“Estimating the Ukrainian companies’ financial potential and the probability of forced liquidation”

AUTHORS	Volodymyr Nusinov https://orcid.org/0000-0002-9293-2969 Liudmyla Burkova https://orcid.org/0000-0002-2840-5785 Natalia Shura https://orcid.org/0000-0001-6734-0550

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Volodymyr Nusinov, Doctor of Economics, Professor, Department of Accounting, Taxation, Public Governance and Administration, Kryvyi Rih National University, Ukraine.

Liudmyla Burkova, Ph.D. in Economics, Associate professor, Department of Accounting, Taxation, Public Governance and Administration, Kryvyi Rih National University, Ukraine. (Corresponding author)

Natalia Shura, Ph.D. in Economics, Associate Professor, Associate professor, Department of Accounting, Taxation, Public Governance and Administration, Kryvyi Rih National University, Ukraine.

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Volodymyr Nusinov (Ukraine), **Liudmyla Burkova** (Ukraine), **Natalia Shura** (Ukraine)

ESTIMATING THE UKRAINIAN COMPANIES' FINANCIAL POTENTIAL AND THE PROBABILITY OF FORCED LIQUIDATION

Abstract

The development of a global economy is impossible without economic ups and downs, which disrupt economic stability. The growth of the crisis in Ukrainian companies is no exception. In world practice, there are many methods for estimating the possibility of companies' bankruptcy. At the same time, there are no methodological approaches to setting up the possible commencement of company's liquidation during its bankruptcy. The article aims to develop a methodology for estimating the possibility of company's liquidation due to the introduction of its bankruptcy procedure and to determine the financial potential of the company based on the Ukrainian economy. Statistical surveys about the activities of Ukrainian companies were conducted. Using a discriminant analysis, a four-factor model for estimating the possibility of companies' liquidation undergoing bankruptcy was developed. An appropriate scale has been constructed to interpret the values obtained using the collective expert estimation method. The matrix method was applied to construct matrices of pairwise comparison for the results of qualitative assessment.

It has been proposed to assess the liquidation of a company by determining the conditional probability of such liquidation. A matrix of the pairwise comparison of the qualitative assessment results has been constructed for the company's bankruptcy procedure commencement probability and that for the company's liquidation procedure commencement. It has been substantiated that the level of the company's financial potential is the reverse indicator of the probability value for the bankruptcy and the liquidation of that company. Matrices have been constructed that qualitatively assess probabilistic level of the financial potential both for the companies at the bankruptcy stage and for those whose bankruptcy procedure has not yet begun. The results of the testing confirm the correctness of the proposed methods and the expediency of their application.

Keywords company, bankruptcy, conditional probability, affiliated person, economic model, insider assessment, matrix of the comparison

JEL Classification C51, D25, G33

INTRODUCTION

In the world, the economic development of business is accompanied by crisis phenomena, the emergence of which is due both to the historically established socio-economic development of the state and the influence of external macroeconomic factors.

Complex indicators and individual financial coefficients brought to an integral form have become widely used in diagnosing the assessment of the corporate bankruptcy commencement probability. Among them, the best known foreign techniques are two- and five-factor Altman models, Lis model, assessment using Beaver indicators, Taffler predictive model, Fulmer model, and Springate model. Ukrainian re-

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searchers such as Blank, Zaytseva, Kovalyov, Savytska, Sayfullin, Tereshchenko, Sheremet, Ishchenko, Nusinova, and others have also addressed the issues of developing similar models.

Nowadays, due to the situation in Ukraine, more and more companies under the influence of economic and political factors are in crisis, which makes a serious risk for their bankruptcy and diminished level of financial potential. The number of bankrupt companies is constantly increasing, and current models of estimation of possible bankruptcy for their prevention are not suitable for use because they do not take into account the specifics of their activities. At the same time, timely identification of signs of possible bankruptcy allows the management to take urgent measures to improve the financial situation and reduce the risk of company's bankruptcy.

