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MODELLING THE STATE OF AGRARIAN ENTERPRISES' ECONOMIC SECURITY WITH MANAGEMENT ACCOUNTING TOOLS

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Abstract. The purpose of the research is to develop a modified version of a risk-oriented approach for assessing the state of economic security of agricultural enterprises, which is based on the management accounting methodological tools and involves the formation of a system of indicators that determine the impact of risk factors on changes in the results of the enterprise's activities. The usage of the following methods was the methodological basis of the research: analysis and synthesis to establish the interrelationship of analytical indicators applied in models for assessing the state of economic security of business entities; theoretical generalization and grouping to substantiate management accounting tools that serve as risk indicators for lowering the level of economic security; comparison in conducting an analytical assessment of actual performance indicators of agricultural enterprises with their indicators.

The paper puts forward a hypothesis about the priority of management accounting in information support for safety-oriented management and forms a system of indicators used as risk assessment indicators for the activities of agricultural enterprises, including the C/S ratio, the margin of safety, the breakeven point, and the operating leverage factor.

The practical value of the scientific research is justified by the proposed approach for assessing the state of economic security of agricultural enterprises, which methodologically expands the toolkit of security specialists and contributes to strengthening the argumentation for funding protective measures to reduce the impact of critical risks and threats.

The testing of the proposed approach to modelling the state of economic security has revealed catastrophic risks associated with the inefficient cost structure of domestic agricultural enterprises. In conditions of a decrease in the market volume for agricultural products, this leads to a sharp increase in the losses of activities and a decline in the level of economic security.

Key words: economic security, modelling, management accounting, risk, margin of safety.

JEL code: M49; N5

Introduction

Security is a necessary condition for the existence of any enterprise. It ensures the protection of its vital interests from the influence of internal and external threats and serves as the basis for sustainable functioning. The increased public attention to security issues is due to the existence of full-scale military operations in Ukraine, which is characterized by an increase in threats and risks in social and economic life, both at the local and global level, and affects the activities of domestic agricultural enterprises.

Taking into account the fact that the majority of large enterprises in the agrarian sector of the Ukrainian economy were characterized by stable profitability and competitiveness in the pre-war period, their loss of these features poses a direct threat to the economy and social stability of the state as a whole, as well as to the staff of each particular enterprise. After all, business entities, being the main structural element of the economy, perform not only a production function but also bear a social burden and responsibility.

Against the backdrop of the mentioned problems, domestic agricultural enterprises face the urgent task of internal self-assessment in terms of their ability to withstand threats from both the internal and external environment. This will enable the management to have a better understanding of the subject's ability to function effectively under conditions of limited resources and maintain competitiveness in the near and distant future.

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Moreover, the assessment of the state of the enterprise's economic security also has a macroeconomic character, since its financial, technical, and human resources' potential is a decisive stabilizing factor for the economic independence of the state and a key condition for preserving its sovereignty.

A significant number of scientific publications by both foreign and domestic scholars and practitioners are devoted to justifying the optimal model for assessing the state of economic security of business entities and its information support characteristics. In particular, L. Hnylytska (2021; 2022) considers a risk-oriented approach to building a model for assessing the state of economic security. L. Honcharenko focuses on an indicator-based approach (2010), H. Kozachenko and O. Liashenko (2003) are followers of the profit-investment-based approach, whereas O. Kravchuk (2008) and I. Ternavska (2015) insist on a resource-functional-based approach. In turn, the works of E. Atkinson and R. Banker (2003), A. Azudin, N. Mansor (2018), D. H. Pham, T. H. Dao, T. D. Bui (2020), D. D. Cuzdriorean (2017), and others are dedicated to the search for optimal information support for assessing the state of economic security. As a result, their scientific achievements have resulted in a considerable range of approaches (often opposed) that differ in the methodology of calculating safety assessment criteria, industry focus, directions for implementing safety measures, etc. These approaches are summarized in Table 1.

Table 1

Classification of methodological approaches to assessing the state of economic security of business entities

No	Classification feature	Types of approaches
1.	By areas of security measures	• approaches based on bankruptcy techniques • approaches based on methods of comprehensive risk assessment • approaches based on methods of the comprehensive assessment of the economic potential of the enterprise
2.	By methodology for calculating the evaluation criteria	• indicator-based • resource-functional-based • profit-investment-based • cost- based
3.	By field of application	• for enterprises of the real sector of the economy • - for financial institutions

Source: compiled by the authors

At the same time, a thorough analysis of the proposed approaches makes it possible to assert that most of them are focused exclusively on historical information on the results of the enterprise's activities when assessing the state of economic security of business entities. Instead, the high level of uncertainty in the modern business environment requires forecast information that is flexible to changes in case of deviation of the actual activities of a business entity from its strategic goals.

