MODELING OF ENTERPRISE ACTIVITIES IN CONDITIONS OF UNCERTAINTY

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Modern enterprises operate in an extremely complex environment, where uncertainty becomes a constant condition of their existence. As a result of the full-scale military invasion of the Russian Federation into Ukraine, Ukrainian enterprises faced physical destruction of assets, forced relocation, labor shortages, and logistical constraints. Security threats and financial and economic risks of enterprise activity are a challenge for the functioning of business in Ukraine. Under these conditions, it is important to additionally involve economic and mathematical modeling tools that allow taking into account factors of uncertainty of the external environment and are the basis for making further management decisions.

Modeling of enterprise activity is becoming an important tool for forecasting, adapting, and making effective management decisions. The use of economic and mathematical models allows enterprises [1]:

- to assess the impact of external factors, such as demand fluctuations, currency risks, and changes in legislation;

- to form alternative scenarios for business development depending on the development of the situation;

- optimize internal processes, including resource and financial management, to minimize costs and maximize efficiency.

Thus, in a period of global turbulence, companies that are able to effectively use modeling of their activities have a higher chance of survival and development in conditions of uncertainty.

Table 1 shows the financial indicators of the company "SEVENPORT" LLC for the period 2022-2024. This company provides comprehensive services in the field of international cargo transportation and customs clearance. Given the constant changes in the industry, high level of competition and conditions of uncertainty, the company actively analyzes the market situation and seeks new opportunities to adapt to changing conditions and ensure sustainable development. Modeling using the logit model allows you to identify key factors that determine the company's success in the market, as well as assess risks and opportunities for further development.

Table 1 – Dynamics of the company's financial indicators "SEVENPORT" LLC for the period 2022–2024

Financial indicators	Time period				
	February 7, 2022 – June 30, 2022	July 1, 2022 – December 31, 2022	January 1, 2023 – June 30, 2023	July 1, 2023 – December 31, 2023	January 1, 2024 – June 30, 2024
1	2	3	4	5	6
Equity	98 732	115 640	125 850	149 425	177 390

Authoried capital	27 000	27 000	27 000	27 000	27 000
Cash and cash equivalents	21 350	29 840	34 650	39 200	53 780
Current liabilities	58 290	69 740	74 120	81 300	92 100
Long-term liabilities	19 870	19 870	19 870	19 870	19 870
Assets	119 200	131 600	143 900	168 100	204 600
Net sales revenue	573 633	600 880	597 253	718 048	881 340
GDP	3 952 560	4 115 740	4 309 250	4 506 820	4 712 440
Net profit	12 668	13 776	17 094	19 237	20 920

Source: compiled by the author based on [2,3]

Based on these data, a logit model was used to assess the risk of enterprise bankruptcy. By adapting the mathematical approach to the specifics of the Ukrainian economy and using appropriate financial indicators, it is possible to create an effective model that will help in making informed financial decisions and reducing the risks associated with enterprise bankruptcy.

In the logit model, the probability of an event occurring is determined using a logistic function that converts a linear combination of independent variables into a probability. Formally, this can be expressed as follows:

$$\text{logit } p = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n, \tag{1}$$

where p is the probability of an event occurring (in our case, the probability of bankruptcy), β_0 is a free term (constant), $\beta_1, \beta_2, \ldots, \beta_n$ are coefficients corresponding to the independent variables $x_1, x_2, \ldots, x_n$

To calculate the probability, we use the logistic function:

$$p = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n)}}, \tag{2}$$

The probability p ranges between 0 and 1, where
- $p < 0.5$ means that the event is unlikely (in our case, a low probability of bankruptcy);
- $p > 0.5$ means that the event is likely (in our case, a high probability of bankruptcy).

Based on formula 2, we will create a general model for calculating the probability of event P. Therefore, the logistic regression model with the calculated coefficients will look like:

$$z = -0{,}0912x_1 - 0{,}2752x_2 + 0{,}8016x_3 + 0{,}0814x_4 - 1{,}3892x_5 - 0{,}0314x_6 + +0{,}8641x_7 - 3{,}2622x_8 - 0{,}2841x_9 - 0{,}697510, \tag{3}$$

where x_1 – the ratio of total assets to GDP; x_2 – the indicator of asset efficiency; x_3 – the total level of asset growth; x_4 – the profitability of assets; x_5 – the profitability of authorized capital; x_6 – the indicator of financial stability; x_7 – the ratio of current liabilities to equity; x_8 is the net income of the enterprise; x_9 – the share of cash in the structure of total assets; x_{10} – the ratio of cash to current liabilities.

The proposed logit model allows you to effectively assess the probability of bankruptcy of an enterprise based on key financial indicators. The analysis confirmed that the model is adequate for use, since:
- VIF for all variables is less than 5, which indicates the absence of problems with multicollinearity in this model;
- all variables, except for x6 (reliability coefficient), have a p-value less than 0.05, which indicates their statistical significance;
- the variable x6 is not significant in the model, since its p-value is greater than 0.05:
- the accuracy of the model is 92%.

In the context of uncertainty caused by the war and the COVID-19 pandemic, the use of this model allows enterprises to:
- quickly assess the risk of bankruptcy depending on changes in financial indicators;
- identify the most influential factors that contribute to stability or, conversely, create threats to business.
- make informed management decisions aimed at reducing risks and strengthening financial stability.

In general, the results confirm the practical value of modeling for strategic management of enterprises in conditions of economic instability. The use of economic and mathematical approaches allows you to increase the effectiveness of management decisions, adapt to challenges and ensure the competitiveness of the enterprise.

References:
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ЕКСПЕРТНЕ ОЦІНЮВАННЯ ПІДПРИЄМНИЦЬКИХ РИЗИКІВ

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Сучасні умови функціонування українських підприємницьких структур (ПС) характеризуються макроекономічною нестабільністю, високим рівнем енергетичних загроз та ін. Це призводить до погіршення фінансового стану ПС, збитковості діяльності, зниження рівня ділової активності. Тому актуальним науково-дослідним завданням є оцінювання ризиків ПС різних типів з метою застосування превентивних механізмів фінансової стабілізації.

При опитуванні менеджменту 33 підприємств різних регіонів була запропонована класифікація ризиків на безпекові (пов'язані з веденням бойових дій і гібридної війни), економіко-політичні (зовнішні, спричинені змінами ринкової кон'юнктури чи політичними рішеннями) та операційні (впливають на стабільність роботи бізнесу). Слід зазначити, що результати експертного оцінювання ризиків ПС показали, що сприйняття ризиків суттєво відрізняється у компаній різних галузей та регіонів.

В ході дослідження були отримані наступні результати. За географічним принципом ризик «руйнування внаслідок обстрілу та окупація підприємства» є домінантним ризиком для підприємств областей, на території яких ведуться бойові дії (крім Миколаївської області). Однак, наприклад для підприємств Дніпропетровського регіону ризик руйнування має однаковий ранговий пріоритет з ризиком нестачі кадрів, незважаючи на те, що цей регіон межує із прифронтовими: Донецькою та Запорізькою областями (рис 1).