

Development of a Mechanism for Preventing Bankruptcy of Enterprises at the Regional and National Level

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The paper develops a mechanism for preventing bankruptcy of enterprises at the regional level, which allows management to make managerial decisions on time that will effectively assess the threat of bankruptcy and anticipate it in advance. The developed research mechanism includes 3 main stages: formation of the feature space; enterprise's bankruptcy probability assessment; forecasting the state of the enterprise.

One proved that every year most Ukrainian enterprises have insignificant incomes and receive huge losses, as a result an unemployment is growing in the country. Quarantine restrictions related to the COVID-19 pandemics have made a significant negative contribution to the activities of both domestic and foreign enterprises.

The object of the study was an international tobacco company whose activities goes in the Kharkiv region. Thus, the analysis of the financial condition showed that the enterprise investigated is not yet in danger of bankruptcy, since it is in a stable financial condition. In addition, the company has high indicators of liquidity and solvency. That is why the paper proposes to consider the mechanism for preventing bankruptcy of enterprises on the example of an international tobacco company.

Thus, as a result of the development of the bankruptcy prevention mechanism, it became possible to form the basis of models that will be adapted to domestic enterprises, which will allow identifying the threat of bankruptcy and preventing bankruptcy at an early stage, thereby increasing the number of financially healthy enterprises and economic growth in the regions.

Keywords: bankruptcy, prevention, modeling, mechanism, region.

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Introduction. Market relations in the Ukrainian economy are accompanied by a payments crisis, the emergence of mutual debt of business entities, the accumulation of debts, which requires state regulation and management of the debt repayment process, stabilization of settlement and payment discipline, provided if the economic entity is preserved as an economically functioning unit in the economic mechanism of the country.

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Characteristic signs of the financial crisis of the enterprise are a reduction in demand for its products and, as a result, a decrease in production volumes; an increase in debt to suppliers, the state budget and banks; delays in the payment of wages to employees. The number of such enterprises in the Ukrainian economy is steadily growing. Bankruptcy as an element of market relations has become a reality of the Ukrainian economy.

The problem of bankruptcy threatens many enterprises in Ukraine. In the first quarter of the year 2020, there were 40.8% unprofitable enterprises in Ukraine. A significant decline in income and huge losses are associated, among other things, with the COVID – 19 pandemics. Kharkiv region is one of the leaders in Ukraine in terms of the number of unprofitable enterprises.

So, it is important for every manager, both at the regional and state levels, to prevent the bankruptcy of enterprises by developing mechanisms for effective management of the institution of bankruptcy and the economy as a whole in conditions of full economic independence of economic entities.

Analysis of recent research and publications. Many scientists, both international and domestic, investigated the topic of the bankruptcy of an enterprise at various levels of management. Among them are the following: E. Altman, U. Astakhov, M. Bellender, U. Beaver, S. Vargich, V. Vasilenko, A. Hagen, O. Glushchenko, L. Guryanova, O. Zaitseva, M. Kizim, B. Kuzin, T. Klebanova, R. Sayfulin, O. Tereshchenko, A. Chernyavsky and others.

However, some issues related to the development of a mechanism that includes a set of economic and mathematical methods for preventing bankruptcy remain insufficiently studied and require detailed research.

The purpose of the paper is to develop a mechanism for preventing bankruptcy of an enterprise based on a set of economic and mathematical models, which makes it possible to make decisions on time that will effectively assess the threat of bankruptcy and provide an opportunity to anticipate it.

Research results. Bankruptcy of a business object is associated with the deterioration of its financial activity and is caused by numerous losses. Taking into account the data from the State Statistics Service of Ukraine, in the period from 2014 to 2019, the number of enterprises that received losses significantly increased. That is, if in 2014 approximately 39% of all enterprises received losses, then in 2019 this figure increased to 45%.

The financial result before taxation of large and medium-sized enterprises in 2020 decreased by 1.7 times, to 264.4 billion UAH. It is also worth noting that the share of unprofitable enterprises in 2020 was 29.2%, while in the previous year – 19.5% [2]. In 2019, in the context of the COVID – 19 pandemics and restrictions, the Ukrainian economy shrank by 4%. More than a half of the total decline in GDP is due to a decline in transport and logistics by 16.4% and in agriculture – by 11.5%. This resulted in GDP losses of 1.09% and 1.03%, respectively [2].

