

DIAGNOSTICS OF CRISIS SITUATIONS IN THE MANAGEMENT OF FINANCIAL SECURITY: AN EXAMPLE OF FOOD INDUSTRY ENTERPRISES

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Received 25.02.2023.

| Send to review 07.03.2023.

| Accepted 29.04.2023.

Original Article



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JEL Classification:

C13, C19, D81, G30, G32

Doi: 10.61432/CPNE0101217Z

UDK: 005.334:339.564]:641.1

ABSTRACT

Food industry enterprises play an important role in the economy. They provide the population with food, create jobs, and make a significant contribution to the production of the gross domestic product. However, competition and an unstable market situation lead to crisis situations. Therefore, for the financial security of the enterprise, it is necessary to determine and analyze the probability of bankruptcy in advance and diagnose the reasons for its occurrence. The methods of discriminant analysis and economic and statistical forecasting create opportunities for determining the probability of the occurrence of crisis phenomena. The purpose of the study is to compare approaches and methods of forecasting the probability of crisis phenomena and to determine the factors that cause them. The article, based on the example of a leading Ukrainian company in the food industry, provides the results of the application of various models for determining the probability of bankruptcy by Beaver, E. Altman, Tafler, K. Springate, and domestic models. Thus, the study confirms the possibility and expediency of using the above-mentioned models to predict the probability of bankruptcy of enterprises. The key factors that affect the company's activity and can be the causes of crisis situations are identified. The implementation of forecasting models in management activities makes it possible to predict the onset of crisis phenomena and generate measures to prevent bankruptcy and ensure financial security in competitive conditions of instability and uncertainty of the market environment.

Keywords: *analysis, management, crisis phenomena, bankruptcy, discriminant analysis, model, forecasting, financial security*

1. INTRODUCTION

A characteristic feature of the modern world is the significant influence of external factors on the financial and economic activity of economic entities, which are often caused by force majeure circumstances. Moreover, these are not only economic factors, namely demographic, social, political and medical characteristics (pandemic, military aggression, global competition), which play an equally important role, the negative impact of which causes the emergence of crisis phenomena both for the economy and for the economy in general and for individual economic units. This affects the financial and economic activity and leads to insolvency, lack of working capital, i.e. it causes the bankruptcy of the enterprise, which negatively affects the financial security of the business entity. In such conditions of chronic uncertainty, the issues of forecasting, prevention and countermeasures against crisis phenomena are becoming more and more relevant. There is a need to implement methods and models of anti-crisis management into practical activity, which can be used to analyze and assess the probability of bankruptcy. Early forecasting of crisis phenomena makes it possible to apply a set of measures to prevent bankruptcy, which will ensure financial security.

Therefore, the relevance of early determination of the probability of bankruptcy and the analysis of factors affecting these processes is beyond doubt. At the same time, it is important to use a complex of methods and tools for diagnosing the causes and factors that lead to the emergence and deepening of crisis phenomena, and their complex application creates opportunities for preventive activities in order to ensure the financial security of economic entities.

2. LITERATURE REVIEW

The etymology of the term “crisis” is of Greek origin and means a sharp break, a severe transitional state, the extreme point of a fall, acute lack, discrepancy. The crisis is a phase of the cycle of economic development that repeats itself, that is, it is the end of the previous periodic cycle and the beginning of the next one (Schumpeter J., 1978). The reason for the emergence of crisis phenomena in Ukraine is the lack of a reliable system of economic security, which would contribute to the creation of a self-sufficient, competitive, socially oriented economy and would ensure its protection from external and internal destructive influences (Yakubenko Yu. L., Sirko A. Yu., 2021). That is, there is a direct dependence of the impact of crisis phenomena on financial and economic security.

During the study, we will take into account that a crisis is an unpredictable, unexpected situation that threatens the organization's priority goals with limited time for decision-making. A state of crisis as a set of crisis phenomena is critical and can lead to the liquidation of the enterprise. Crisis phenomena are a small number of unstable crisis manifestations that occur synchronously with each other in different directions of the enterprise's activity or a certain phenomenon that occurs during the implementation of a specific process of the functioning of economic entities (Yakubenko Yu., Sirko A., 2021). However, crisis phenomena caused by difficult economic and military conditions are not a traditional crisis that enterprises often face. After all, during a war, institutions, phenomena, systems, mechanisms change and adapt to wartime. The anti-crisis management mechanism of the enterprise is no exception. Vatchenko, B., Sharanov, R. (2022) defined the differences between a traditional crisis and a wartime crisis at an enterprise.

Crisis phenomena lead to the inability of a business entity to fulfill its financial obligations to ensure current production activities, that is, to a financial crisis, which is a phase of unbalanced activity of the enterprise and limited opportunities for its management to influence financial relations (Shvets Yu., 2017). In practical activity, the crisis is identified with insolvency, lack of profit and potential for effective functioning, that is, with bankruptcy.

The Code of Ukraine on Bankruptcy Procedures defines bankruptcy as the inability of the debtor to restore his solvency through the rehabilitation and restructuring procedure and to repay the monetary claims of creditors established in accordance with the procedure specified by this Code, other than through the application of the liquidation procedure (Code of Ukraine on Bankruptcy Procedures, 2022).

Bankruptcy is a court-determined financial inability of an enterprise to meet its obligations to creditors and the budget on time (Lohmann, C., Möllenhoff, S., 2023). Being bankrupt, the company cannot meet the demands set by creditors and obligations to the budget in the required time, which is caused by the problem of insufficient assets in liquid form (Blank I., 2006). In addition, catastrophic risks of the enterprise are realized in the process of its financial activities, as a result of which it is not able to satisfy the demands put forward by creditors and fulfill its obligations to the budget within the established terms (Lyashenko O., 2015). Avci, P., Sümerli Sarıgül, S. (2023) explain bankruptcy as a situation that occurs when a business cannot obtain sufficient value to cover the costs of doing business.

Bankruptcy of enterprises is a consequence of the financial crisis and a threat to financial security, which requires the implementation of a system of measures by the state aimed at ensuring the recovery and stabilization of the development of the economic system (Keynes J., 1998.). The specific management function of preventing and overcoming crisis phenomena, the process of preparing anti-crisis actions involves the structure of the management apparatus, powers, duties of employees, qualified and professional management personnel, which monitors the identification of signs of crisis (Khalilov, E., 2023). It should be a constantly active process of identifying signs of crisis phe-

nomena and implementing a general plan to prevent the spread of crisis phenomena and stagnation of the enterprise's development, which is carried out throughout the entire period of its operation" (Blank I., 2006).

