

## РОЗДІЛ 6

### МАТЕМАТИЧНІ МЕТОДИ, МОДЕЛІ ТА ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ В ЕКОНОМІЦІ

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**Kasianova Valeriia**

ORCID: <https://orcid.org/0000-0002-6302-366X>

**Lomachynska Iryna**

Odesa I. I. Mechnikov National University

ORCID: <https://orcid.org/0000-0002-6112-6884>

#### INFLUENCE OF MACROECONOMIC RISKS ON THE INDICATORS OF ECONOMIC ACTIVITY SUBJECTS

In the course of the research, the results of which are presented in this article, it was proven that the use of qualitative methods for a relevant assessment of the macroeconomic risks impact on the performance indicators of enterprises is insufficient. Therefore, by implementing a mathematically formalized method, the impact of macroeconomic risks on the economic and financial indicators of economic entities has been quantitatively proven. Using the correlation analysis method, the significance of the relationship between risks for the country's economy as a whole and enterprise performance indicators was established. The differentiation of the impact of macroeconomic risks on large, medium, small and micro enterprises has been proven. The relevance of the results is confirmed by using two indicators that are commonly used to assess macroeconomic risks: the integral indicator of the economic security level and the financial stress index. The analysis of the level of density of the correlation between the profit and loss of enterprises before tax and the integral indicator of the level of economic security made it possible to establish that the correlation coefficient for the profit of enterprises before tax is significantly lower than the correlation coefficient for the loss of enterprises before tax. This substantiated the advantages of a survival strategy over a profit maximization strategy for the average enterprise in wartime.

**Keywords:** economic risks, risk analysis, risk assessment, classification of risks, macroeconomic risks, enterprises, performance indicators, correlation analysis, quantitative assessment, risk management, business sustainability, national economy.

**Statement of the problem.** Economic entities are one of the main sources of support for the national economy during martial law, while macroeconomic risks affect the activities of enterprises. But in wartime, enterprise management reacts more to immediate, direct threats to business activities. These threats are dynamic in nature and therefore encourage the use of operational management methods. Macroeconomic risks, due to the longer lag in their impact on the activities of enterprises, are often underestimated by management, although they indicate the need for strategic management even in the volatile conditions of war. These risks are no less significant than the threats of missile and bomb strikes, the need to relocate to safer regions, the lack of raw materials due to the aggressor seizing the territories where they are extracted, etc. The adaptability of enterprises increases with a relevant determination of the significance of the macroeconomic risks impact on business processes. Timely forecasting of macroeconomic risks makes it possible to provide organizational, resource, and financial support for management measures to neutralize their negative impact on the activities of enterprises, and even ensure their survival in conditions of excessive threats. This requires not only a qualitative but also a quantitative assessment of the specified impact, identifying the specifics of the macroeconomic risks impact for certain categories of economic entities.

**Analysis of recent research and publications.** Research into the impact of macroeconomic risks on business activities becomes relevant in wartime. The scientific literature has widely used qualitative

approaches to analyzing the impact of macroeconomic risks under martial law on economic entities [1; 2; 3; 4]. Scientists note that war conditions increase the need to take into account macroeconomic risks of both direct and indirect action in the activities of enterprises, and point to the need to increase management efforts to adapt business processes to critical values of the level of threats in wartime [5, p. 91].

Financial and economic risks, financial instability of the economy as a threat to the sustainable operation of enterprises are indicated in the article by Kamyshnykova et al. [6]. The risk of financial instability of the national economy, financial and economic risks can create threats of deterioration of the financial short-term liquidity of the enterprise, and form a chronic decrease in solvency and profitability [6, p. 173]. At the same time, in the article Primorac et al. [7, p. 173] The individual nature of the impact of macroeconomic risks on economic entities is indicated, which raises some doubts. In the study of Tkachuk et al. [8, p. 74] A detailed analysis shows that systemic economic risks affect internal negative factors, enterprises, but this influence is not formalized. For recognizing the significant impact of war and identifying the risks to manufacturing enterprises Makaliuk et al. [1] the classification of these risks does not even distinguish macroeconomic risks. In the article Solosich et al. [2, p. 162] among the most important macroeconomic security parameters for the enterprise level, the inflation rate is named. Indeed, moderate values of this indicator contribute to sustainable production and, at the same time, it would be more appropriate to analyze the impact of

the integrated indicator of the economic security level on the activities of enterprises [9].