The hotel and restaurant sector suffered the most – its gross value added in 2020 decreased by 28.5%. But given the relatively small share in the structure of GDP, the contribution of this industry to the negative dynamics of GDP was limited to a quarter of a percent.

Table 1 shows the loss before taxation of enterprises by region for 2014–2019 [2].

The results of the analysis shown in Table 1 showed that in the year 2019, the top three regions in terms of unprofitability were Dnipropetrovsk region – unprofitability at the level of 20,9%, Donetsk region – 17,6% and Kharkiv and Zaporizhia regions, where unprofitability is at the level of 7%.

The emergence of a threat of bankruptcy of a business entity can be caused by a number of reasons, which consideration is very important when managing such an entity, especially at the

stage of arbitration proceedings, when the future fate of the debtor is being decided – the appointment of liquidation or rehabilitation procedures.

Table 1

Standard values of indicators, thousand UAH

Region	2014	2015	2016	2017	2018	2019
Vynnytsia region	6509525	5511511	2896177	2750069	2591320	2402596
Volyn region	9105094	7165666	3863336	3124206	2055223	4711711
Dnipropetrovsk region	85150952	80446445	42788990	30874504	51315589	34465974
Donetsk region	56318988	71329464	29093128	45652244	22886544	29022918
Zhytomyr region	4793059	4235647	2290710	3188462	2592254	2822303
Transcarpathian region	3393004	3594422	1362465	2471343	1919866	1922762
Zaporizhzhya region	19888396	20771920	8671747	4879188	6175128	12054558
Ivano-Frankivsk region	11279942	10691941	6642198	4811338	3066674	5221559
Kyiv region	39996696	39712745	17260467	13321215	26272579	8809193
Kirovohrad region	7712152	14602385	1663506	5954464	2364430	1808047
Luhansk region	48475986	54581061	28906129	29606065	4462439	2143859
Lviv region	15968593	16564540	9198089	9084577	9372783	13368375
Mykolaiv region	12889470	10703424	9217835	4478831	2549959	2851622
Odessa region	37180105	31829912	19121758	12920184	6421236	7772159
Poltava region	13677791	18345190	9054662	7900853	11646014	6823949
Rivne region	10243001	9157713	3253860	2638718	2380406	1186594
Sumy region	4874358	4439266	2433944	3157832	4701738	2208460
Ternopil region	9299040	7729435	3556136	9270986	4744850	3629471
Kharkiv region	18246801	21549433	14743601	10663996	11198944	10648192
Kherson region	5077125	3855822	2773903	1620250	1506415	1647575
Khmelnitskyi region	8338466	8698117	3721977	7542788	2395096	2807216
Cherkasy region	10660074	7980053	4009886	3084198	2147914	2513245
Chernivtsi region	1787991	1037257	688677,8	1879671	1097538	1420002
Chernihiv region	4933567	4717755	4421677	1581028	3681416	2909325

The causal relationship between the occurrence of bankruptcy of economic entities has insufficient scientific development, which means that it is a problematic area in the management of such entities. The lack of a clear and scientifically based classification of the causes of bankruptcy prevents their tracking, accumulation and elimination, which does not contribute to reducing the number of bankruptcy cases considered in Ukraine, overcoming the payment crisis and stabilizing the economy of regions and the country as a whole [1, 4].

Thus, it is necessary to distinguish six main features that characterize the crisis financial condition of an enterprise (Fig. 1).

However, the most important external feature for bankruptcy management should be considered the suspension of current payments of the debtor on its obligations, since it is the delay in payment that determines the right of creditors to open arbitration proceedings in the debtor's bankruptcy case.

The essence of bankruptcy, the establishment of its differences from insolvency, as well as criteria and signs indicate that bankruptcy can be managed through an assessment of the state of enterprises, establishing control over the appearance of signs of bankruptcy in a business entity [6].