The consequences of crisis phenomena are the difficulties and troubles of financial and economic activity, which are studied and highlighted in the scientific literature as financial failure, economic failure, technical failure, negative capital and bankruptcy (Demirkhan, H., Sayilgan, G., 2021). Biver W. (1966) defined financial distress as the company's inability to pay interest on debt. Altman, E. (1968), Deakin, E. (1972), Ohlson, J. (1980) and Zmijewski, M. (1984) in their analysis considered the bankruptcy status of the company. Blum, M. (1974) defined financial distress as a company's failure to pay debts. Taffler, R. (1983) examined the stage at which creditors approach the court under the insolvency criterion.

A paradigm shift in the classic legal definition of bankruptcy has expanded the definition of financial insolvency to include economic, technical insolvency and bankruptcy (Rashmi Soni, 2019).

The application of methods for diagnosing the financial condition in order to determine the threat of bankruptcy of the enterprise involves the identification of solvency, the level of insolvency and the type of bankruptcy situation. Methodological recommendations define that "solvency (liquidity) is one of the main qualitative indicators of the enterprise's activity, which determines the enterprise's ability to make payments, settle debts in the required amount and within the specified period with its available funds or those that are continuously replenished at its expense activity, insolvency is the inability of a business entity to fulfill its monetary obligations to creditors, including wages, as well as to fulfill its obligations to pay insurance premiums for mandatory state pension insurance, taxes and fees (mandatory payments) no other way than through the restoration of solvency". The Code defines "insolvency - the debtor's inability to fulfill his monetary obligations to creditors after the set deadline has come, no other way than through the application of the procedures provided for by this Code".

Luchko, M., Zhukevich, S. and Farion, A. (2016), investigating the issue of financial analysis in the management of enterprises, highlight one of its tasks of determining the probability of bankruptcy, arguing that bankruptcy is the inability of an enterprise to pay its debt obligations and fulfill obligations to the budget. The authors distinguish the following types of bankruptcy: voluntary, forced, hidden, intentional and fictitious. Bankruptcy can be generated by external (exogenous) factors that do not depend on the activity of the enterprise, and internal (endogenous) factors that depend on the enterprise. According to financiers, one-third of bankruptcies in developed countries are due to external factors, and two-thirds are due to internal factors. The main external factors of enterprise bankruptcy are: macroeconomic and political instability; downturn in the economy; decrease in the purchasing power of the population; significant level of inflation; instability of economic and tax legislation; strengthening intra-industry competition; crisis of a separate industry; seasonal fluctuations; strengthening of monopoly in the market; discrimination of the enterprise by authorities and management; deterioration of the criminogenic situation, etc. It is also possible to single out a large number of internal factors of bankruptcy: ineffectiveness of operational, investment and financial activities; low quality of management; low level of personnel qualification; shortages in supply; low level of marketing; lack of innovation and rationalization; underdevelopment of financial controlling, etc. There is a connection between the factors, so you cannot concentrate on one of them, even a very important one, you should consider both internal and external factors and their interaction.

Taking into account the relevance and necessity of the development of theoretical foundations and the applied application of methods for determining the probability of bankruptcy, taking into account domestic conditions and factors, the authors examine both foreign approaches and the work of Ukrainian scientists in determining the probability of bankruptcy (Zhukevich, S. and Zhuk, N., 2023).

In particular, an attempt was made to apply the methods of determining the probability of bankruptcy to food industry enterprises. Considering the fact that the food industry is multi-sectoral and covers about 40 industries, while researching diagnostic methods for determining the probability of bankruptcy, the authors selected enterprises of the confectionery industry, which include

enterprises of various organizational and legal forms of business and differ in the size of business activities - large, medium, small. In this study, foreign and domestic models for determining the probability of bankruptcy of small enterprises in the confectionery branch of the food industry were used (Zhukevich, S. and Zhuk, N., 2023). At the same time, the possibility of applying the method of diagnosing the probability of bankruptcy for medium and large enterprises and corporations with the determination of their impact on financial security in modern business conditions is unresolved and quite relevant.

Therefore, the study of the main approaches to the analysis of the probability of the occurrence of crisis phenomena leading to bankruptcy in modern economic conditions is a necessary element of determining their impact on the level of financial security of food industry enterprises and determines the relevance of highlighting these issues.

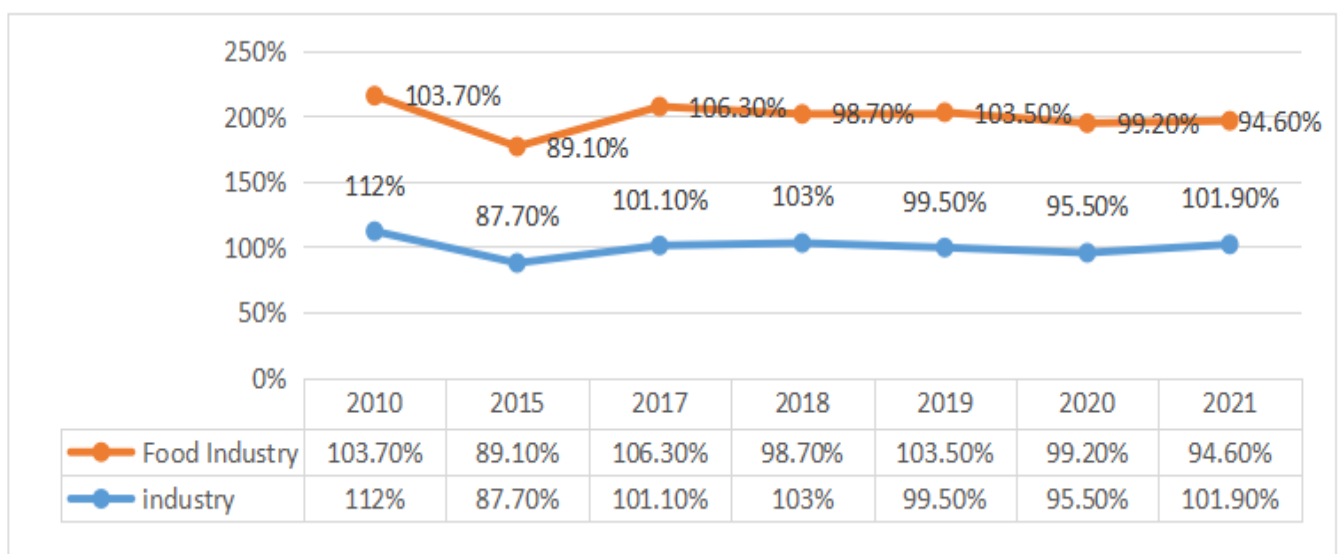
3. AIM OF THE RESEARCH

The purpose of the study is to diagnose the probability of the onset of crisis situations that lead to bankruptcy and affect the level of financial security of enterprises in the confectionery branch of the food industry. At the same time, apply foreign and domestic models and methods of determining the probability of bankruptcy and evaluate the effectiveness of these models for domestic enterprises.