**Highlighting previously unresolved parts of the overall problem.** At the same time, scientific research has not paid due attention to the quantitative rather than qualitative justification of the impact of macroeconomic risks on enterprise indicators, the features of this impact on certain groups of economic entities have not been presented, and the need to choose an enterprise strategy in wartime has not been substantiated in a mathematically formalized manner.

**Objectives of the article** is a quantitative analysis of the impact of macroeconomic risks on the performance indicators of enterprises, establishing the features of this impact by group of enterprises.

**Summary of the main material.** In wartime, the impact of macroeconomic risks on the activities of enterprises is significantly increased. All types of macroeconomic risks for economic entities are increasing during this period. Thus, the fiscal deficit of the state budget makes it necessary not only to increase tax pressure on enterprises, but, which is also a risk, requires frequent and unpredictable changes to the regulatory framework in this area. The lack of funds in the budget results in an increase in inflationary risk, which, for example, in conditions of impoverishment of the population and, accordingly, the inability to increase retail prices for their products, leads to a decrease in the level of profitability of enterprises and, in critical cases, even to their bankruptcy. This is confirmed by the Deloitte company's data [10] – 75% of surveyed business managers indicate a decrease in demand, 20% indicate an increase in the time it takes to return funds for delivered products, 40% enterprises lack working capital, which becomes critical in the context of rising bank lending costs. Demographic catastrophe and mass migration as a result of the war create not only a problem with human resources but also narrow the domestic sales market.

For almost half of enterprises [10], logistics risks, instability or even disruption of logistics chains are becoming critical.

Energy shortage risks lead to instability of business processes, increase in the cost of products/services of enterprises.

At the same time, according to the results of a survey of top managers of enterprises (Fig. 1), the majority of respondents do not see any direct macroeconomic obstacles to their activities. The most significant indirect macroeconomic threats are: “labor shortage” and “increase in input prices”.

According to the dynamics of these indicators in the period 05. 2022-12. 2024, their relative importance gradually decreases and obstacles to the stable operation of enterprises are considered more important. At the same time, it cannot be said that the factors of “lack of labor” and “rising input prices” have ceased to influence the activities of enterprises. This rather indicates that management is gradually adapting to these threats.

This also indicates that risk management at the enterprise level is more of an “event” nature, that is, it boils down to reactions to an emerging threat. That is why, as the data presented in Fig. 1 shows, the time required to adapt to the threat is approximately two years. This is unacceptable in wartime, since changes in macroeconomic risks during martial law are dynamic in nature. At the same time, the data of the correlation analysis conducted during the research, some of the results of which are presented in this article, indicate a close relationship between macroeconomic risks and enterprise performance indicators.

The analysis used generally accepted estimates of the level of correlation density: strong – for correlation coefficient values greater than 0.70; medium – for values in the range of 0.50-0.69; moderate – from 0.30 to 0.49; weak – from 0.20 to 0.29; insignificant – for correlation coefficient values less than 0.19.

Thus, the density of the correlation between the added value at the production costs of large, medium, small, and micro enterprises and the integral indicator of the level of economic security (see Fig. 2) should be estimated as average.

At the same time, the data presented in Fig. 2 indicate, firstly, a significant differentiation of the density of the correlation between the added value at production costs and the integral indicator of the level of economic security for large, medium, small and micro business entities, secondly, about the existing tendency to increase the level of density while decreasing production volumes, since the highest level (0.6251) is characteristic of assessments of the activities of individual entrepreneurs. This, in turn, indicates the peculiarity of the impact of macroeconomic risks – the greater dependence of enterprises with small volumes of products or services on macroeconomic security. This is a specific feature of the impact of macroeconomic risks.