It is better to agree with the scientists who consider the following general reasons for the inappropriateness of using foreign well-known models of enterprise bankruptcy risk assessment: insufficient justification for the use of financial indicators in the models (Zaychenko, Rogoza, & Stolbunov, 2009); absence of development of the Ukrainian stock market (Ponomarenko, 2016; Linder, 2016), using of some models only to large enterprises which quote their shares on the stock exchange (Fuchedzhy, 2010; Sushko, 2014; Linder, 2016), absence of adaptability of models to the specifics of Ukrainian economy (Sushko, 2014; Ponomarenko, 2016; Hlushchuk, 2011; Linder, 2016; Kolyshkin, Gilenko, Dovzhenko, Zhilkin, & Choe, 2014; Fuchedzhy, 2010); difference between the Ukrainian tax and accounting legislation from the standards of foreign countries (Fuchedzhy, 2010; Sushko & Pavliuk, 2014; Ponomarenko, 2016) there are significant differences in the qualitative interpretation of data obtained from different models and even their fundamental opposite (Ponomarenko, 2016; Hlushchuk, 2011), etc.

Outlined aspects are key to any country's economy. That is why the issues of timely prevention and forecasting of possible company's bankruptcy are always urgent, attract close attention among scientists, and lead to discussions.

1. LITERATURE REVIEW

The most accurate is the multivariate discriminant corporate bankruptcy commencement probability assessment, since it simultaneously takes into account the impact of many factors, while statistical tests corroborate their reliability. Still, such methodologies seem to be more suitable for application by external users who do not fully understand the true origin of the indicators employed in such models.

Recently, techniques have emerged, the authors of which rightly point to the presence of a large number of affiliate liabilities in the total amount of debt of a company. The authors agree with that, but provided that the researcher possesses insider information about the creditors regarding their affiliation with the owners of the company being assessed. After all, an insider has access to sensitive information, has internal information about the company's activities at the current time, and can assess the company's status better than any other specialist who uses external information only.

According to Ishchenko (2014) and Nusinova (2011), "current affiliate liabilities are long-term", while Ishchenko (2014) suggests the following classification of them:

1. Absolutely affiliate liabilities, i.e., those that arise for companies that are fully controlled by the owners of the same company (p. 101).

2. Conditionally affiliate liabilities, i.e., those that arise for companies that are only partially controlled by the owners of the same company or there are other owners (p. 101).

According to Ishchenko (2014):

- in the process of assessing the company's financial condition, the liabilities of the second group should be attributed to the current liabilities of the company, while the liabilities of the first group should be classified as the long-term ones (taking into account the share of the owner in the authorized capital of the

company, which should constitute 100%, and the degree of the owner's control over the activities of the company) (p. 101);

- while assessing the corporate bankruptcy commencement probability, both absolutely and conditionally affiliate liabilities should be excluded from the total amount of the company's liabilities (p. 103).

According to Ishchenko (2014), *"owners of the company will not initiate its bankruptcy regardless of the degree of their control over the company and their share in the authorized capital of the company"*.

That classification of affiliate liabilities appears to be noteworthy, as it allows for a proper assessment of the company's financial position; however, it needs some clarification.

Thus, in practice, there are cases where affiliated persons voluntarily renounce the repayment of liabilities owed to them, i.e., they actually donate those liabilities to the respective company. The amount of those liabilities should be excluded from the total liabilities of the company both when assessing the latter's financial position and when assessing the probability of its bankruptcy. On top of that, it is necessary to take into account the maturity of liabilities to affiliated persons and the possibility of the extension of those liabilities' repayment. It is, therefore, advisable to rank the affiliate liabilities by the maturity period, for which they are due. Somewhat controversial is the argument of Ishchenko (2014) and Nusinova (2011) regarding the unlikelihood of the situation where affiliated persons will initiate the company's bankruptcy procedure. It is believed that it is also necessary to take into account the situation where it is advantageous for the company's affiliated persons to initiate that company's bankruptcy procedure. However, in this case, it makes no sense to assess the company's bankruptcy probability because the occurrence of such an event is obvious.

Summarizing the above, the classification of affiliate liabilities proposed by Ishchenko (2014) is considered insufficiently correct and developed based on such criteria as the share of the owner in the authorized capital of the company and the degree of the owner's control over the activities of the company. In addition to those criteria, it is considered appropriate to take into account the economic nature of affiliate liabilities too.

Besides, according to Ishchenko (2014) and Nusinova (2011), *"the owners of the company own affiliated companies directly or indirectly, the repayment of affiliate liabilities leads therefore only to a redistribution of funds failing at the same time to change the overall financial position of such companies"*. It seems logical that affiliated companies' policies need to be taken into account, since in practice, affiliated persons may not require repayments at all, require partial repayments, or require full repayments.