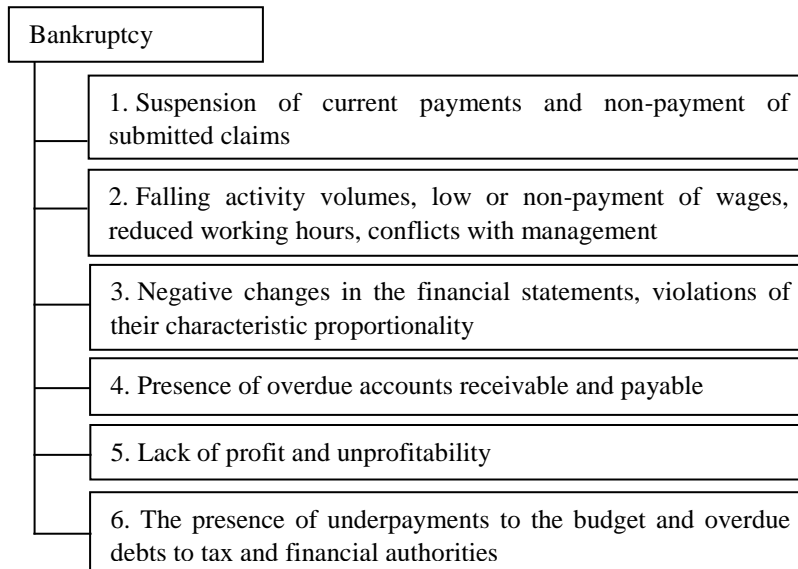


Figure 1. External signs of bankruptcy of an enterprise

Currently, there are a large number of methods and models that allow to determine and assess the possibility of the threat of bankruptcy at enterprises. However, most of the domestic and foreign methods that are generally accepted for determining bankruptcy by Ukrainian enterprises have a number of disadvantages, especially due to the selection of indicators that are the main criteria for determining bankruptcy. These disadvantages include the following [3, 5]:

- selective approach to the system of indicators formation, which are subjective;
- lack of indicators in the proposed systems that characterize the efficiency of resource use, efficiency of functioning;
- limited information support for calculating certain criteria of weighting coefficients related to predicting the probability of bankruptcy;
- inaccurate, unjustified certainty of thresholds for certain criteria derived from financial reporting indicators;
- there is no focus of most existing models on the specifics of industries and the specifics of the activities of the relevant enterprises;
- problems related to access to information, its truthfulness and objectivity.

The disadvantages and main problems of modern methods and models for assessing the threat of bankruptcy of an enterprise indicate that it is necessary to develop a set of models that will accurately determine the risk of bankruptcy of an enterprise and present measures aimed at stabilizing its financial condition or maintaining the current state. Therefore, it was decided to develop a mechanism for preventing bankruptcy of enterprises, the algorithm of which is shown in Fig. 2.

Let us take a closer look at the algorithm. The first stage presents the preparation process for building a model. It is the basis that will ensure the construction of the model and its functioning, so it is extremely important to form it correctly and efficiently. The initial data space is formed, on the basis of which the model will be built. As initial data, indicators of the financial condition

of the enterprise are considered, which comprehensively characterize its activities (from indicators of property status to liquidity) [10-11].

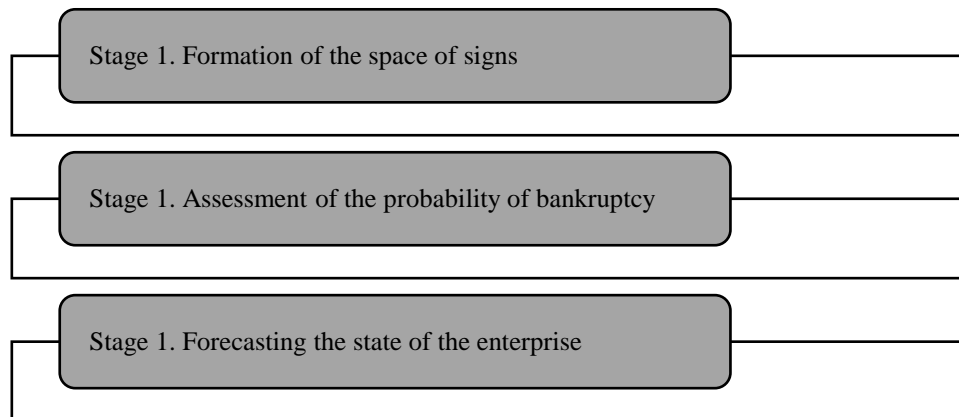


Figure 2. Algorithm for constructing a mechanism for preventing bankruptcy of enterprises