At the same time, an assessment of the level of density of the correlation between the profitability of enterprises and the integral indicator of the level of economic security (see Fig. 3) indicates, on the one

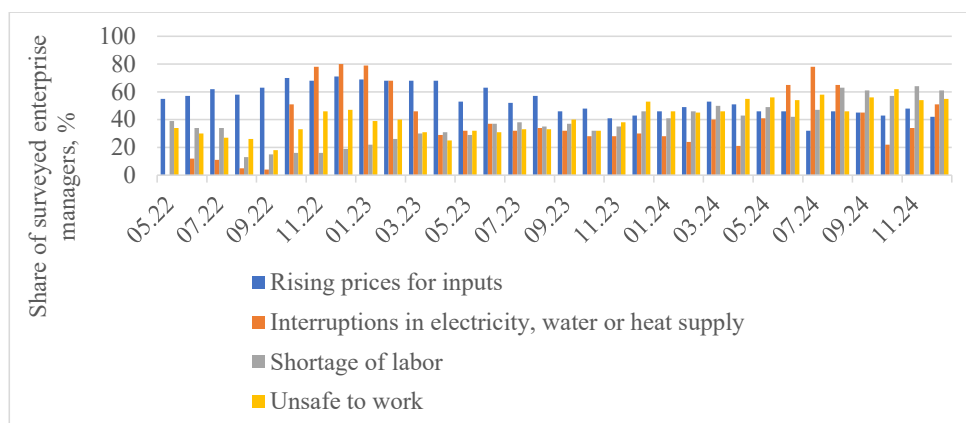
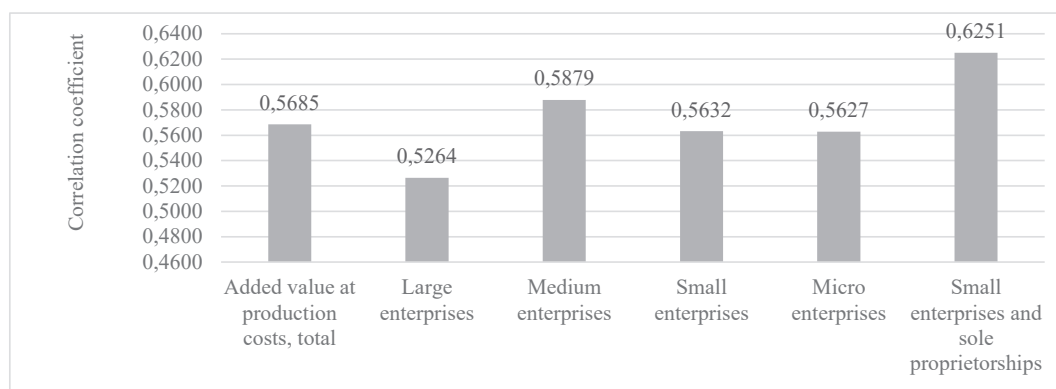


Figure 1. Assessment by enterprise management of risks for production activities

Source: compiled by the authors based on data [11]



**Figure 2. Correlation coefficient of value added by production costs of large, medium, small, micro businesses and the integral indicator of the level of economic security**

Source: compiled by the authors based on data [12; 13]

hand, that the specified connection can be defined as strong, and, on the other hand, that large enterprises have a higher level of profitability with a lower level of macroeconomic risks, in particular, due to the reduction of logistics costs due to increased safety of transport routes, greater market coverage, the absence of the need to use a survival strategy and rely on a profit maximization strategy, etc. This can also be characterized as a feature of the macroeconomic risks impact.

To verify the results, an assessment of the density of the correlation level of the enterprises profitability from another integral macroeconomic indicator of the risk level – the financial stress index (see Fig. 4) was carried out. This assessment confirmed the conclusions about the existence of a significant range of macroeconomic risks affecting the performance of large, medium, small and micro enterprises and about the increasing impact of risks due to a decrease in production volumes by economic entities.

This is confirmed by including other indicators of enterprise activity in the analysis, in particular their financial results (balance) before taxation (see Fig. 5). At the same time, data on maximizing the correlation level density for medium-sized enterprises is presented.

In our opinion, this may indicate an increase in the level of shadow economic activity, which is more difficult for medium-sized enterprises to hide than for small enterprises, which are less burdened by regulatory authorities inspections.

The analysis of the level of density of the correlation between the profit and loss of enterprises before taxation

and the integral indicator of the level of economic security allowed us to establish a significant difference between them. Thus, the correlation coefficient between the profit of enterprises before tax and the integral indicator of the level of economic security is 0.5791, and the correlation coefficient between the loss of enterprises before tax and the integral indicator of the level of economic security is -0.8722.