It should be noted that the corporate bankruptcy commencement probability is closely related to the level of the company's financial potential, which is nowadays corroborated by several scientific papers. That being the case, some scholars emphasize the priority of determining the corporate bankruptcy commencement (the severity of the financial crisis) to further determine the level of the company's financial potential (Miroshnichenko, 2017; Leskiv & Semchuk, 2014; Kiriliuk, 2013; Chalenko & Senchenko, 2014; Skrynkovskyi, 2015; Pustovhar, 2015; Lisnichuk & Vynohradova, 2018; Khryniuk & Bova, 2018), while other researchers, on the contrary, point to the importance of taking into account the level of the financial potential of the company when assessing the probability of its bankruptcy (Antonets, 2015; Datsenko, 2018; Rudyk, 2007).

According to Miroshnichenko (2017), "*before deciding whether it is expedient to expand the volume of financing the company's activities at the expense of the sources brought in, it is necessary to determine the probability of the company's bankruptcy, since only in the absence or with the low probability of bankruptcy of the company an increase can be achieved in the level of its financial potential if decisions as mentioned above were to be made. That is, a high probability of the corporate bankruptcy "is a high-risk state of the financial potential of the company and implies a refusal to attract external borrowed resources*" (p. 24).

Leskiv and Semchuk (2014) also emphasize identifying indicators of a bankruptcy risk as part of the assessment of the financial potential (p. 41).

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Antonets (2015), when assessing the rehabilitation feasibility of a company, proposes to determine the level of use of the financial potential that should be calculated based on the forecast of the company's financial performance in the absence of efforts on its financial recovery, which meets the provisions of the concept of the existing company's valuation (p. 120).

Datsenko (2018) uses the assessment and the prediction of a company's ability to counteract the risk of bankruptcy, taking into account the company's internal financial potential (p. 162).

As a separate research area, the issue of the formation of the so-called remedial capacity of the company based on the available financial potential is worth outlining, which is represented in papers of Andrushchenko (2011), Rekova and Andrushchenko (2012), Bahatska (2005), Bilokon (2008). According to Andrushchenko (2011), the company's remedial capacity acts as a criterion for deciding on the further life development of the company taking into account its capacity of the financial potential to overcome the financial crisis.

2. METHODS

Given the above, the following classification of affiliate liabilities is proposed:

I. By repayment probability:

1. Non-returnable affiliate liabilities.

2. Returnable affiliate liabilities.

2.1. Fully returnable affiliate liabilities (with an appropriate discount rate applied to them).

2.2. Partially returnable affiliate liabilities (with an appropriate discount rate applied to them).

II. By repayment deadline:

1. Current affiliate liabilities.

2. Current affiliate liabilities extended to become long-term liabilities.

Given the foregoing, it is considered appropriate, when assessing the corporate bankruptcy commencement probability, to take account of only the portion of the affiliate liabilities that requires repayment. That being the case, the deadlines for repayment of affiliate liabilities can be either put back or forward, which follows from the order of their repayment. On this basis, it is necessary to separate from the current affiliate liabilities the portion that was extended to become long-term liabilities.

If the corporate bankruptcy commencement probability is assessed by employing a function that uses not the full amount of liabilities, but only part of it that characterizes short-term indebtedness (for example, Springate model), then the above portion of affiliate liabilities should not be taken into account.

In general, the financial service of any company is well aware of the "patience level" of its creditors and tries to manage the process of debt repayment. An important indicator here is the turnover period of the company's current liabilities.

It is proposed to have the corporate bankruptcy commencement probability assessed by insiders based on the turnover period of the current liabilities of the company, but without taking into account the liabilities that require repayment to its affiliated persons. To achieve that, the following steps should be taken:

1. The amount of the current liabilities of the company to affiliated persons that requires repayment $\left(CL_{a.p.}\right)$, thousands UAH, is determined:

$$CL_{a.p.} = \frac{CL_{b.p.} + CL_{e.p.}}{2} \cdot \%CL_{a.p.}, \qquad (1)$$

where $CL_{b.p.}$, $CL_{e.p.}$ – amount of the current liabilities of the company at the beginning and end of the reporting period, respectively, thousands UAH, $\%CL_{a.p.}$ – percentage of the current liabilities of the company to affiliated persons that requires repayment (determined based on management's accounting data), thousands UAH.