The second stage presents the process of building a model for assessing the threat of bankruptcy of an enterprise. As a model, it was decided to use a fuzzy neural network, which, along with other methods and models, has a number of advantages over them. In comparison with traditional technologies, neural networks have the following advantages [3, 5]:

- universality – neural networks do not depend on the original data set; they are not demanding on their specific distribution or type of objective function;
- simplicity – to use neural networks, one does not need to delve into the details of the internal mechanisms of their operation, unlike classical statistical methods;
- no dimension problem, since networks are able to model dependencies even with very large amounts of source data;
- the speed of the neural network is much faster than traditional models.

At the third stage, the initial indicators are predicted to determine the threat of bankruptcy of the enterprise in the future periods. For this purpose, various time series forecasting models will be used, among which the best ones will be selected according to the minimum absolute error criterion.

The object of research is the enterprise with foreign investments "Kharkiv Regional Representative Office "Imperial Tobacco Ukraine", whose activities run in the Kharkiv region [7]. On the basis of its financial statements, an analysis of its financial condition will be carried out.

Imperial Tobacco (officially Imperial Tobacco Group PLC) is an international tobacco company headquartered in Bristol, United Kingdom. It is the fourth largest cigarette company in the world (after Philip Morris International, British American Tobacco and Japan Tobacco). It is also the world's largest producer of cigars, thinly sliced tobacco and tobacco products. The company produces more than 320 billion cigarettes a year, has 51 factories worldwide and its products are sold in more than 160 countries around the world. Its brands are Davidoff, West, Gauloises Blondes, Montecristo, Drum (the second largest selling thinly sliced tobacco in the world) and Rizla (popular tissue paper). During the period of operation in the Ukrainian market,

the company invested about 150 million US dollars in the development, this made it possible to build a modern, high-tech factory on the basis of the Kiev Tobacco Factory [7].

The total number of employees is 1,100 people, the Kharkiv branch employs about 100 people. Today, in terms of its technical condition, equipment and working conditions, "Imperial Tobacco Ukraine" is one of the best enterprises in the industry not only in the countries of the former USSR, but also in Eastern Europe.

Thus, the analysis of indicators of the financial condition (liquidity, financial stability, profitability, business activity and property status assessment) of the Enterprise showed that it is not in danger of bankruptcy and the enterprise is in a stable financial condition. In addition, the company has high indicators of liquidity and solvency.

Therefore, it is at this enterprise to be proposed to consider the mechanism for preventing bankruptcy of enterprises.

To build a fuzzy neural network, the MatLab program was chosen, namely its Fuzzy Logic Toolbox package, which is used for designing and studying systems based on fuzzy logic [3,5, 8-9]. The constructed fuzzy neural network has the structure shown in Fig. 3.

Probability of bankruptcy assessment of the Enterprise PSII "Kharkiv Regional Representative Office "Imperial Tobacco Ukraine" showed that it is not in danger of bankruptcy, and it has a margin of financial stability. However, for a complete picture, it is necessary to make an assessment of the risk of insolvency in subsequent periods. To do this, one needs to predict the company's indicators that will be used in the neural network to assess bankruptcy.