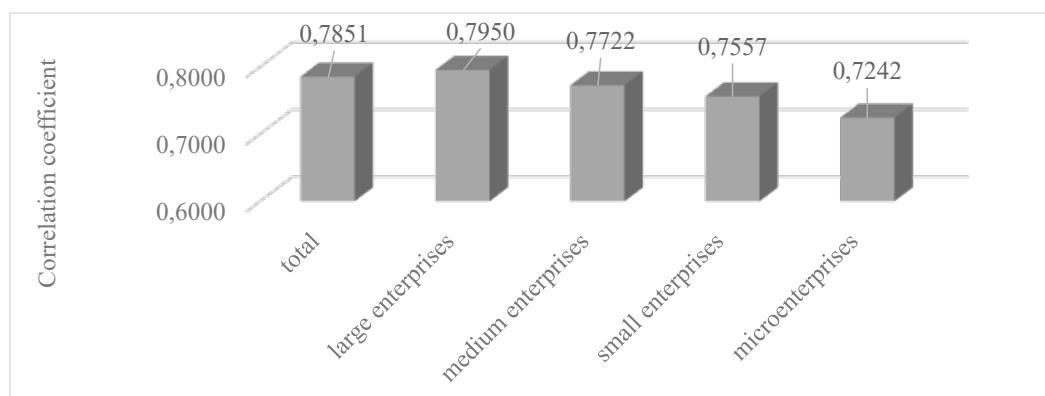
This indicates that in war conditions, a significant level of macroeconomic risks necessitates the management of enterprises to choose a survival strategy rather than a profit maximization strategy.

**Conclusions from the study.** The results of the study showed a significant level of correlation density between macroeconomic risks and enterprise indicators. This quantitatively substantiated the significance of the impact of threats to the economy of Ukraine in wartime on economic entities.

To confirm this conclusion, a parallel assessment of the impact of macroeconomic threats on economic entities was introduced by developing two recognized indicators: an integral indicator of the level of economic security and an index of financial stress.

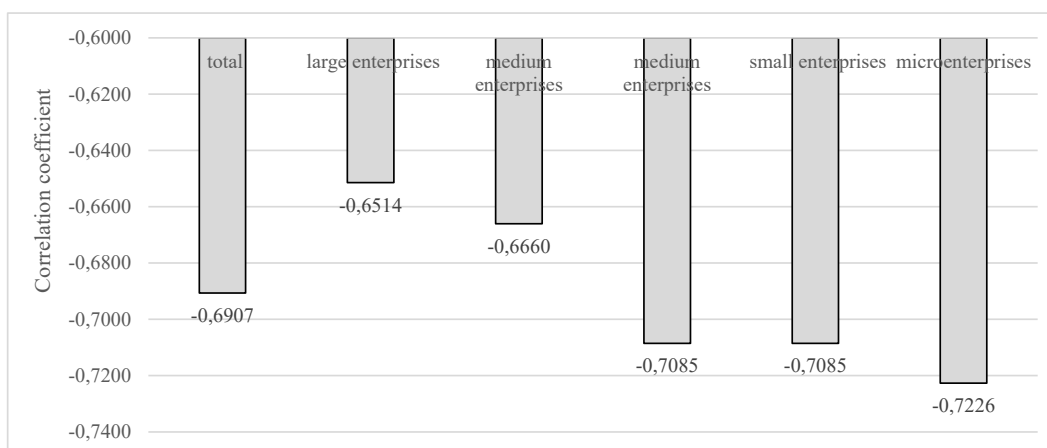
Significant differentiation of the impact of macroeconomic risks has been established for large, medium, small and micro enterprises. The analysis also took into account individual entrepreneurs. It has been proven that the impact of macroeconomic risks on individual entrepreneurs is significant.