4. METHODS

Over the past ten years, the food industry has become one of the top three sectors in which about 18% of the country's population works, taking a leading position in the economy of Ukraine. Thus, in 2021, the Ukrainian industry showed growth by 1.9% - 101.9% compared to 2019, although in 2021 the indicators of the food industry compared to 2019 were - 94.60%, which indicates a decrease in the index by 5.4% of the previous period (Figure 1).

Figure 1. Indices of industrial production by types of activity (percentages compared to the previous year).
for 2010-2021

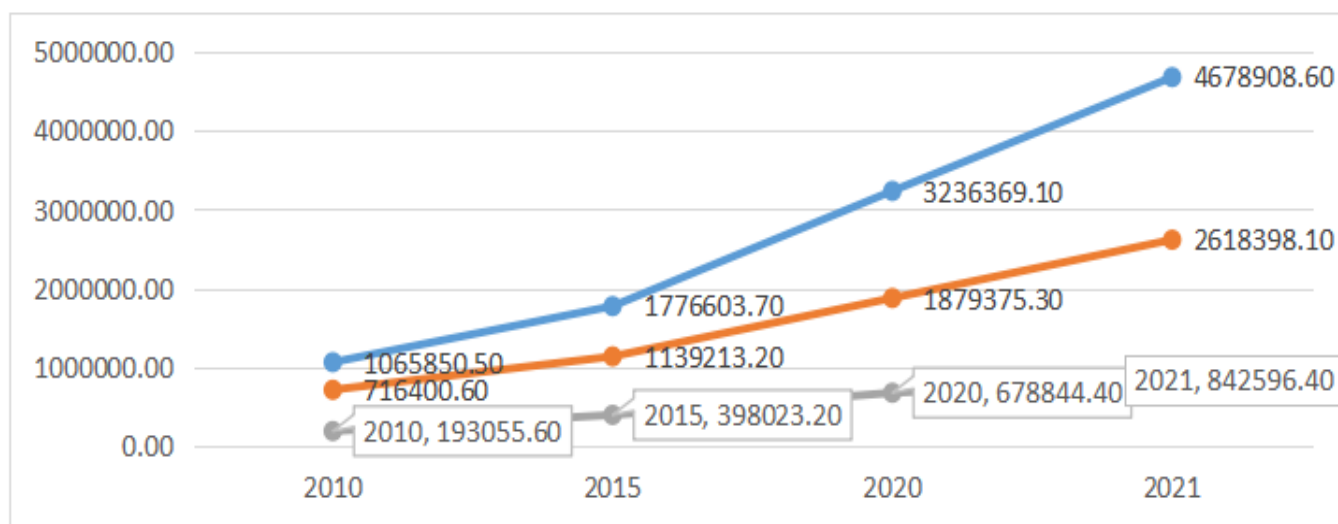


Source: compiled by the authors based on official statistical data

The food industry provides the population with food products – 5.5% of the total volume of sold products and 16.8% of industrial production, creates a large number of jobs – 4.1% of those employed in the economy, 16.7% of those employed in industry and 23.7% of the employed in the processing industry, makes a significant contribution to the production of the gross domestic product and attracts foreign capital to the country (Angel, E. 2022).

Despite the conditions of the systemic crisis, there is an increase in the volume of industrial production and sales in general and the food industry in particular (Figure 2).

Figure 2. Dynamics of the volume of industrial products sold, mln.hrn

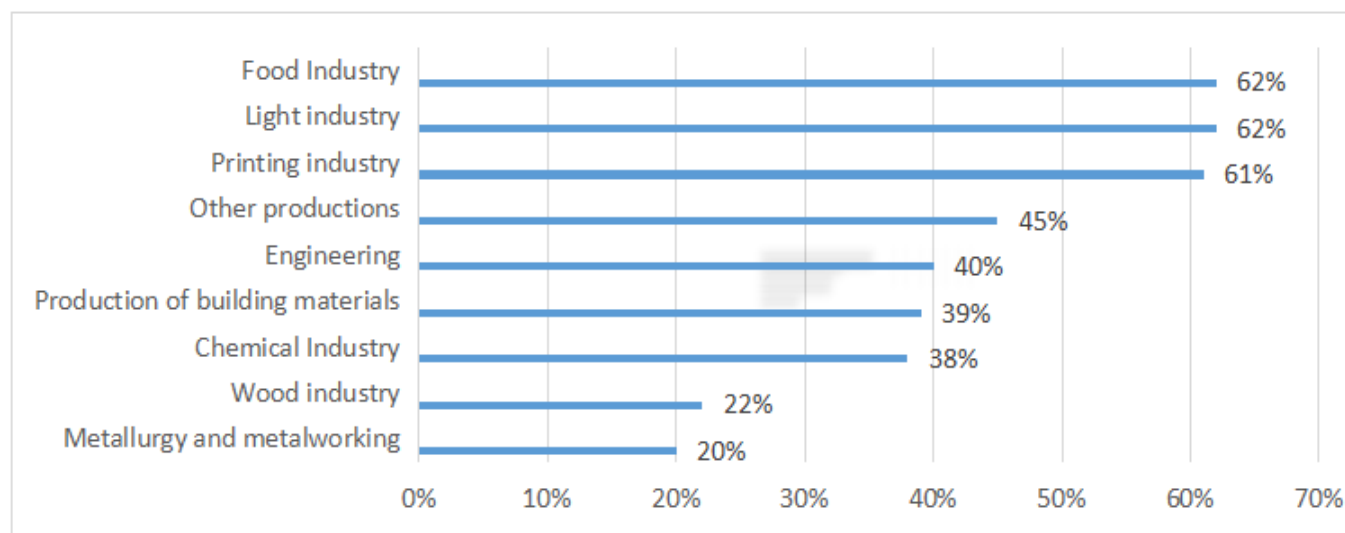


Source: compiled by the authors based on official statistical data

During the full-scale military invasion, Ukraine's economy naturally suffered numerous destructions and losses. According to the experts of the Institute of Economic Research and Political Consultations, the result of the war was a drop in industry by 42.6% while the GDP decreased by 31% (Angel, E. 2022).