2. The amount of the current liabilities of the company, without taking into account the li-

abilities to affiliated persons, that demands repayment $\left(CL_{without\,a.p.}\right)$, thousands UAH, is determined:

$$CL_{without\,a.p.} = \frac{CL_{b.p.} + CL_{e.p.}}{2} - CL_{a.p.}. \quad (2)$$

3. The turnover ratio of the current liabilities of the company, without taking into account the liabilities to affiliated persons, that requires repayment $\left(k_{to.r.}\right)$, thousands UAH, is determined:

$$k_{to.r.} = \frac{Net\ income}{CL_{without\ a.p.}}, \quad (3)$$

where $Net\ income$ – net income from the sale of products (goods, work, services), thousands UAH.

4. A turnover period of the company's current liabilities, excluding liabilities to affiliated persons, that require repayment $\left(T_{to.p.}\right)$, thousands UAH, is determined:

$$T_{to.p.} = \frac{12}{k_{to.r}}. \quad (4)$$

A scale has been developed to assess the corporate bankruptcy commencement probability based on the calculated value of the turnover period of the company's current liabilities without taking into account the liabilities to that company' affiliated persons (Table 1). The peer panel review method (Delphi technique) was applied to establish the value intervals of that indicator.

The present study analyzes the data on the activities of the Ukrainian shipbuilding and machine-building companies that are currently at the stage of bankruptcy, but whose liquidation procedure has not begun yet. Using the discriminant analysis, a four-factor model has been developed of their liquidation procedure commencement probability assessment:

$$L = 3.352 \cdot k_1 + 0.0023 \cdot k_2 + \\ +0.0061 \cdot k_3 + 2.5121, \quad (5)$$

where L – integral indicator for the company's liquidation procedure commencement probability assessment, decimal fraction.

The coefficients used in the proposed model are calculated as follows:

$$k_1 = \frac{\begin{matrix} Net\ financial\ result \\ of\ the\ company's\ activities \end{matrix}}{\begin{matrix} Magnitude\ of\ current \\ and\ long\text{-}term\ llabilties \end{matrix}}; \quad (6)$$

$$k_2 = \frac{\begin{matrix} Net\ income\ from\ the\ sale \\ of\ products\ (goods,\ work,\ services) \end{matrix}}{\begin{matrix} Accounts\ receivable \\ for\ products\ (goods,\ work,\ services) \end{matrix}}; \quad (7)$$

$$k_3 = \frac{Asset\ value}{\begin{matrix} Magnitude\ of\ current \\ and\ long\text{-}term\ llabilties \end{matrix}}. \quad (8)$$

A scale has been developed to diagnose the liquidation procedure commencement probability for companies that are at the stage of bankruptcy, viz.:

$L < 1.8$ very high probability of the company's liquidation procedure commencement;

Table 1. Scale to assess the corporate bankruptcy commencement probability based on the calculated value of the turnover period of the company's current liabilities without taking into account the liabilities to that company' affiliated persons that require repayment

Source: Developed by the authors.

Turnover period of the current liabilities of the company without taking into account liabilities to the company' affiliated persons ($T_{to.p.}$)	Corporate bankruptcy commencement probability assessment
3-5 months	Low corporate bankruptcy commencement probability
6-11 months	Medium corporate bankruptcy commencement probability
12-17 months	High corporate bankruptcy commencement probability
18-24 months	Very high corporate bankruptcy commencement probability

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- $1.8 \leq L < 2.2$high probability of the company's liquidation procedure commencement;
- $2.2 \leq L < 2.6$ medium probability of the company's liquidation procedure commencement;
- $L \geq 2.6$ low probability of the company's liquidation procedure commencement.

The peer panel review method (Delphi technique) was used to establish the value intervals on this scale.

It is sometimes necessary to determine not only the bankruptcy procedure commencement probability but also, as a result, the probability of going into a liquidation procedure. Those events are interdependent because it is not possible to begin the company liquidation procedure as a result of that company's bankruptcy without starting the bankruptcy procedure as such. That is, there is the classic case of assessing the conditional probability for the company's liquidation procedure commencement, the value of which is determined using the well-known formula:

$$P\left(\frac{L}{B}\right)=\frac{P(LB)}{P(B)}, \tag{9}$$

where $P\left(\frac{L}{B}\right)$ – conditional probability of the company's liquidation procedure commencement provided that the company is undergoing a bankruptcy procedure, $P(LB)$ – company's liquidation procedure commencement probability, $P(B)$ – corporate bankruptcy commencement probability.