The analysis of the level of density of the correlation between the profit and loss of enterprises before taxation and the integral indicator of the level



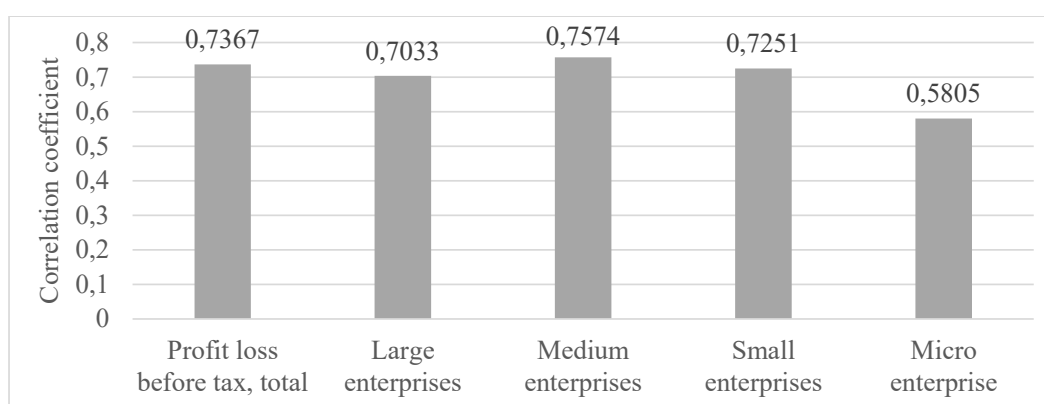
**Figure 3. Correlation coefficient of the level of profitability of all enterprise activities and the integral indicator of the level of economic security**

Source: compiled by the authors based on data [11; 12]



**Figure 4. Correlation coefficient between the level of profitability of all enterprise activities and the financial stress index**

Source: compiled by the authors based on data [12; 13]



**Figure 5. Correlation coefficient of the financial result of enterprises (balance) before taxation and the integral indicator of the level of economic security**

Source: compiled by the author based on data [11; 12]

of economic security made it possible to establish that the correlation coefficient for the profit of enterprises is significantly lower than the correlation coefficient for the loss of enterprises.

This formed the basis for justifying the advantages of a survival strategy rather than a profit maximization strategy for the average enterprise in war conditions, which lead to increased macroeconomic risks.

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Касьянова В. А.  
Ломачинська І. А.

Одеський національний університет ім. І. І. Мечникова

### ВПЛИВ МАКРОЕКОНОМІЧНИХ РИЗИКІВ НА ПОКАЗНИКИ СУБ'ЄКТІВ ЕКОНОМІЧНОЇ ДІЯЛЬНОСТІ

#### Анотація

У ході дослідження, результати якого представлені в представленій статті, доведено, що використання традиційних якісних методів аналізу для релевантної оцінки впливу макроекономічних ризиків на показники діяльності підприємств є недостатнім. Таким чином, шляхом реалізації математично формалізованого методу кількісно доведено вплив ризиків для економіки країни в цілому на звітні економічні та фінансові показники суб'єктів господарювання. За допомогою методу кореляційного аналізу встановлено значущість зв'язку ризиків для економіки країни в цілому з показниками діяльності підприємств. Доведено диференціацію впливу макроекономічних ризиків на великі, середні, малі та мікропідприємства. Аналіз також враховував фізичних осіб-підприємців. Доведено, що вплив ризиків національної економіки в цілому на фізичних осіб-підприємців є значним і навіть більшим, ніж на інші категорії суб'єктів господарювання. Вказано на тенденцію до збільшення впливу ризиків національної економіки в цілому та зменшення обсягів виробничої діяльності підприємства за окремими звітними показниками. Актуальність отриманих результатів підтверджується використанням двох індикаторів, які зазвичай використовуються для оцінки макроекономічних ризиків: інтегрального показника рівня економічної безпеки та індексу фінансового стресу. Аналіз рівня щільності кореляційного зв'язку між прибутком і збитком підприємств до оподаткування та інтегральним показником рівня економічної безпеки дозволив встановити, що коефіцієнт кореляції для прибутку підприємства до оподаткування та інтегрального показника рівня економічної безпеки значно нижчий, ніж коефіцієнт кореляції для збитковості підприємств до оподаткування та інтегрального показника рівня економічної безпеки. Це обґрунтувало рекомендації керівникам підприємств щодо вибору стратегії виживання, а не стратегії максимізації прибутку середнього суб'єкта господарювання в умовах війни.

**Ключові слова:** економічні ризики, аналіз ризиків, оцінка ризиків, класифікація ризиків, макроекономічні ризики, підприємства, показники ефективності, кореляційний аналіз, кількісна оцінка, управління ризиками, стійкість бізнесу, національна економіка.