientists and practitioners working in consulting, audit, valuation firms, commercial banks, rating agencies and other organizations.

When analyzing company's financial condition, the following groups of financial indicators are distinguished: general indicators, liquidity and solvency analysis, financial stability, business activity, profit and profitability, cash flows and financial activity, business valuation, integral rating analysis. Among the methodological problems in forecasting of potential bankruptcy of organizations the following can be mentioned:

- financial rather than economic analysis is carried out according to a complex methodology (while aggregated factor analysis is not carried out);

- analysis involves mainly Form 1 and Form 2 of accounting reports, other forms with analytical capabilities are disregarded;

- internal analysis is not always corroborated by environmental factors' analysis; financial analysis of economic entities' activities should be preceded by macroeconomic analysis (situation in the national economy, sectoral trends and regional characteristics);

- the problem of adaptation of Western methods for indicators' calculation as per Russian specifics of accounting and reporting persists;

- the difference between Russian accounting system (RAS) and the International Accounting System (IAS) and IFRS is maintained;

- within the framework of our analysis, three following areas of economic activities are not studied thoroughly: operational, investment and financial ones;

- within the framework of such an analysis business and management are not always assessed properly;

- company's investment attractiveness analysis does not actually provide a complete picture of its innovative activities;

- in the absence of standards (recommended values) of financial ratios, the integral indicator of economic activity cannot always be determined;

- analysis of the best and/or the most effective business types is not conducted since benchmarking tool as such is;

- specific features at various stages of bankruptcy (observation, financial recovery, external management, bankruptcy proceedings, settlement agreement) are not taken into account;

- as a rule, sectoral methods are limited to agriculture only, thus, when being applied to trade, for example, these methods do not sufficiently capture the specificity of accounting and/or analysis purposes as such;

- analysis of added value is rarely carried out as such.

As of today, there is still no domestic model developed and available specifically for Russian insurance companies, commercial banks and non-bank credit organizations.

In general, in order to obtain more adequate conclusions about the financial state, it is advisable to apply a set of models in the analysis.

Thus, our research shows that official methods of financial analysis organization have a serious drawback - the basis for conclusions is formed by accounting data only, while the stage of organization's life cycle is not taken into consideration at all, thus, the future state cannot be really predicted as precisely as it is expected. For the aims of financial management it would be important to conduct system analysis, covering all processes in the external environment and the role of the human factor, in addition to organization's financial state assessment. Such comprehensive methods of analysis are indisputably more labor-intensive, but they allow not only increasing the reliability of the results obtained, but also exploring the hidden causes and consequences of all related phenomena. Consequently, this more comprehensive analysis would help raising the efficiency of commercial organizations' crisis management.

References:

Baestaens D-E., Van Den Bergh W., & Wood D. (1997). Neural Network: Solutions for Trading in Financial Markets. Moscow, Russia. Scientific publishing house TVP. (in Russian).

Collins, R. A. and Green, R. D. (1982). Statistical methods for bankruptcy forecasting. *Journal of Economics and Business*, *32*.

Laitinen T., Kankaanpaa M. (1999). Comparative analysis of failure prediction methods: the Finnish case. *The European Accounting Review, 8 (l),*89.

Lennox C. (1999). Identifying Failing Companies: A Re-evaluation of the Logit-, Probit- and DA Approaches. *Journal of Economics and Business, 51,4.*

Ooghe, H., & Balcaen, S. (2002). *Are failure prediction models transferable from one country to another? An empirical study using Belgian financial statements.* Belgium. Ghent University.

Patlasov O.Yu., Vasina N.V. (2008). Models of financial state assessment for the purpose of solvency analysis. *Economics of agricultural and processing enterprises, 12,* 87.

Patlasov O.Yu., Vasina N.V. (2009). Modeling the borrowers (legal entities) solvency. *Audit and financial analysis, 5,* 103.

Patlasov O.Yu., Vasina N.V. (2013). Models for the borrowers (agricultural organizations) solvency assessment. *Finance and Credit, 39,* 18-24.

Patlasov O.Yu., Vasina N.V. (2014). The technique of borrower's solvency analysis and scoring modeling. *Actual Problems of Economics, 10 (160),* 490-503.

Postin K. M., Harmon K.W., Gramlich J.D. (1994). A Test of Financial Ratios as Predictors of Turnaround Versus Failure Among Financially Distressed Firms. *Journal of Applied Business Research, 10*, 298-325.

Voronin V.T. (1994) Time as the space for events (sociophilosophical aspect). *Humanities in Siberia, 1,* 20-25. (in Russian).