That being the case, the condition $P(B)>0$ must be observed.

Formula (9) is difficult to use in practical calculations, since not all models calculate the quantitative values for the corporate bankruptcy commencement probability and, accordingly, the probability of the company commencing to go into a liquidation procedure. Those models determine instead only the qualitative characteristics of those probabilities (low, medium, high, or very high). It is, therefore, proposed to determine the conditional probability of the company's liquidation procedure commencement using a matrix of the pairwise comparison of the assessment results done for the corporate bankruptcy commencement probability and the company's liquidation procedure commencement probability. That conditional probability is determined according to the methodology proposed (Table 2). That being the case, the conditional probability sought cannot be greater than the corporate bankruptcy commencement probability or the probability of the company commencing to go into a liquidation procedure, calculated separately. That conclusion has been drawn because the conditional probability sought characterizes the product of two probabilities, each of which is less than or equal to one.

Summarizing the scientific literature on the relationship between the probability of bankruptcy (including the probability of liquidation) of a company and its financial potential suggests that this relationship is inverse and based on the assumption that the company is losing some level of its financial potential if the probability of its bankruptcy (including that of its liquidation) increases.

It should be noted that one or another level of the financial potential can have a certain probability for the company expressed similarly to the probability of bankruptcy in a qualitative way (high, medium, low, etc.). Therefore, in this context, one

Table 2. Matrix of the pairwise comparison of the qualitative assessment results for the corporate bankruptcy commencement probability and the company's liquidation procedure commencement probability

Source: Developed by the authors.

Corporate bankruptcy procedure commencement probability	Company's liquidation procedure commencement probability			
	Low	Medium	High	Very high
Low	Low	Low	Low	Low
Medium	Low	Medium	Medium	Medium
High	Low	Medium	High	High
Very high	Low	Medium	High	Very high

talks about the probabilistic nature of the level of the financial potential that, together with the company's bankruptcy (liquidation) commencement probability, constitutes a unit, which can be formulated as follows:

$$P(FP)+P\left(\frac{L}{B}\right)=1, \qquad (10)$$

where $P(L/B)$ – company's bankruptcy and (or) liquidation commencement probability provided that the company is undergoing a bankruptcy procedure, $P(FP)$ – probability of the company's level of the financial potential.

In the context of the relationship between the financial potential and bankruptcy (including liquidation), it is a qualitative assessment of the level of the financial potential that is of interest. That being the case, it is clear that the company that is at the stage of bankruptcy has a low level of the financial potential, while the liquidation of the company indicates a critical level of the latter.

Consequently, it follows from formula (10) that the higher the probability of bankruptcy (liquidation) commencement of a company, the less stock of the financial strength (financial potential) the company has. Accordingly, the probabilistic level of the company's financial potential can be determined as follows:

$$P(FP)=1-P\left(\frac{L}{B}\right)=1-\frac{P(LB)}{P(B)}. \qquad (11)$$

Thus, the probabilistic level of the financial potential is the conditional probability of a stock of the financial strength of the company expressed in terms of a decimal fraction, which probability, all other things being equal, reduces the conditional probability of the bankruptcy (liquidation) commencement of the company in question and determines the degree of its resistance to financial crisis.

Given the established relationship between the probabilistic level of the financial potential and the bankruptcy procedure commencement probability, the following matrix of the pairwise comparison has been proposed (Table 3).

Table 4 shows the respective comparison matrix for the levels of the financial potential and the company's liquidation procedure commencement when the company is at the stage of bankruptcy. Since it follows from the previous matrix that, with a high probability of bankruptcy, the level of the financial potential is already low and the probability of liquidation is possible for high and very high levels of bankruptcy (as noted in the matrix shown in Table 2), then medium, high, and very high levels of the financial potential are not considered at all; instead, a critical level is introduced.

