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STATISTICAL METHODS OF ESTIMATING
ECONOMIC SECURITY OF ENTERPRISES

Світлана Тютченко. СТАТИСТИЧНІ МЕТОДИ ОЦІНКИ ЕКОНОМІЧНОЇ БЕЗПЕКИ ПІДПРИЄМСТВ. В статті представлені статистичні методи та способи розрахунків показників, які дозволяють зробити висновки про спроможність підприємства протистояти зовнішнім та внутрішнім загрозам, забезпечити його стійке функціонування та перспективний розвиток.

Проаналізовано дослідження зарубіжних та вітчизняних науковців в питанні визначення методів оцінки безпеки на рівні підприємств та організацій.

Існуючі методи та способи розрахунків показників дозволяють проаналізувати та зробити висновки про здатність підприємства протистояти зовнішнім та внутрішнім загрозам.

Автором запропоновано використання статистичних методів для аналізу стану економічної безпеки підприємств з метою забезпечення його стійкого функціонування та перспективного розвитку. Важливим є використання матричного статистичного діагностичного аналізу, суть якого зводиться до зображення системи найважливіших показників діяльності підприємства у вигляді квадратної матриці, елементами якої є індекси використання потенціалу підприємства. Комплексна оцінка ефективності виробничо-господарської діяльності проводиться на основі узагальнюючого показника рівня ефективності за формулою середніх арифметичних індексів цільових елементів матриці. Запропоновану методику можна приміняти для визначення рівня економічної безпеки протягом аналізованих періодів та розробляти шляхи його підвищення .

Крім того, в статті запропонованј методи, які базуються на основних законах статистичного аналізу визначення економічних ризиків, які впливають на рівень безпеки підприємства. В основі методів лежить принцип ідентифікації внутрішніх та зовнішніх загроз функціонування підприємства. Вони дозволяють визначати характеристики та динаміку зміни показників економічної безпеки підприємства.

Ключові слова: економічна безпека підприємства, фінансове становище, фінансова стійкість, ефективність діяльності, статистика, ризики.

Problem statement. Improving the economic security of an enterprise is one of the most important functional areas of management, since its level affects the economic and social and security of the whole country.

Expanding economic ties with European countries has identified the problem of ensuring the economic security of domestic enterprises. The current economic conditions are characterized by the impact of negative factors caused by the global financial and economic crisis, a high level of dependence on imports of food and raw materials, market transformations, which increase the uncertainty of the development of business processes.

Successful functioning of enterprises depends on their flexibility, adaptation to changes in the environment, availability of economic security system, which provides the enterprise with self-preservation, prevention of external and internal threats and creation of conditions for sustainable functioning and development. Economic security is based on the economic sustainability of the enterprise and implies its ability to self-finance its activities.

Analysis of the publications that started solving this problem. The study of economic security of the enterprise was engaged in by foreign and domestic scientists, namely: V. Ponomareva, E.A. Oleynikova, A. Kozachenko, S.M. Ilyashenko, T.B. Kuzenko, et al. [5, p. 17]. There is a large number of developed scientific methods of security assessment at the level of enterprises and organizations. This article proposes the use of statistical methods to

analyze the economic security of enterprises.

The article's objective. In order to ensure the sustainable development of the enterprise, it is necessary to determine the level of economic security, and on its basis to select the tools that allow efficient use of available capital and contribute to improving the quality of management, constant updating of technologies and improvement of the information base. Therefore, an urgent scientific task is to find and develop approaches, to select the necessary criteria and methods for assessing economic security.

The basis of economic security of the enterprise consists of: availability of necessary afunds, their rational placement and effective use, financial relations with other legal and natural persons, solvency and financial stability.

Basic content. Economic security of the enterprise is a complex characteristic, which means the level of protection of all types of potential of the enterprise from internal and external threats, which ensures its stable functioning and effective development. The content of this concept contains a system of means that ensure the competitiveness and economic stability of the enterprise [1, Article 12].

The economic security of enterprises depends first and foremost on the ability to generate the competitive advantages that underlie profitable, effective activity. Therefore, economic security is directly related to such a category as the economic efficiency of the enterprise.

There is no universal measure of activity appraisal, as different enterprises and industries may use different criteria. Therefore, efficiency can be determined from the point of view of meeting certain requirements in terms of financial results, business processes, consumer efficiency, innovative activity, which together will allow to make a balanced system of indicators, to reflect the results of entrepreneurial activity of the enterprise.

The most accurate results in the analysis of different areas of activity of the company gives a diagnosis of the financial condition of the company, which is conducted according to the financial statements. Financial condition as a whole is a multidimensional characteristic of all internal processes and results of operations in monetary form.

However, for a more accurate and general financial and economic analysis of the enterprise's activity, it is necessary to study and investigate the correlation of indicators in dynamics, as it gives an opportunity to estimate the pace of development of the economic entity and allows to determine to what extent it approached the highest level of resource use and efficiency of activity. Changes in dynamics can be study by comparing statistical relative and absolute values, analyzing types of dynamics, analyzing trends and relationships between statistics.