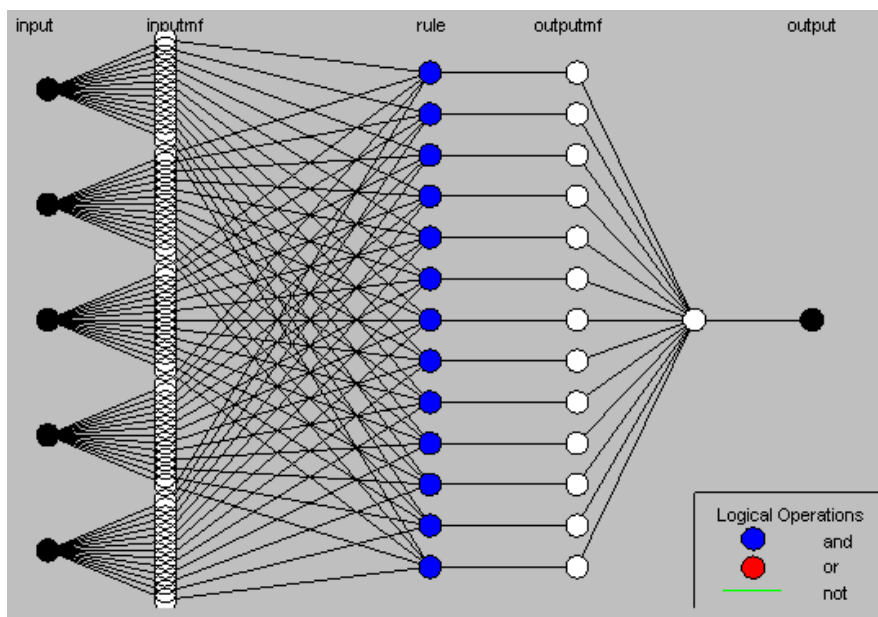


Figure 3. Structure of a fuzzy neural network

These indicators include the rapid liquidity ratio, the share of production assets in working capital, the transformation ratio, return on equity, and the financial independence ratio. The initial data are presented in Table. 2.

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The forecast was made on the basis of exponential smoothing of time series using Brown, Holt, exponential and damped trend models.

So, exponential smoothing models were constructed to predict indicators that will be used to assess the threat of bankruptcy of the studied enterprise in the forecast period. The results are presented in Table. 4.

Table 2

Initial data for forecasting

Year /quarter	Rapid liquidity ratio	Share of production assets	Transformation ratio	Return on equity	Financial independence ratio
2017 1 qtr.	8,6521	0,6421	3,6984	0,3284	0,8765
2017 2 qtr.	9,0325	0,6398	3,7591	0,3314	0,8917
2017 3 qtr.	9,5214	0,6573	3,8547	0,3376	0,9192
2017 4 qtr.	9,8139	0,6776	3,8940	0,3393	0,9286
2018 1 qtr.	9,7452	0,6082	3,6882	0,3391	0,9299
2018 2 qtr.	9,9541	0,6432	3,6957	0,3408	0,9315
2018 3 qtr.	10,0125	0,6519	3,7158	0,3418	0,9337
2018 4 qtr.	10,6071	0,6647	3,7307	0,3434	0,9345
2019 1 qtr.	12,5621	0,6341	3,7314	0,3434	0,9331
2019 2 qtr.	12,7421	0,6034	3,7964	0,3456	0,9446
2019 3 qtr.	12,7854	0,6157	3,8278	0,3456	0,9452
2019 4 qtr.	12,8335	0,6011	3,8413	0,3458	0,9455

Table 4

Results of forecasting indicators

Year /quarter	Rapid liquidity ratio	Share of production assets	Transformation ratio	Return on equity	Financial independence ratio
2021 1 qtr.	13,16889	0,621365	3,773856	0,350495	0,966795
2021 2 qtr.	13,54068	0,619361	3,773856	0,352180	0,973556

As a result of forecasting, we have obtained forecast indicators that can be used for a threat of bankruptcy assessment in the forecast period.

Using the already built fuzzy neural network, we will assess the threat of bankruptcy of the Enterprise "Kharkiv Regional Representative Office "Imperial Tobacco Ukraine". The results of the forecast for the second quarter of 2021 are shown in Fig.4.

Based on the figure, one can conclude that the company in the second quarter of the year 2021 is not threatened with bankruptcy in the forecasted period, and it has a sufficient level of financial stability margin.