The combination of the matrices proposed enables us to put forward a generalized assessment of the level of the financial potential for the companies that are at the initial stage of the liquidation procedure. Since it is sometimes necessary to determine not only the corporate bankruptcy procedure initiation probability but also, as a result, the probability of the company going into liquidation, it is necessary, when assessing the level of its financial potential, to take into account the company's probability of the conditional liquidation procedure commencement provided that the

Table 3. Matrix of the pairwise comparison of the qualitative assessment results for the probabilistic level of the financial potential and the bankruptcy procedure commencement probability

Source: Developed by the authors.

Corporate bankruptcy commencement probability	Low	Medium	High	Very high
Probabilistic level of the company's financial potential	Very high	High	Medium	Low

Table 4. Matrix of the pairwise comparison of the qualitative assessment results for the probabilistic level of the financial potential and the company's liquidation procedure commencement probability when the company is at the stage of bankruptcy

Source: Developed by the authors.

Company's liquidation procedure commencement probability when the company is at the stage of bankruptcy	Low	Medium	High	Very high
Probabilistic level of the company's financial potential	Low		Critical	

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Table 5. Matrix of the pairwise comparison of the qualitative assessment results for the probabilistic level of the financial potential, the corporate bankruptcy commencement probability and the conditional probability of the liquidation procedure commencement provided that the company is undergoing a bankruptcy procedure

Source: Developed by the authors.

Corporate bankruptcy commencement probability	Conditional probability of the company's liquidation provided that it is undergoing a bankruptcy procedure	Probabilistic level of the company's financial potential
Low	Low	High
Medium	Low	High
	Medium	Medium
High	Low	Medium
	Medium	Low
	High	Low
Very high	Low	Low
	Medium	Low
	High	Critical
	Very high	Critical

company is undergoing a bankruptcy procedure. Then, the pairwise comparison matrix is presented in Table 5.

Enhancing the level of the financial potential of the company is considered the main tool for crisis management.

Consequently, a financial crisis significantly reduces the financial potential of all companies, while at the same time leading many of them to full bankruptcy and liquidation. Accordingly, managing the company's financial potential requires the mandatory consideration of those factors of financial and economic activity that may adversely affect the company's financial condition and increase the probability of its bankruptcy.

3. RESULTS

As exemplified by the ore mining and processing companies based in the city of Kryvyi Rih and Private Joint Stock Company Beryslav Machine-Building Plant, the bankruptcy commencement probability assessment from the insider's viewpoint has been conducted for those companies based on the calculated value of the turnover periods of their current liabilities without taking into account the liabilities to affiliated persons (Table 6). The calculations take into account the fact that for all the companies surveyed, the percentage of the current liabilities to affiliated persons requiring repayment is around 10% of the total current liabilities of the respective company. The only exception is Private Joint Stock Company Ingulets Iron Ore Mining and Processing Plant, for which that value is around 20%.

Besides, as exemplified by the above companies, a bankruptcy commencement probability assessment has also been performed using Altman model.

The results of the comparison of the data regarding the bankruptcy commencement probability assessment conducted for the companies under study by external and internal users of information can be summarized as follows:

1. For the most part, the findings regarding the bankruptcy commencement probability assessment conducted for the companies under study by external and internal users of information and insiders coincide.

2. In several cases, the bankruptcy commencement probability assessment conducted for the companies under study by insiders indicates a higher level of such probability than a similar assessment made by external users of information. That being the case, the insider assessment is more correct.

Drawing on the four-factor model developed, let us analyze the liquidation procedure commencement probability for the Ukrainian shipbuilding and machine-building companies that are cur-

Table 6. Summary of the data regarding the bankruptcy commencement probability assessment conducted for the companies under research by external and internal users

