

PREDICTING OF BANKRUPTCY AT THE ENTERPRISE:

APPROACHES AND MODELS

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After a wave of economic business failures that followed during all over the world as a result of the global economic crisis, the issues of forecasting are of particular interest among theorists and practitioners. possible bankruptcy of enterprises. The article summarizes the current approaches to solving this problem in the world literature, their advantages and disadvantages are noted, and the developments of domestic economists are analyzed. After a wave of economic failure of the business, followed over the world as a result of a world economic crisis, the particular interest among theorists and experts is caused by questions of predicting of possible failure of the enterprises. In the paper approaches existing at present in the world literature to the decision of the given problem are generalized, their merits and demerits, developments of domestic economists are analyzed.

Keywords: Bankruptcy, insolvency, forecasting model bankruptcy, financial indicator, discriminant analysis, logit model, probit model, decision tree, neural networks, proportional responsibility model.

Over the past 40 years, a significant number of studies have been devoted to issues of predicting the bankruptcy of enterprises. Most they have two functions: predictive (how high is the probability of bankruptcy of enterprises) and diagnostic (complex multi-criteria diagnostics of the current state of the enterprise, with assignment to a certain class). At the very beginning of research on this issue (1932), there were no sufficient statistical data and the necessary hardware. Up until 1980, discriminative analysis remained dominant in models for predicting the potential bankruptcy of enterprises. However, the heterogeneity of enterprises predetermined the need to use non-parametric intellectual data

analysis methods. One of the first authors to address logit models in the study of the problems of the American banking sector were Santomero and Vinso [1] .

After a successful application experience in solving optimization problems in the technical field, genetic algorithms offer a new heuristic modeling algorithm is no longer only biological, but also economic systems. Throughout the 90s of the last century, the use of neural networks in predicting the possible bankruptcy has achieved good results. Among the most used are mathematical models based on artificial neural networks and graph models, known as decision trees. The advantages of graph models, in our opinion, are simplicity development of "if-then" rules, the applied classification does not require a large array of calculations, the ability to use dynamic and categorical (fixed) variables. Most of the research on bankruptcy prediction focuses on finding a single or group of indicators (financial coefficients) that most reliably reflect the financial state of the enterprise. Despite numerous approaches in the context of bankruptcy prediction, no unified theory has become generally accepted. Bankruptcy prediction models mostly focus on three groups of indicators: profitability, monetary flow and leverage (leverage). As shown by the critical analysis, the individual economic relationships used in bankruptcy prediction models are inadequate and sometimes economically impractical. Let's consider some of them: 1) the current liquidity ratio does not make sense, since individual elements of working capital, such as stocks and goods transferred as collateral may be outdated and have no buyers. Debtors, as well as the analyzed enterprise, can become insolvent, especially if they belong to the same industries;

2) the use of "retained earnings" (retien earnings) does not allow obtaining reliable information about the real profitability of the company, and even more so about the degree of replenishment of funds. Building a forecast based on the obtained static value at a certain point in time will also not be economically correct, since in this case, we do not take into account structural changes in the economy and technologies. In addition to the term "ratien earnings" to refer to "retained earnings" in foreign models is also used the term "net income", which introduces certain difficulties when using models in the conditions of Russia; 3) the use of "working capital" in forecasting bankruptcy is not advisable if its negative the value is due to the peculiarities of operating activities. Partially, this problem can be solved if we use not the absolute value of working capital, but as part of relative indicators; 4) to improve the forecast, total assets should be used taking into account their market value, since in accordance with the provisions of

accounting in Russia, property is accounted for in the accounting reporting at residual value, which may be lower or higher market. In both cases, there is a distortion of the indicators. In addition, in connection with the development of alternative sources of attraction fixed production assets (rent, leasing) at present there is a decrease in the property solvency of enterprises; 5) many bankruptcy forecasting models mistakenly "idealize" the concept of "cash flow" (cash flow) as one of the most important indicators in assessing the solvency of an enterprise. Against, it is rather a derivative value, as it depends on the level of net profit, receivables, payment of invoices for cash, as well as the credit policy of the enterprise. Cash flow reflects in this case the company's ability to generate cash, as well as the nature of the relationship with suppliers and buyers, taking into account business practice; 6) models developed using the discriminant analysis and logit/probit models based on statistical data for a specific reporting date, therefore, they do not take into account the possible effect of seasonality and cyclicity; 7) a large proportion of bankruptcy prediction models are based on "popular" financial ratios (ROE, ROA, EBITTA), therefore, enterprise managers often artificially "manage" these popular indicators. Thus, it is advisable to use "non-traditional" financial criteria;