However, the food industry shows relative stability against the background of other types of activity. In general, as of September, 62% of food industry enterprises were working at almost full (75–99%) or full and greater capacity compared to the pre-war period (Figure 3). This is partly due to the fact that industries that provide the basic needs of the population are in daily demand both inside and outside the country.

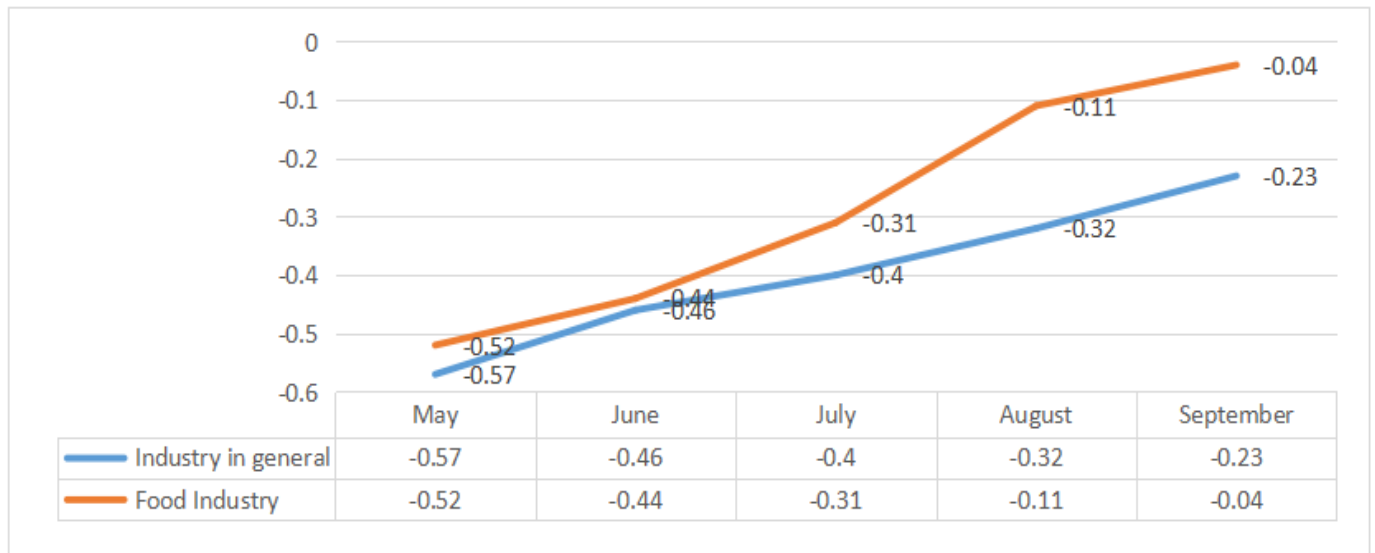
Figure 3. Share of industrial enterprises operating at almost full capacity (75-99%, 100%) as of September 2022



Source: constructed by the authors based on the results of official data

The food industry best maintains its powerful potential by supporting the economy in times of war. In the food industry, optimistic assessments of the business environment and the financial and economic situation at enterprises appear compared to other industries (Figure 4).

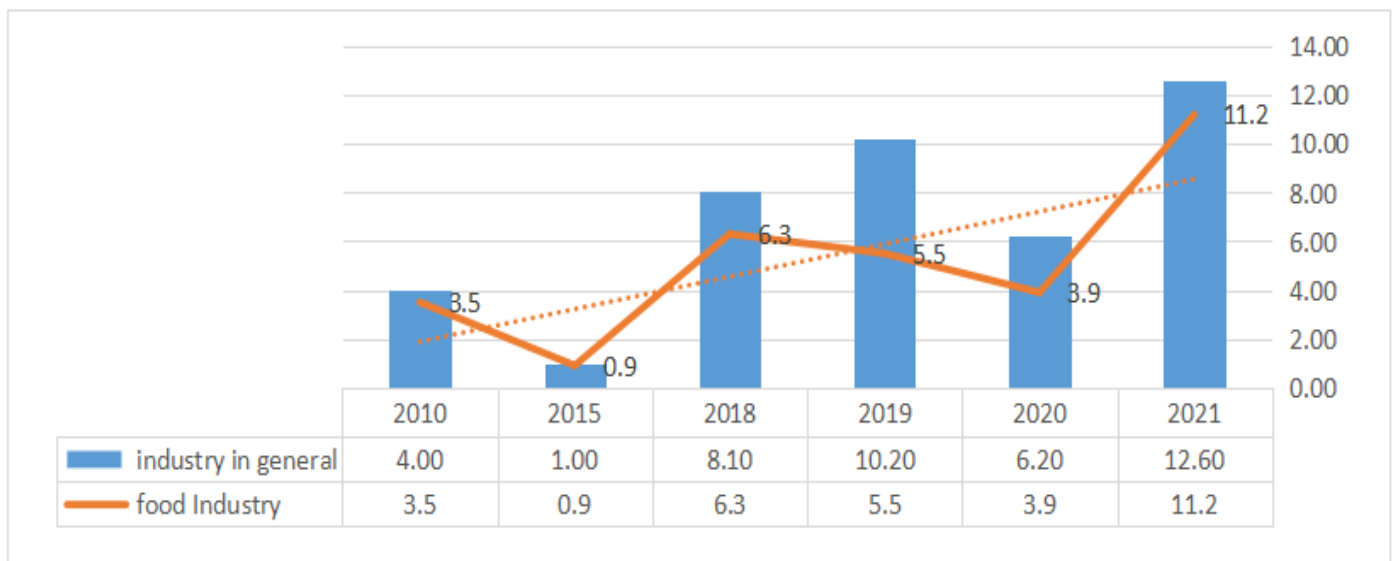
Figure 4. Indices of the general economic environment, 2022



Source: constructed by the authors based on the results of official data

The industry has a high investment attractiveness due to a shorter investment payback period (two to three years) compared to basic industries and a fairly high level of profitability, which especially increased in 2021 (Figure 5) and is an important factor in conditions of economic instability.