Company name	Year	Corporate bankruptcy commencement probability assessment determined using Altman model	Corporate bankruptcy commencement probability assessment from the insider viewpoint	Change in the results of the corporate bankruptcy commencement probability assessment
Public Joint Stock Company Southern Iron Ore Mining and Processing Plant	2012	Low	Low	–
	2013	Low	Low	–
	2014	Low	Low	–
	2015	Low	Low	–
	2016	Low	Low	–
	2017	Low	Low	–
	2018	Low	Low	–
Private Joint Stock Company Northern Iron Ore Mining and Processing Plant	2012	Medium	Medium	–
	2013	Low	Low	–
	2014	Low	Low	–
	2015	Low	Low	–
	2016	Low	Low	–
	2017	High	Medium	Improvement
	2018	Low	Medium	Deterioration
Private Join Stock Company Ingulets Iron Ore Mining and Processing Plant	2012	Low	Medium	Deterioration
	2013	Low	Medium	Deterioration
	2014	High	Medium	Improvement
	2015	Very high	Very high	–
	2016	Very high	Very high	–
	2017	High	Very high	Deterioration
	2018	High	Very high	Deterioration
Private Joint Stock Company Central Iron Ore Mining and Processing Plant	2012	High	Medium	Improvement
	2013	Low	Low	–
	2014	Low	Low	–
	2015	Low	Low	–
	2016	Medium	Low	Improvement
	2017	Low	Medium	Deterioration
	2018	Low	Medium	Deterioration
Private Joint Stock Company Beryslav Machine-Building Plant	2012	Medium	Low	Improvement
	2013	High	Low	Improvement
	2014	Very high	Low	Improvement
	2015	Very high	Medium	Improvement
	2016	Very high	Low	Improvement
	2017	Very high	Low	Improvement
	2018	High	Low	Improvement

rently at the stage of bankruptcy, but whose liquidation procedure has not yet begun. It should be mentioned that while calculating for operating companies, the latest data was taken into account, which are in the public domain, and for those companies that are in the process of liquidation or at the current time have already been liquidated, the public data of the last year had already been eliminated before the liquidation process began. The results of the calculations done are summarized in Table 7.

It should be noted that the testing results of the four-factor model developed for the company's liquidation procedure commencement probability assessment indicate that this model is correct. This conclusion is confirmed by the fact that PJSC Galeschynsky Machine-Building Plant of Agricultural Machinery Equipment and PJSC Diesel Plant have already stopped their activity today, and other analyzed enterprises are currently in the state of termination. According to Altman's model, the possibility of bankruptcy of PJSC

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Table 7. Liquidation procedure commencement probability assessment for the Ukrainian shipbuilding and machine-building companies that are currently at the stage of bankruptcy, but whose liquidation procedure has not yet begun

Company name	Year	Calculated value of the integral indicator for the under-research company liquidation procedure commencement probability assessment (*L*)	Corporate bankruptcy procedure commencement probability assessment
Public Joint Stock Company Galescha Machine-Building Plant of Agricultural Machinery and Equipment	2012	2.5	Medium
	2013	2.4	Medium
	2014	2.0	High
Public Joint Stock Company Diesel Plant	2012	2.1	High
	2013	1.7	Very high
Public Joint Stock Company Kryvyi Rih Turbine Plant "Konstar"	2012	2.1	High
	2013	2.0	High
	2014	1.3	Very high
	2015	2.0	High
Public Joint Stock Company Black Sea Shipyard	2012	2.5	Medium
	2013	2.5	Medium
	2014	1.8	High
	2015	2.4	Medium
	2016	2.1	High
	2017	2.3	Medium
Public Joint Stock Company Kherson Shipyard	2013	2.3	Medium
	2014	1.6	Very high
	2015	1.6	Very high
	2016	2.2	Medium
Public Joint Stock Company Mykolaiv "Okean" Shipyard	2011	2.2	Medium
	2012	2.4	High
	2013	2.0	High
	2014	1.8	High
	2015	1.6	Very high
	2016	1.5	Very high
	2017	1.3	Very high

Borislav Machine-Building Plant was estimated, according to the developed four-factor model, the possibility of the beginning of liquidation procedure appeared. Taking into account the obtained data, the results of qualitative estimation of possibilities of bankruptcy procedure beginning of the investigated company and the start of liquidation procedure (Table 8).

Consequently, if the corporate bankruptcy commencement probability is diagnosed as medium, high, or very high, then a liquidation procedure

Table 8. Pairwise comparison of the qualitative assessment results for the companies' bankruptcy procedure commencement probability and that for their liquidation procedure commencement

Company name	Years	Corporate bankruptcy commencement probability assessment determined after the E. Altman model	Company liquidation procedure commencement probability assessment determined according to the proposed methodology	Conditional probability of the company liquidation procedure commencement
Private Joint Stock Company Beryslav Machine-Building Plant	2012	Medium	Medium	Medium
	2013	High	Low	Low
	2014	Very high	Very high	Very high
	2015	Very high	Medium	Medium
	2016	Very high	High	High
	2017	Very high	Low	Low
	2018	High	Low	Low

commencement probability also arises for the company in question. That latter probability increases as the severity of the bankruptcy commencement probability established for the company increases.