In addition, in most cases, these approaches are often characterized by an extensive analytical framework and a low balance of indicators that describe the impact of internal and external threats on the safe state of the business entity's activities, which significantly complicates their use in the practical activities of agrarian enterprises.

The multifaceted nature of the problems faced by domestic agricultural enterprises in the practical application of existing models for assessing the state of economic security proves the need for further scientific research in the direction of their improvement.

Under these conditions, there is a growing need, on the one hand, to improve the information basis for the formation of assessment indicators that determine the security status of agricultural enterprises, and on the other hand, to simplify and standardize analytical procedures for their understandability when used by security specialists.

The study of security-oriented management concepts, covered in domestic scientific publications (I. Ternavska 2015; V. Horbulin 2005, V. Kuzomko 2013), allowed formulating the hypothesis that the central place in the information support of such management is assigned to the methods and techniques of management accounting. At the same time, the theoretical basis for the use of methodological tools of management accounting in assessing the state of security of agricultural enterprises is its conceptualization as an information basis for efficient resource utilization and a subsystem of strategic management.

Taking into account the above-mentioned provisions, the most common management accounting techniques that can be used as an information basis for managing the economic security of agricultural enterprises include:

- a balanced system of economic indicators (when assessing the implementation of the enterprise's strategy in the field of its development and security);
- budgeting and control (when developing the measures to ensure the economic security strategy and further monitoring of their implementation);
- cost-benefit analysis (when assessing the effectiveness of security measures by comparing the resources used and the benefits obtained as a result of threats prevention);
- break-even analysis (when assessing the state of security and forecasting changes in its level under the influence of entrepreneurial risk factors).

Thus, the purpose of the study is to develop a modified version of the risk-oriented approach to assessing the state of economic security of agrarian enterprises, which is based on the methodological tools of management accounting and provides for the formation of a system of indicators that determine the impact of risk factors on changes in the results of the enterprise, formalization of their calculation, and standardization of analytical procedures used in security assessment.

Materials and methods

The following methods were used in the research: analysis and synthesis to establish the interrelation of analytical indicators used in models for assessing the state of economic security of business entities; theoretical generalization and grouping to substantiate management accounting tools that serve as risk indicators for reducing the level of economic security; comparison when conducting an analytical assessment of actual performance indicators of agricultural enterprises with their benchmarks; logical generalization of results when formulating conclusions and recommendations.

Results and discussion

The proposed approach is a modification of the risk-oriented approach and involves modelling the state of security of agricultural enterprises based on the actual values of certain performance indicators that serve as risk indicators, comparing them with the benchmark, and establishing a trend in the future.

The practical implementation of this approach includes the following stages:

1) identification of management accounting tools as assessment indicators that serve as risk indicators of reducing the level of economic security and formalization of their calculation;
2) formation of boundary values of the assessment indicators;

3) standardization of analytical procedures aimed at assessing the level of entrepreneurial risks' impact on the state of owners` capital of agricultural enterprises and reducing the level of their economic security.

When justifying the management accounting tools, one should proceed from the following positions:

- maximum satisfaction of the information needs of security specialists when assessing the level of enterprise protection against risks and threats;
- expediency and the possibility of using the tools based on the existing information base of the enterprise;
- consistency of the tools with each other;
- the ability to compare agricultural enterprises of different sizes.

We believe that the management accounting tools that can be used in modelling the security state of agricultural enterprises should include the following elements of breakeven analysis (CVP analysis): breakeven point (critical volume of activity); contribution margin; margin of safety (margin of safety ratio); operating leverage (operating leverage ratio).

The breakeven point is the level of activity at which the sales revenue equals the total costs of the enterprise, i.e., the level of sales at which the enterprise has neither profit nor loss. In practice, this indicator is called the starting point of a business, emphasizing that it is advisable to start a business only if revenues cover costs, even though there will be no profit.

The higher the breakeven point is, the fewer opportunities the company has to increase its profit. Therefore, from the perspective of increasing the level of economic security, the activities of agricultural enterprises should be characterized by a low breakeven point.

The contribution margin is a relative indicator of evaluating the profitability of a company's activities. It reflects the share of contribution in the sales revenue. This indicator is considered to be a risk indicator for loss of enterprise financial stability, as its value below 0.5 signals a high probability of such a risk.