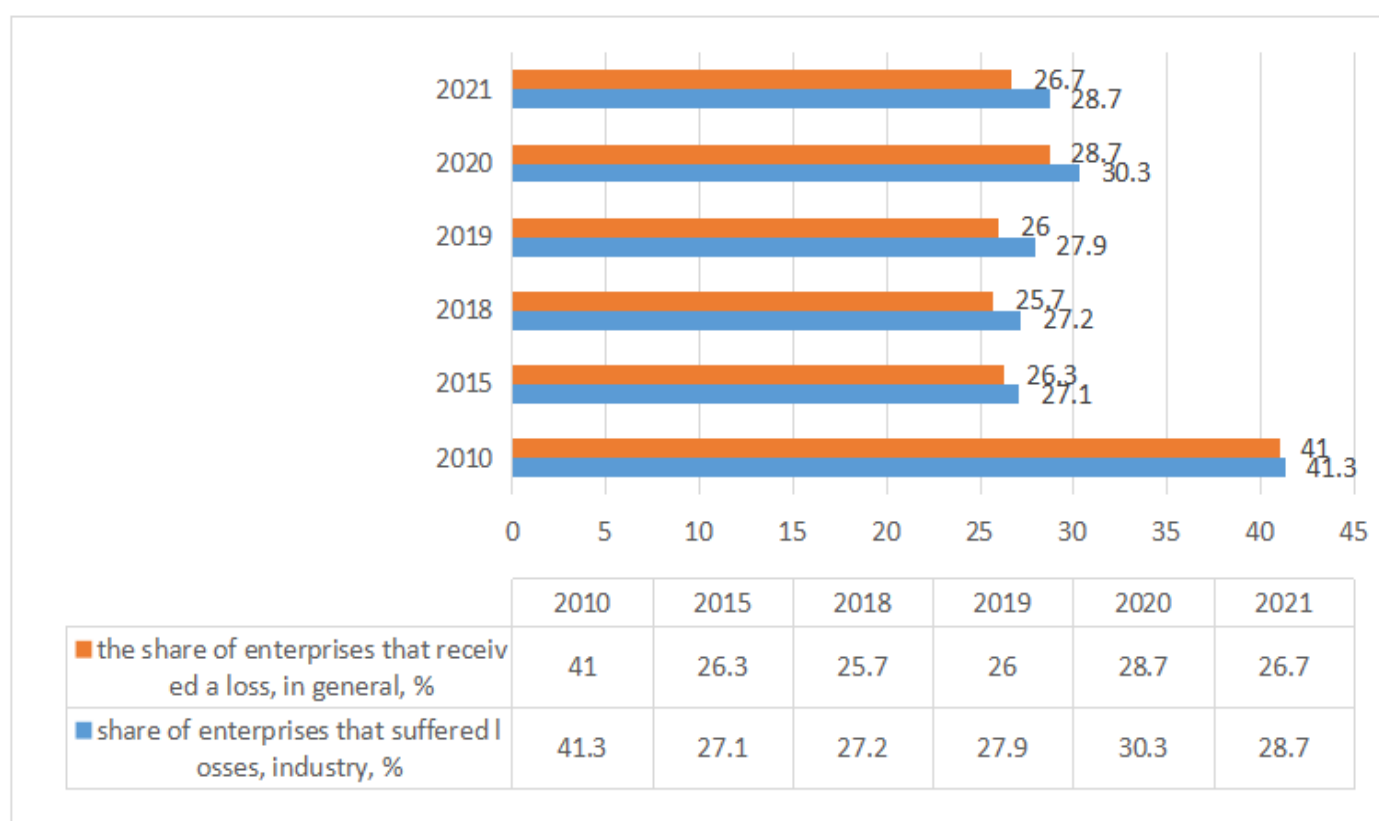
Figure 5. Profitability of operating activities for 2010-2021



Source: constructed by the authors based on the results of official data

Therefore, despite the received profits, which are growing significantly in the industry, the share of unprofitable enterprises is 28.7%, which is a rather significant indicator and once again proves the necessity and relevance of the issues of financial security of the food industry in general and of individual economic entities in the crisis conditions of the Ukrainian economy (Figure 6).

Figure 6. Share of unprofitable enterprises for 2010-2021



Source: constructed by the authors based on the results of official data

It should be noted that the food industry is a priority and strategically important component of the economy of Ukraine, which provides the needs of the world and domestic markets. The food industry covers more than 20 industries (40 industries), the specifics of which affect the efficiency of financial and economic activity and, accordingly, the determination of the probability of crisis phenomena and the onset of bankruptcy. For research, we chose the confectionery branch of the food industry. One of the tasks of managing enterprises in the confectionery branch of the food industry is forecasting the onset of crisis phenomena and preventing bankruptcy.

In order to timely warn of the insolvency of the enterprise, it is necessary to systematically analyze its activities using methods that make it possible to predict the onset of bankruptcy. All models of assessing and forecasting the probability of bankruptcy of enterprises can be divided into the following groups: expert methods; methods of assessing financial status; economic and mathematical methods; artificial intelligent systems (Shvets, Yu.O., 2017). The most common methods and models used in bankruptcy are logistic regression (LOGIT) and neural network (Bayhan, A., 2023). Manurung, A., Suhartono D., Hutahayan B., Halimawan, N. (2022) review the bankruptcy probability study using a support vector regression model and show good performance as it has the highest coefficient of determination compared to previous studies.

Lohmann, C., Möllenhoff, S. (2023) use generalized additive models to identify and analyze nonlinear relationships between accounting-based and market-based independent variables. Such consideration of nonlinear relationships significantly improves several measures of statistical reliability and increases the discriminatory power of bankruptcy prediction models.

Juškaitė, G. (2023) investigate methods for detecting intentional bankruptcies after examining financial statement fraud and its effect on the probability of bankruptcy. The study evaluated trends in the Altman Z'-Score model and applied binary logistic regression analysis to a sample of intentional and unintentional bankruptcies. Regression analysis created a model for intentional bankruptcies and identified the following metrics: net income/assets, liabilities/assets, liabilities/equity, and Altman's Z'-score. The authors proposed an independent t-test that shows the differences in the mean values of financial indicators between intentional and unintentional bankruptcies.

Papík, M., Papíková, L., (2022) investigated that the analysis of the impact of the crisis on the effectiveness of bankruptcy forecasting models. the performance of forecasting models was significantly weaker during crisis periods than the performance during non-crisis periods

Methodological recommendations suggest determining the probability of bankruptcy by calculating financial indicators that analyze all aspects of the enterprise's activity, especially financial using methods of financial analysis - horizontal, vertical, absolute differences, structural.

However, the complication of the financial and economic activity of enterprises by factors of the external environment and internal environment, and, accordingly, the emergence and functioning of economic formations on the market, which are determined by the organizational and legal form, size of the enterprise, branch affiliation, create the need to take into account the specifics of the activity in the algorithm for determining the financial condition, solvency and probability of bankruptcy.