4. DISCUSSION

Nowadays, there is a large proportion of insolvent companies and companies undergoing bankruptcy or liquidation in various countries around the world. The share of such companies is increasing, and the system of bankruptcy prevention and liquidation, as well as measures to improve the financial condition of such companies, do not always seem effective in practice. That is why there is a need for timely and qualitative estimation of companies' bankruptcy probabilities and their liquidation. In the world practice, foreign techniques were acquired for assessing the probability of companies' bankruptcy (Altman, Forest, Beaver, Taffler, Fulmer, Springate, and other researchers). However, there is a fundamental difference between bankruptcy procedures for Ukrainian and foreign companies.

Therefore, in foreign countries, the bankruptcy procedure of their companies, their shares are completely depreciated, which harms the interests of their owners. And in the first stage of the bankruptcy procedure of Ukrainian companies, that is, at the stage of disposal of property, with the shares of such companies, as a rule, no changes occur, and they continue to operate in their usual mode of operation. Therefore, for owners of foreign companies, the bankruptcy procedure is inherently similar to the procedure of liquidation of Ukrainian companies.

By way of continuation of the corporate bankruptcy commencement probability assessment, Nusinov (2016) presents a universal model developed to determine: 1) the absence or the presence of a financial crisis at the company and the corresponding severity of that crisis; 2) the probability of the company going into a bankruptcy procedure and also the probability of the company's liquidation (p. 87).

At the same time, when testing the model as exemplified by several Ukrainian companies, a conclusion was drawn that it was more expedient to develop two separate models: a model for the company's bankruptcy procedure initiation and, accordingly, a one for the company that is at the stage of bankruptcy starting to go into a liquidation procedure. The point is that going into the liquidation stage is possible for those companies only that are at the stage of bankruptcy.

CONCLUSION

It is determined that bankruptcy in Ukraine is quite common today. According to the Supreme Economic Court of Ukraine, 377 bankruptcy cases were stated in 2018, and 356 in 2019.

According to statistics, from July 1, 2018 to July 1, 2019, the number of state public joint stock companies has decreased by 17.9% as a result of their liquidation (up to 1,548 units); foreign companies – by 2% (up to 634 units), credit unions – by 0.7% (up to 1,068 units).

In general, bankruptcy procedure for Ukrainian companies does not always end in liquidation. This research considered the value of existing models for estimating possible bankruptcy for Ukrainian companies. The necessity of applying two separate models is proved: the probability of introduction of company's bankruptcy procedure and, therefore, the transition of companies in bankruptcy to the stage of liquidation procedure. Companies that are not in bankruptcy are advised to estimate the probability of their liquidation. It is defined that the level of financial potential of the company is the opposite magnitude index of the probability of bankruptcy and liquidation of such a company. Taking into account the abovementioned, appropriate techniques are proposed.

On the example of Ukrainian companies, the developed methods were tested: 1) estimation of the company's bankruptcy possibility by the investors, 2) estimation of the companies' liquidation probability

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(which are in the bankruptcy procedure), 3) conditional probability of liquidation of the companies that are not in the bankruptcy procedure. The results these techniques' approbation confirmed their correctness.

The limitation of this research is assessing only the possibility of bankruptcy and liquidation of a company. If a high possibility of bankruptcy or liquidation of a company is determined, then no further action is taken by top managers. It is assumed that this limitation can be addressed by answering the question: "To save or not to save the company?" The decision involves the development of appropriate strategic and tactical measures.

AUTHOR CONTRIBUTIONS

Conceptualization: Liudmyla Burkova, Natalya Shura, Volodymyr Nusinov.
Data curation: Liudmyla Burkova, Natalya Shura.
Formal analysis: Liudmyla Burkova.
Investigation: Liudmyla Burkova.
Methodology: Liudmyla Burkova, Natalya Shura, Volodymyr Nusinov.
Project administration: Liudmyla Burkova.
Supervision: Volodymyr Nusinov.
Validation: Liudmyla Burkova, Natalya Shura, Volodymyr Nusinov.
Visualization: Liudmyla Burkova, Natalya Shura.
Writing – original draft: Liudmyla Burkova, Natalya Shura.
Writing – review & editing: Liudmyla Burkova, Natalya Shura, Volodymyr Nusinov.

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