The margin of safety is the level of the company's current activity that exceeds the breakeven volume. Despite the variety of names of this indicator found in the literature (financial safety margin, financial strength margin, safety zone, etc.), the margin of safety always shows the maximum allowable decrease in the actual volume of activities without threatening the company to enter into the loss zone. In addition, the margin of safety can be used as a mechanism for determining operating profit, because it shows the sales volume above the breakeven point, and, therefore, this volume will certainly bring profit to the company.

The safety margin can also be expressed as a relative indicator - the safety of margin ratio, the value of which allows estimating the percentage by which the activity of the enterprise can decrease before it enters the loss zone. Therefore, the safety of margin ratio is considered to be one of the key indicators of the risk of loss of profitability, guided by the following rules: the higher its value is, the more reliable the financial position of the company will be. It is also true to say that this will cause less negative consequences for the enterprise if such unfavourable trends as a decrease in demand for products, changes in market conditions, changes in resource prices, and so on occur. Some scientists (Adu-Gyamfi J., Chipwere K. Y. W., 2020), based on the results of practical research, note that if the safety factor is below 30%, this is a sign of a high risk of loss of profitability.

Equally important for assessing the impact of structural risk on the performance of agricultural enterprises is the use of operating leverage (production leverage, production leverage). It is a mechanism for correlating fixed and variable costs, which ensures that the percentage of profit growth (decline) exceeds the corresponding percentage of sales growth (decline).

In other words, the operating leverage ensures profit management in the context of changes in the volume of the company's activities based on the optimization of the fixed cost/variable costs ratio. The economic meaning of this indicator is as follows: the lower the specific weight of fixed costs in the total amount of the company`s cost is, the lower the amount of contribution required to cover them, and therefore the lower the impact of changes in the volume of activities on changes in the enterprise's profit will be, and vice versa (Hansen D. R., 2002).

The impact of operating leverage on the change in operating profit of agricultural enterprises can be assessed using the operating leverage factor, which shows a percentage change in the enterprise's profit in case of a one percent change in business volume.

Therefore, using the operating leverage factor as an indicator of structural risk, agricultural enterprises should remember that in the face of a decline in their production, they should strive to reduce the operating leverage factor, which will help slow the rate of decline in profits compared to the rate of decline in the volume of activities. The reverse is also true: a higher level of operating leverage results in a greater impact on profit due to changes in activity. Therefore, when the agricultural market conditions improve, the security policy of agrarian enterprises should be aimed at increasing the operating leverage factor.

Table 2

Composition and procedure for calculating analytical indicators used in modelling the economic security of agricultural enterprises

No	Analytical indicators	Purpose	Calculation formula
1.	Total contribution, monetary unit	It allows estimating the margin generated by the company's production activities. Shows the contribution of each segment to covering the fixed costs of the enterprise and generating operating profit.	Revenue - Variable costs or Fixed costs + Operating profit
2.	Contribution margin, ratio	It allows estimating the share of contribution in each monetary unit of sales revenue. If the contribution margin is below 0.5, it is a sign of a high risk of losing financial stability.	Total contribution Sales revenueПрибутоквідопераційн оїдіяльностіСереднявартістьвл асногокапіталу+середнявартіс тьдовгостроковихзобов'язань
3.	Breakeven point, units	It allows estimating the volume of activities when sales revenue is equal to the total costs of the enterprise, i.e. the volume of sales in which the enterprise has neither profit nor loss.	Fixed costs Contribution per unit
4.	Breakeven point, monetary unit	It allows estimating the volume of activities when sales revenue is equal to the total costs of the enterprise, i.e. the volume of sales in which the enterprise has neither profit nor loss.	Fixed costs Contribution margin
5.	Margin of safety, units	It allows determining the level of current (planned) activity of the enterprise that exceeds the breakeven volume.	Actual (planned) volume of activities - Breakeven point
6.	Margin of safety, ratio	It allows estimating the possible decline in actual (planned) volumes of activity before the company reaches the breakeven point. Its value below 0.3% is a sign of a high risk of loss of profitability.	Margin of safety Actual (planned) volumes of activity
7.	Operational leverage factor, ratio	It allows to estimate by what percentage the company's profit will change if the volume of activities changes by one percent.	Operating profit Total contribution

Source: compiled by the authors

Based on the above considerations, Table 2 proposes the composition and formalization of analytical indicators that can be used in modelling the economic security of agricultural enterprises.

As already mentioned, assessing the state of economic security requires not only calculating the actual meanings of the ratios that characterize the riskiness of agricultural enterprises but also comparing them with the established benchmark (limiting) values. The absence of assessment benchmarks precludes comparison of indicators characterizing the security of agricultural enterprises in terms of cluster groups, regions, and countries, while the assessment is limited to determining the trend of their change over several periods. This significantly reduces the reliability of the assessment conducted, especially when it comes to the rating of the competitiveness of domestic agricultural enterprises in the world economic markets.