Berest, M., Bobro, M., (2021) propose an approach to the diagnosis of crisis phenomena at the enterprise using the method of taxonomic analysis based on the construction of partial and total integral indicators of the level of crisis development. A system of indicators for assessing crisis phenomena has been formed, which is the result of a comparative analysis of models for assessing the probability of bankruptcy of enterprises. There are 3 groups of analytical coefficients for assessing the development of the crisis: indicators of the capital structure of the enterprise, indicators of the efficiency of the use of enterprise resources, and indicators of the structure of the formation and financing of assets.

Currently, the use of static models based on discriminant analysis, which involves estimating the ratio of financial coefficients when constructing a discriminant function using mathematical and statistical procedures and calculating the integral index Z, has gained considerable popularity. Note that the analysis with the calculation of the integral index has significant accuracy in predicting the bankruptcy of the subject management (86%), therefore it is most often used and makes it possible to develop directions and take measures for its prevention or improvement of anti-crisis, security-oriented management.

The most widespread are economic and mathematical methods of predicting the probability of bankruptcy, namely discriminant analysis, which includes Beaver's W. (1966) coefficient, two-factor, five-factor, adapted models of Altman, E. (1968, 1977, 2012), models of Lees, R., Tuffler J. (1983), Springate H. (1978), Tereshchenko O. (2008), Matviychuk A. (2006).

Thus, Green D. (1978) used the analysis of financial statements using ratio analysis as a method of testing the financial condition of reporting companies. The American scientist Beaver W. (1966). investigated that the analysis of financial indicators is able to predict the results of the firm's activities.

The Z-score formula was first developed in the 1960s by Edward Altman, a professor at New York University, who proposed it as a solution to the time-consuming and somewhat confusing process investors had to go through to determine how close a company was to bankruptcy. It gave investors an idea of the company's overall financial condition. This model is also called the multiple discriminant analysis (MDA) model. In the first study, he used 66 firms, half of which were bankrupt. After comparing bankrupt and non-bankrupt organizations, the researcher selected only five coefficients for predicting bankruptcy from a large number. The result showed 95% accuracy one year before and 72% two years before the crisis.

Over the years, Altman continued to improve the Z-score. From 1969 to 1975, Altman analyzed 86 companies in distress. From 1976 to 1995, he monitored 110 companies. Finally, from 1997 to 1999, he evaluated another 120 companies. From his findings, it was found that the Z-score had an accuracy of 82% to 94%. In 2012, Altman proposed an updated version of Z-score – Altman Z-score Plus, which can be used to evaluate public and private, manufacturing and non-manufacturing companies, as well as US and non-US companies (Kenton, W., 2022). It should be noted that Collins R. (1980) using many different models to assess bankruptcy in his research, recognized Altman's Z-score as one of the best models. Our research using the above-mentioned foreign and domestic models to determine the probability of bankruptcy of small private enterprises in the confectionery branch of the food industry allowed us to agree with this (Zhukevich, S. and Zhuk, N., 2023).

Therefore, in the proposed study, we will use the above-mentioned models for a large enterprise, namely Roshen confectionery corporation, which is a representative of the large business of the food industry of Ukraine.

5. RESEARCH RESULTS AND APPLICATION OF MODELS FOR DETERMINING THE PROBABILITY OF BANKRUPTCY

Current, critical and supercritical types of solvency are distinguished, which are the primary sign of the probability of a crisis situation and a threat to financial security. The main information base for determining indicators is financial and accounting reporting.

We note that the current solvency (PP) of food industry enterprises arises in the presence of overdue payables and is defined as the difference between the amount of cash equivalents, other highly liquid assets and current liabilities.

If the value of the indicator $PP \leq 0$, then this is a sign of current insolvency.

If there are signs of current insolvency, and the coefficients of self-funding (Kzvoz) and coverage (Kp) are less than their normative values - 1.0 and 0.1, then these are characteristic features of critical insolvency (formula 1).

$$PP < 0, Kp < 1,0, Kzvoz < 0,1 \quad (1)$$

Such inequality characterizes a financial state with a high probability of bankruptcy.

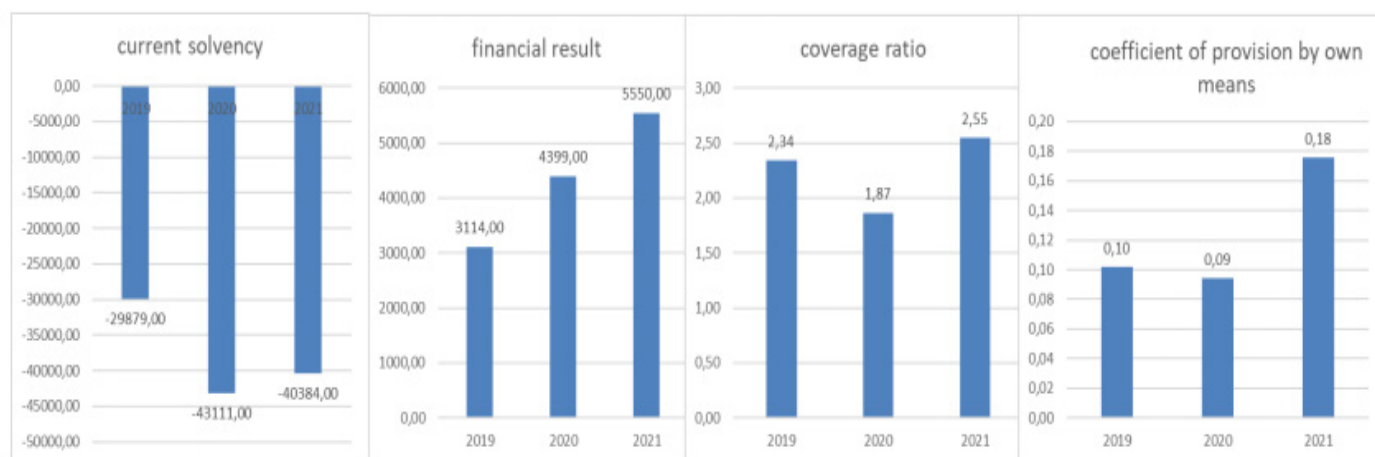
Supercritical insolvency is diagnosed by the presence of the following signs:

$$Kp < 0, FR < 0 \quad (2)$$

where FR is the financial result.

Figure 7 shows the dynamics of the necessary indicators for assessing solvency as a sign of financial condition and a criterion for the probability of bankruptcy of the food industry enterprise Roshen Confectionery Corporation for 2019-2021.