In our opinion, the economic security assessment of an enterprise includes two main components: a comprehensive assessment of the financial stability of the enterprise and the level of its development. Therefore, for a comprehensive assessment of the financial stability of the enterprise, we propose a statistical method for determining the efficiency of production and economic activity on the basis of the general indicator of the level of efficiency by the formula of arithmetic indices of the target elements of the matrix.

It is very important to use matrix statistical diagnostic analysis, the essence of which is to depict the system of the most important indicators of enterprise activity in the form of a square matrix, the elements of which are the ratio of the selected indicators by the column of the matrix to the indicator by row. The input parameters on the row are active and on the column are passive. The set of elements of this matrix is an interdependent system of characteristics of the enterprise. The elements of the matrix that are under the main diagonal are the characteristics of utilizing the potential of the enterprise. If they are more than one, there is an increase in resource efficiency and profitability of the enterprise, which, in turn, contributes to improving the economic security of the enterprise [4, p. 34].

$$I_0 = \frac{2 * \sum_{i=1}^{n} \sum_{j=1}^{n} X_{ij}}{n^2 - n} \qquad (1)$$

Therefore, the general index matrix will have the form presented in Table 1.

Table 1 – General view of the index matrix

Xi	Yj					
	Profit	Revenue	Spending	Current assets	Fixed assets	Number of employees
Profit	1					
Revenue	C12	1				
Spending	C13	C23	1			
Current assets	C14	C24	C34	1		
Fixed assets	C15	C25	C35	C45	1	
Number of employees	C16	C26	C36	C46	C56	1

The indices of development of the organization are given in the table divided into six orders, each of which characterizes the analytical side of activity: 1 – correlation of results (C12); 2 – cost effectiveness (C13, C23); 3 – profitability of resources (C14, C15, C16); 4 – return on resources (turnover of working capital – C24, fund return – C25, labor productivity-C26); 5 – resource costs (C34, C35, C36); 6 – progressive ratio of resources (C45, C46, C56) [3, p. 22].

The dynamic matrix model allows to determine the influence of factors on the change of the estimation parameters of the enterprise activity, ie the target elements of the index matrix. If the index is much larger than one, then we can conclude that the level of efficiency of the enterprise. The proposed methodology can be applied to determine the level of economic security during the analyzed periods and to develop ways to improve it.

In addition to the above method of assessing the level of security of the enterprise, there are approaches based on the basic laws of statistical analysis of the definition of economic risks. The methods are based on the principle of identifying internal and external threats to the enterprise. Types and degree of risk are determined on the basis of calculations of indicators by statistical and probabilistic methods, based on the principle of comparing the magnitude of losses from the activity of the enterprise with the levels of its risk.

The methods of multivariate statistical analysis include: correlation, regression, factor, cluster. They allow you to determine the characteristics and dynamics of changes in the economic security of the enterprise.

The most common tools for the statistical method of risk calculation are:
• average or mathematical expectation ($\overline{X}$) of a random variable;
• dispersion (σ^2);
• standard deviation (σ);
• coefficient of variation (V).

For a limited number (n) of possible values of a random variable, its average value is determined by the formula [5, Article 32]:

$$\overline{X} = \sum_{i=1}^{n} X_i * p_i \ , \tag{7}$$

where X_i is the value of a random variable;
p_i is the probability of a random variable.

Important characteristics that determine the degree of variability of a possible result are:
variance, which is defined as the weighted average of the squares of the deviations of the partial results from the mean values:

$$\overline{\sigma^2} = \sum_{i=1}^{n} (X_i - \overline{X})^2 * p_i \ , \tag{8}$$

standard deviation:

$$\sigma = \sqrt{\sigma^2} = \sqrt{\sum_{i=1}^{n} (X_i - \overline{X})^2 * p_i} \ , \tag{9}$$

coefficient of variation, which is calculated as the ratio of the mean square deviation to the mean and shows the degree of deviation of the values obtained:

$$V = \frac{\sigma}{\overline{X}} \ , \tag{10}$$

Using the coefficient of variation, you can compare the deviations of the features expressed in different units of measurement.

The calculation of the economic security indicators of the enterprise is an important element for rapid response to possible deficiencies in the management of the enterprise, which can be an obstacle to effective confrontation of external and internal threats of the enterprise and prompt elimination of risk situations. This is a prerequisite for a stable economic development of a manufacturing enterprise that operates in a changing and unstable environment.

Conclusions. Analysis of scientific developments of domestic and foreign scientists give grounds for determining the economic security of the enterprise as a state of the most effective use of all its resources to prevent internal and external threats, ensuring stable functioning in the present and in the future.

In this article the author proposes and substantiates the use of statistical methods for assessing the economic security of an enterprise. These methods and models can be used to evaluate and develop the security concept of any enterprise.

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Summary

The article presents statistical methods and methods of calculating indicators that allow to make conclusions about the ability of an enterprise to withstand external and internal threats, to ensure its stable functioning and future development.

Keywords: *economic security of the enterprise, financial situation, financial stability, efficiency of activity, statistics, risks.*