We believe that when setting reference (limiting) values, it is advisable to be guided by the following rules:

- for financial performance indicators, their industry average values should be chosen, which most accurately reflect the specifics of enterprises of a certain type of economic activity or average normative values;
- for non-financial indicators, as well as financial indicators for which it is impossible to establish normative or industry average values, a benchmarking approach should be applied to justify them.

The practical implementation of the proposed approach to assessing the state of security of agricultural enterprises actualizes the need to standardize analytical procedures for such an assessment.

The methodological basis for these analytical procedures is a comparative analysis of the actual indicators of the riskiness of an enterprise's activities, carried out in three interdependent directions:

1) comparison with their limit values (comparison with expected results);
2) comparison with previous periods;
3) comparison in branch and regional sections.

The use of a risk-oriented approach to assessing the state of economic security of agricultural enterprises actualizes the issue of establishing the significance of the impact of the level of entrepreneurial risk on the state of economic security. Depending on this influence, a normal (stable) state, a crisis (critical) state and a catastrophic state of economic security are distinguished.

The characteristics of the impact of entrepreneurial risk on the financial condition and economic security of agricultural enterprises are presented in Table 3.

Table 3

Characteristics of the risk impact on the financial condition and economic security of agricultural enterprises

No	Level of risk	Impact on the company's financial position and the cost of capital	Impact on the state of economic security
1.	Acceptable risk (characteristic of the stable activity of the enterprise under conditions of uncertainty)	The impact is defined as small and is characterized by the loss of part of the expected profit and impairment of assets.	At this level of risk, the enterprise functions stably and develops, and its activities retain economic feasibility. The deviation of the achieved evaluation indicators does not exceed 15% of their limit values. The state of security is assessed as normal *(stable)*.
2.	Critical risk (this mode is typical for enterprises that manage their resources inefficiently)	The impact is defined as large and is characterized by financial losses in the amount of the expected sale revenue and by a decrease in the initial value of assets, which leads to a loss of part of owners' equity and, as a result, a decrease in the financial stability of the enterprise.	At this level of risk, the company operates with significant losses but does not lose its financial stability and economic independence. The main assessment indicators show a decrease in their value by 30-60% compared to the benchmark. The state of economic security is assessed as *critical*.
3.	Catastrophic risk (this mode is typical for enterprises that are potential bankrupts or are in force majeure circumstances)	The impact is defined as catastrophic and is characterized by losses exceeding the owners' equity of the company	At this level of risk, the company's activity is characterized not only by financial losses, but also by reputational losses. There is a decline in production, and irreversible losses of the company's potential, which indicates its potential bankruptcy. The values for all assessment indicators are lower than the standard by more than 60%. The state of economic security is assessed as *catastrophic*.

Source: compiled by the authors

The author's approach to modelling the security state of agricultural enterprises was tested on one of the largest agro-industrial enterprises in Ukraine - Kernel-Trade LLC, which is a leading exporter of agricultural products and is among the TOP-5 producers of unrefined sunflower oil.

The practical implementation of the methodological developments was carried out in three stages. Thus, at the preparatory stage, a system of information sources was formed and the composition of indicators that determine the level of economic security (or the riskiness of activities) was substantiated. The main sources of data used as an information basis for assessing the riskiness of activities were the financial statements of Kernel-Trade LLC for 2021-2022 (Financial statements of Kernel-Trade LLC for 2021-2022).

An extract from the financial statements containing generalised indicators of income and costs for assessing the riskiness of Kernel-Trade LLC is given in Table 4.

Table 4

Structure of income and costs for risk analysis of Kernel-Trade LLC for 2021-2022

No	Indicator	2021	2022	Deviation	
				absolute, thousand UAH	relative, %
1.	Sales volume, million tonnes	12.249	12.204	- 0.045	- 0.4
2.	Revenue (sales and other operating income, thousand UAH	175 170 000	162 270 000	- 12 900 000	- 7.4
3.	Variable costs (production and selling), thousand UAH	144 660 000	140 760 000	- 3 900 000	- 2.7
4.	Specific weight of variable costs in revenue, %	82.6	86,7	+ 4.1	+ 5
5.	Contribution, thousand UAH	30 510 000	21 510 000	- 9 000 000	- 29.5
6.	Fixed costs (production and operating), thousand UAH	9 840 000	18 750 000	+ 8 910 000	+ 90,5
7.	Specific weight of fixed costs in revenue, %	5.6	11.6	+ 6.0	+ 107.1
8.	Operating profit, thousand UAH	20 670 000	2 700 000	- 17 970 000	- 86.9
9.	Specific weight of operating profit in revenue, %	11.8	1.7	- 10.1	- 85.6