Figure 7. Dynamics of individual financial indicators of Roshen Confectionery Corporation for 2019-2021



Source: constructed by the authors based on the results of official website of Roshen confectionery corporation

The results of the calculations make it possible to conclude that the current solvency is less than zero, which is a sign of insolvency. The growth of the financial result during the researched period is positive. The indicators of the coverage ratio and the ratio of providing with own funds are within the normative values.

To test the models for analyzing the probability of a crisis (bankruptcy), we use data from the financial statements of the Roshen confectionery corporation's food industry enterprise: Balance Sheet (Report on Financial Status) and "Report on Financial Results (Report on Total Income). Reporting is an information base for assessing the company's financial condition and diagnosing the level of financial security.

The Methodological Recommendations define the structure of the balance sheet and the probability of detecting bankruptcy by conducting a systematic express analysis of the company's financial condition using the Beaver W. ratio, which is the ratio of the difference between net profit and depreciation to liabilities (long-term and current). Calculation data are systematized in Table 1.

Table 1. Indicators of bankruptcy analysis and assessment of the Roshen confectionery corporation using the methodology of Beaver W

№ 3/П	Financial ratio	Data			Indicator criteria		
		2019	2020	2021	Successful activity	5 years before bankruptcy	1 year before bankruptcy
1	Beaver coefficient	-1,049	-0,850	-0,957	0,4–0,45	0,17	-0,15
2	Return on assets	0,007	0,010	0,013	6–8	4	2
3	Financial leverage	0,081	0,106	0,098	≥ 37	≥ 50	≥ 80
4	Asset coverage ratio with net working capital	0,166	0,183	0,233	0,4	$\geq 0,3$	0,06
5	Coverage ratio	2,345	1,865	2,545	$\geq 3,2$	≥ 2	≥ 1

Source: constructed by the authors based on the results of official website of Roshen confectionery corporation

If Beaver's W. coefficient does not exceed 0.2 for 1.5-2 years, then this is a sign of an unsatisfactory balance sheet structure, which is a consequence of a reduction in the share of profit directed to the development of production. The economic entity begins to work in debt, and its leverage factor becomes less than 0.1. The same trend is observed in the researched food industry enterprise, and the calculated data in Table 1 indicate the possibility of a crisis situation and the probability of bankruptcy.

The adapted Z-score formula (Altman Z-score Plus, 2012) for manufacturing companies is calculated according to formula 3, table 2:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5 \quad (3)$$

Table 2. Determining the probability of bankruptcy using the Altman Z-score Plus model for the Roshen confectionery corporation, 2019-2021

Indicator	Algorithm for calculation	Years		
		2019	2020	2021
X_1	working capital/total assets	0,166	0,183	0,233
X_2	retained earnings/total assets	0,078	0,079	0,089
X_3	earnings before interest and taxes/total assets	0,009	0,012	0,015
X_4	market value of equity/total liabilities	0,919	0,894	0,902
X_5	sales/total assets	0,697	0,706	0,773
Z	$Z > 2,99$ Safe zone	1,585	1,612	1,769
Імовірність банкрутства	$1,81 < Z < 2,99$ "Grey" zone $Z < 1,81$ Disaster zone	"Grey" zone	"Grey" zone	"Grey" zone

Source: constructed by the authors based on the results of official website of Roshen confectionery corporation

Altman's two-factor model covers two factors and is calculated according to the following algorithm (table 3) formula 4:

$$Z = 0.3877 + 1.0736X_1 + 0.0579X_2 \dots \quad (4)$$

Table 3. Determining the probability of bankruptcy according to Altman's E. two-factor model for Roshen confectionery corporation

Indicator	Algorithm for calculation	Years		
		2019	2020	2021
X_1	working capital/current liabilities	2,345	1,865	2,545
X_2	current and long-term liabilities/balance currency	0,081	0,106	0,098
Z	$Z > 0$ more than 50%	2,910	2,396	3,126
Probability of bankruptcy	$Z < 0$ is less than 50% $Z = 0 = 50\%$	big	big	big

Source: constructed by the authors based on the results of official website of Roshen confectionery corporation

The next model of discriminant analysis is Springate's K. model, which involves the calculation of four factors focused on the future income of the enterprise with an accuracy of up to 92% (Dobrovolska, O., Dubrova, N., 2021). The longer the forecast period, the less accurate the forecast. This model has the following form - formula 5:

$$Z = 1,03x_1 + 3,07x_2 + 0,66x_3 + 0,4x_4 \quad (5)$$

The algorithm and the result of calculating the penalties are shown in Table 4.

Table 4. Determining the probability of bankruptcy of Roshen confectionery corporation according to the model of Springate K

Indicator	Algorithm for calculation	Years		
		2019	2020	2021
x1	working capital/total value of assets	0,166	0,183	0,233
x2	operating profit/total value of assets	0,009	0,012	0,015
x3	profit before taxes/current liabilities	0,125	0,123	0,168
x4	sales volume/total asset value	0,697	0,706	0,773
Z	$Z > 2,45$ Safe zone	0,560	0,590	0,708
	$0,862 < Z < 2,45$ "Grey" zone	Disaster zone	Disaster zone	Disaster zone
	$Z < 0,862$ Disaster zone			

Source: constructed by the authors based on the results of official website of Roshen confectionery corporation

So, according to this model, the enterprise is in a disaster zone, that is, there is a significant probability of becoming bankrupt, which threatens financial security. This indicates an insufficient level of anti-crisis management and the effectiveness of the financial security strategy. However, if the management implements a number of measures to increase working capital, improve the efficiency of operations and use of assets, the company will be able to overcome temporary difficulties.

The application of the model of Lees R., which is calculated according to formula 6, confirmed the low probability of bankruptcy (table 5) (Dobrovolska, O., Dubrova, N., 2021).

$$Z = 0,063X_1 + 0,092X_2 + 0,057X_3 + 0,001X_4 \quad (6)$$

Table 5. Determining the probability of bankruptcy of Roshen confectionery corporation according to the model of Lees R

Indicator	Algorithm for calculation	Years		
		2019	2020	2021
X1	working capital / assets	0,166	0,183	0,233
X2	profit from sale/ assets	0,009	0,012	0,015
X3	retained earnings/ assets	0,078	0,079	0,089
X4	equity / liabilities	11,272	8,427	9,228
Z	$Z > 0,037$ low	0,027	0,026	0,030
Probability of bankruptcy	$Z = 0,037$ marginal	висока	висока	висока
	$Z < 0,037$ high			

Source: constructed by the authors based on the results of official website of Roshen confectionery corporation

The used models for determining the probability of a crisis (bankruptcy) reflect various aspects of the enterprise's economic activity, are easy to calculate, simple and accurate in calculations, and enable their application to external users, which are their positive characteristics. However, they are developed for the enterprises of the USA and Western Europe, that is, they are adapted for the conditions of the developed market. It is clear that these models do not take into account the modern operating conditions of the domestic market, which have their own peculiarities in the accounting entry system, tax legislation, the significant impact of inflation on financial and economic activity, the industry affiliation of the enterprise, etc.