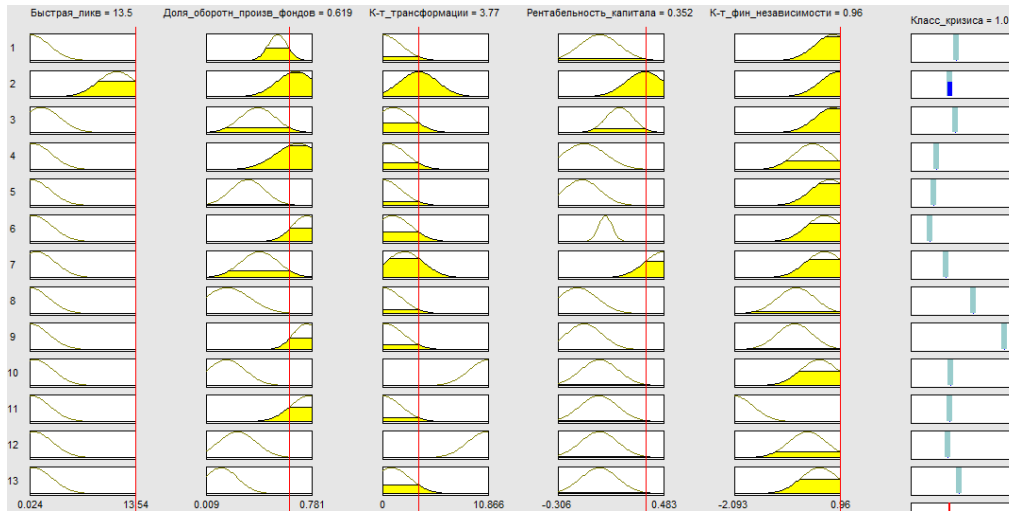


Figure 4. Results of the bankruptcy threat assessment

However, the stable financial condition of the enterprise does not mean that it does not need anti-crisis management. After all, it is aimed at preventing crisis situations, even if they are not observed at the enterprise.

Conclusions and prospects for further scientific developments. Thus, as a result of the development of the bankruptcy prevention mechanism, it will be possible to form the basis of models that will work very well with domestic enterprises, determine the threats of bankruptcy for them, which will prevent bankruptcy at an early stage, thereby increasing the number of financially healthy enterprises and economic growth of the regions. Also, the proposed mechanism will make it possible to choose the financial strategy of the enterprise, which will be aimed at the effective operation of the financial management system, with the help of which it is possible to ensure the solution of such strategic tasks as profit optimization, net asset value growth, capital structure optimization.

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У статті розроблено механізм попередження банкрутства підприємств на регіональному рівні, що дає можливість керівництву вчасно прийняти управлінські рішення, які будуть ефективно оцінювати загрозу банкрутства та завчасно її передбачати. Розроблений механізм дослідження, включає в себе 3 основні етапи: формування простору ознак; оцінка ймовірності банкрутства підприємства; прогнозування стану підприємства.

Доведено, що з кожним роком більшість українських підприємств мають незначні доходи та отримують величезні збитки, внаслідок чого в країні зростає безробіття. Вагомий негативний внесок в діяльність як вітчизняних, так і зарубіжних підприємств внесли карантинні обмеження, пов'язані з пандемією COVID – 19.

Об'єктом дослідження була міжнародна тютюнова компанія, діяльність якої зосереджена в Харківському регіоні. Так, проведений аналіз фінансового стану показав, що дослідженому підприємству, наразі, не загрожує банкрутство оскільки воно знаходиться в стабільному фінансовому стані. Крім того, підприємство має високі показники ліквідності та платоспроможності. Саме тому в роботі запропоновано розглянути механізм попередження банкрутства підприємств на прикладі міжнародної тютюнової компанії.

Таким чином, в результаті розробки механізму попередження банкрутства стало можливим сформулювати базис моделей, які будуть адаптовані під вітчизняні підприємства, що дасть змогу визначати загрозу банкрутства та запобігати банкрутству на ранніх стадіях, тим самим збільшуючи кількість фінансово здорових підприємств і економічне зростання регіонів.

Ключові слова: банкрутство, попередження, моделювання, механізм, регіон

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