8) Z-score and other bankruptcy prediction models do not take into account factors such as the length of the operating cycle, the volatility of income, the adequacy of cash flow to the operating expenses of the enterprise, the cost structure of the enterprise and the liquidity of various classes assets. This type of model excludes from total assets some material assets and research and development costs, not intended for enterprises engaged in the production of products with a short shelf life, and companies that own hard-to-sell, long-term assets; 9) bankruptcy prediction models do not take into account the effect of anti-crisis measures taken by the debtor's management: reorganization of share capital, negotiations with creditors on debt restructuring and conclusion of a settlement agreement. Mossman, Swartz conducted a comparative study of the rules bankruptcy forecasting based on financial ratios, cash flow and profitability [2,3]. In particular, they were found that none of the rules provides a better prediction, although the use of financial ratios and cash flow is more effective to apply for an interval of 2 years until the moment of bankruptcy. Models for predicting a crisis situation at an enterprise and their probable bankruptcy not only have a fairly long history, but also a wide geography. We adhere to the classification of models predicting bankruptcy on the following grounds: 1) by goals; a) predictive models;

b) comparative models. The comparison is made in three directions: comparison of the results obtained using previously known models, comparison of different accounting methods adopted on the volume or another enterprise, comparison of different models or samples enterprises; c) other models. In particular, here analysts include works, providing a theoretical basis for empirical research methods, a critical comprehensive analysis of existing methodological approaches to predicting the bankruptcy of enterprises, experimental testing of solvency of a wide range enterprises; on the definition of the concept of "bankruptcy". Depending on how each of the authors identifies for themselves, the financial difficulties of the enterprise will vary and their proposed models. A number of authors consider bankruptcy as legal fact, others - as non-fulfillment of monetary obligations and mandatory payments. Altman, for example, identified three facets of this concept: companies experiencing serious problems, temporary difficulties and companies without problems [4]. For the variables used, retrospective analysis showed that for the time that has passed since the appearance of the first two-factor model, it has been transformed into a model with five, six and more variables.

According to the methods used - a single-variant method, when the forecast is based on one factor, and a multi-variant (multivariant, multifactorial) method. Within the framework of this method, we single out the method of multivariate statistics (discriminant analysis) and traditional statistical models used to predict the probability of events by fitting data to a logistic curve (logit model, probit model). Risk management models can also be included in this group, although at the moment they are not widely used. Discriminant analysis is the most widely used by the authors compared to other methods. The assignment of an enterprise to the category of solvent or insolvent is carried out on the basis of a special index - accounts (Z-accounts). However, in the works of recent years, this method is noticeably inferior in relation to others. The logit model considers the probability of an event occurring not as a linear function, like the previous method, but rather as a standard logistic function (Peel, Lo, Chye Koh, Bahnson and Bartley [5,6,7,8]). It should be noted that, in addition to logit model there is a tendency to use multilogit model (Lau, Keasey [9,10]), second degree logit models (Tseng and Lin [11]), and mix-logit models (Hensher, Jones [12]). The probit model, in turn, is used to determine the influence of a quantitative trait to the binary response (Campbell [13]). Statistical models also do not lose their "popularity". random selection (Shumway, Hillegeist, Chava [14,15,16]): c) other methods, statistical:

repetitive divisions in tree graph (Frydman [17]), player crash model (Wilcox [18]), mathematical, disaster theory; Black-Scholes-Merton model (Hillegeist [15]), data encryption algorithm. d) According to the results obtained, first of all, it should be noted that in relation to models for predicting potential bankruptcy There are 2 types of potential misconceptions. The so-called Type I errors, when an insolvent company is classified as not bankrupt - and Type II errors - that is, the classification of solvent companies as bankrupt. Part of this problem is due to the fact that that in the mass of their model they select an equal number of bankrupts and do not bankrupt. In addition, it must be taken into account that the interval analysis is limited to five (three) years before the onset bankruptcy. This does not take into account the liquidation of newly created companies, and there is no collection and analysis of data after bankruptcy. The models that have appeared recently make it possible to give more a broad classification of enterprises beyond the previously used bivariate (bankrupt-not bankrupt), artificial neural networks (Lacher , Chye Koh and Suan Tan , Zhang , Barney [19,7,20,21]); self-regressive models (Theodossiu [22]). Despite its completeness, this is not the only classification bankruptcy prediction models found in the literature. Altman, in turn, divided the models into two groups: for developed countries (Japan, Germany, England, France, Canada, Holland, Spain, Australia, Greece) and developing countries (Argentina, Brazil, India, Ireland, North Korea, Malaysia, Singapore, Finland, Mexico, Uruguay, Turkey). The models of developed countries are characterized by the following features: the doctrine of predicting potential bankruptcies is quite long history; financial data of companies is more accessible; financial hardship is easier to identify due to the presence bankruptcy laws; government intervention, though to a lesser extent, but still present; availability of mechanisms protection to protect investors. In developing countries, usually the above factors are missing. Since its inception, predictive models Bankruptcies are subject to constant analysis and criticism. Before In total, foreign authors note that the models do not take into account the factor seasonality and cyclicity of the economy. However, these two factors can lead to data distortion and erroneous conclusions. In addition, bankruptcy prediction models do not take into account availability of guarantees and guarantees, solvency of debtors, and also the possibility of offsetting and thus avoid formal initiation of insolvency (bankruptcy) proceedings, the possibility of restructuring liabilities, qualitative factors, such as a qualified auditor's report and litigation the question of the legal purity of the transaction on which obligations arose. In our opinion, in order to obtain the most

reliable forecast potential bankruptcy of the enterprise, it is advisable to use not a single model, but a combination of them. In particular, to the same Miller and Kealhofer [23,24] come to the conclusion. Specifics of foreign forecasting models bankruptcy led to the fact that in different periods, individual authors tried to develop an adapted version of the domestic bankruptcy prediction models. Among them, we note the model G.V.Savitskaya (Minsk, 2001), six-factor model by O.P.Zaitseva (Novosibirsk), model A.V. Kolyshkin (St. Petersburg), model S.V. Byk (Orsk), a comprehensive indicator of financial stability enterprises of V.V. Kovalev (St. Petersburg), integral ballroom estimate by L.V. Dontsova and N.A. Nikiforova, model by Irkutskaya state economic academy, Kazansky model State Technological University, model Yu.V. Adamova, model by R.S. Saifulin and G.G. Kadykov, model by A.O. Nedosekin (St. Petersburg), non-formalized criteria of A.I. Kovalev and V.P.Privalova, model A.D.Sheremet, model M.A.Fedotova, model

V.F. Filosofov, A.D. Belikov's four-factor model. Also contributed to the problems of diagnosing insolvency (bankruptcies) of enterprises were introduced by G.P. Gerasimenko, V.I. G.V. Davydova, I.A. Astrakhantseva, L.V. Andreeva, M.I. Bakanov,

I.T.Balabanov, I.G.Kukina, V.I.Makar'eva, E.A.Markaryan. Thus, there is clear progress in the area of building models for predicting potential bankruptcy. If the goal of the initial work was to make a forecast with the maximum accuracy, then in the latter one can clearly see the orientation towards specific industries, new methods are being tested, ongoing development of a theoretical base on the issue of insolvency. On the other hand, recent work do not have the revolutionary character that the works had Altman, Ohlson and others. This can be explained by the fact that most of the works of contemporary authors are more empirical nature, without affecting the theoretical basis of the process bankruptcy.

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