Among the discriminant models for determining the risk of the probability of the occurrence of crisis phenomena developed in Ukraine are the model of [Tereshchenko, O. \(2008\)](#), [Matviychuk, A. \(2006\)](#), a model proposed by the Ministry of Finance of Ukraine.

A characteristic feature and a positive side of Tereshchenko's O. model is the coverage of various determinants of the financial state in the study of a business entity: liquidity, profitability, turnover, structure of property, capital, etc. (formula 7, table 6).

$$Z = 1,5X_1 + 0,08X_2 + 10,0X_3 + 5,0X_4 + 0,3X_5 + 0,1X_6 \quad (7)$$

Table 6. Determining the probability of bankruptcy of Roshen confectionery corporation according to the model of Tereshchenko O

Indicator	Algorithm for calculation	Years		
		2019	2020	2021
X1	cash receipts/ liabilities	0,006	0,003	0,003
X2	balance currency/liabilities	12,272	9,427	10,228
X3	net profit/ average annual amount of assets	0,007	0,010	0,013
X4	profit / income from sales	0,011	0,014	0,016
X5	production stocks/ income from sales	0,106	0,086	0,104
X6	income from sales / fixed capital	0,697	0,706	0,773
Z	$Z > 2$ low	1,156	0,962	1,068
Probability of bankruptcy	$1 < Z < 2$ limit value	limit value	high	limit value
	$0 < Z < 1$ high			

Source: constructed by the authors based on the results of official website of Roshen confectionery corporation

Having studied the application of existing models in the conditions of a transformational economy, Matviychuk A. proposed a "model for assessing the axiological (subjective) probability of bankrupt-

cy” (Savchenko, A., Fisher, N. (2020) of Ukrainian enterprises in the form of a discriminant function, which has the following calculation algorithm (formula 8, table 7).

$$Z = 0,033X_1 + 0,286X_2 + 0,045X_3 + 0,018X_4 + 0,004X_5 + 0,15X_6 + 0,702X_7 \quad (8)$$

Table 7. Determining the probability of bankruptcy of Roshen confectionery corporation according to the model of Matviychuk A

Indicator	Algorithm for calculation	Years		
		2019	2020	2021
X1	current assets/non-current assets	0,199	0,224	0,303
X2	net sales income/current liabilities	9,826	7,197	8,457
X3	net sales income/equity	0,759	0,790	0,857
X4	balance/net income from sales	1,435	1,416	1,293
X5	(current assets - current liabilities)/current assets	0,573	0,464	0,607
X6	(long-term liabilities + current liabilities)/balance sheet	-0,060	-0,090	-0,085
X7	equity/(security of future expenses and payments + long-term liabilities + current liabilities)	11,272	8,427	9,228
Z	Z > 1,104 low probability of bankruptcy	10,614	7,914	8,817
	Z < 1.104 high probability of bankruptcy	low	low	low

Source: constructed by the authors based on the results of official website of Roshen confectionery corporation

Because Matviychuk’s A. model takes into account the peculiarities of the functioning of economic agents in the transformational conditions of the economy, therefore it is considered the most adequate in characterizing the actual financial and economic situation in the context of ensuring the financial security of the enterprise.

Thus, according to Matviychuk’s A. model, it is possible to identify the enterprise of the food industry - the Roshen confectionery corporation as being at risk in 2021. The result of the previous 2019-2020 years is positive, which characterizes the company with a low probability of bankruptcy. The deterioration of the state of affairs during the researched period is the influence not only of internal economic factors, but also of external conditions of conducting financial and economic activities, which today have a significant impact on the efficiency of entrepreneurial activity. It can be argued that the Roshen Confectionery Corporation should pay attention to improving the efficiency of operations and profitability, ensuring absolute liquidity, turnover of working capital and its amount, which are the main determinants of preventing the onset of a crisis and ensuring financial security. During the studied period, the Roshen confectionery corporation does not use its assets enough to accumulate profits. A negative factor for financial security is insufficient profitability of product sales. However, in order to determine the specific factors influencing the probability of bankruptcy and their quantitative measurement, it is necessary to carry out a more detailed analysis for each component of the company’s financial condition.

6.CONCLUSIONS

Management of financial and economic activities of food industry enterprises requires systemic changes and qualitatively new approaches to identifying crisis phenomena at the earliest possible time of their manifestation. Crisis phenomena are equated with the onset of bankruptcy of the enterprise and a high degree of risk in financial activities, the consequence of which is the impossibility of fulfilling obligations and demands to the budget and creditors within the specified period. It is important to detect the signs of a crisis in an enterprise in advance, which is possible by conducting

an analysis using diagnostic research methods that make it possible to determine the probability of bankruptcy with a certain accuracy and predictability.

Analytical methods for determining the financial condition include the methods of assessing the probability of the occurrence of crisis phenomena: vertical and horizontal analysis of reporting, calculation of coefficients, methods of determinant integral analysis.

To diagnose the probability of bankruptcy, the study used deterministic integral analysis using models of foreign and domestic scientists. The official data of the Roshen Confectionery Corporation food industry enterprise became the information base. The applied methods of bankruptcy forecasting have a number of advantages: complexity, but ease of calculation, the possibility of their use by external users with the help of open databases of financial and accounting statements. At the same time, some of their superficiality is noted, which requires a more detailed analysis of individual factor components. It should be noted that the application of foreign methods does not take into account domestic conditions, circumstances and peculiarities of financial and economic activity of various organizational and legal forms of management. Therefore, we consider it expedient to use the models of foreign scientists to diagnose the probability of bankruptcy. However, in our opinion, it is appropriate to combine with the proposed methods, to use other methods that would take into account the specifics of the industry, the size of the enterprise, and the factors of the external, market environment.

Therefore, in order to achieve a high level of financial security of the enterprise in difficult, unpredictable conditions, it is extremely important to implement effective anti-crisis, security-oriented management to forecast and prevent the emergence of threats and take measures to correct the situation. market economy.

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