Source: compiled by authors

According to the information presented in Table 4, the company reduced its sales by 45 thousand tonnes in 2022, which constitutes a decrease 0.4% compared to the previous year, although it planned to sell 20 million tonnes of grains and oilseeds. The main factor behind this decline was the full-scale military actions in Ukraine resulting in difficulties with exporting the products. Against the backdrop of a 0.4% decline in sales, Kernel-Trade's revenues in 2022 decreased by 7.4%, while variable costs fell by only 2.7%. Such a disproportion in the composition of revenues, costs, and volumes of activities led to a 29.5% drop in contribution compared to the indicators of 2021.

Meanwhile, Kernel-Trade's fixed costs in 2022 increased by 90.5% compared to 2021. The growth was caused, on the one hand, by a decrease in the net realisable value of inventories to a level below cost, and, on the other hand, by a sharp increase in provisions for doubtful debts, which is typical for a business in wartime, when business contacts are significantly disrupted. This, in turn, led to a sharp decline (by 86.9%) in the company's operating profit.

Considering the cost structure of Kernel-Trade LLC, a high share of variable costs (82.6% in 2021 and 86.7% in 2022 respectively) should be highlighted, which is quite justified for agro-industrial enterprises.

In return, in 2022 the share of fixed costs increased significantly and amounted to 11.6% compared to 5.6% in 2021. During periods of production decline, restructuring the cost structure in favour of increasing the share of fixed costs is absolutely justified. However, in Kernel-Trade LLC, the growth in the share of fixed costs was not due to a decrease in the share of variable costs, but due to a sharp drop in the share of profit in sales revenue.

The analytical stage involves the direct conduct of analytical procedures to assess the riskiness of Kernel-Trade LLC's activities for 2021-2022. The results of the assessment are presented in Table 5.

Table 5

Risk assessment of Kernel-Trade LLC for 2021-2022

Risk indicator	A benchmark or a trend	Actual value		Deviations from 2021, %	Assessment of the risk level
		in 2021	in 2022		
Contribution to sales ratio	0.5	0.17	0.13	-23.5	Critical level of risk of financial stability decline
Breakeven point, thousand UAH	should strive to reduce	57 882 353	144 230 769	+149	Critical level of risk of profitability reduction
Margin of safety, thousand UAH	should strive for growth	117 287 647	039 231	-99.9	Critical level of risk of profitability reduction
Margin of safety, ratio	0.3	0.67	0.11	-63.3	Critical level of risk of profitability reduction
Operational leverage factor, ratio	with a decrease in the volume of activities should decrease	1.5	8.0	+433.3	Catastrophic level of structural risk

Source: compiled by the authors

The results of the analysis presented in Table 5 indicate that there is a negative trend in all indicators characterising the riskiness of Kernel-Trade LLC's activities, with no exception. The level of structural risk is particularly high, as the operating leverage factor increased by more than 4 times in 2022 compared to 2021 data due to the decrease in business activity. In addition, in 2022, the company's activities are characterised by a catastrophic level of risk of declining profitability, confirmed by an increase in the breakeven point by more than 2.5 times compared to 2021 data, as well as a 63% drop in the margin of safety ratio compared to the benchmark and almost 6 times drop compared to the 2021 indicator.

At the final (assessment) stage, the level of economic security of Kernel-Trade LLC was determined. According to the scale of interpretation of the impact of risk on the state of economic security of agricultural enterprises, presented in Table 3, the studied enterprise is characterised by a catastrophic level of economic security in 2022.

Therefore, if Kernel-Trade LLC does not reformat its costs in the context of reducing the share of their variable component, with a further decline in activity level in 2023, the losses of the enterprise will be even more significant, and the level of security will be even lower.

Without pretending to be perfect, we believe that the proposed approach to assessing the state of economic security of agricultural enterprises will methodologically expand the toolkit of security professionals and help strengthen the arguments for financing protective measures to offset the impact of critical risks and threats on the to the enterprise's operations.

Conclusions, suggestions, recommendations

The carried-out research allows to formulate a number of generalising provisions on the use of management accounting instruments in modelling the economic security of agricultural enterprises as follows.

1) A prerequisite for the activities of agricultural enterprises and a social requirement of today is assessment of the state of their economic security. In order to eliminate subjectivity in decision-making in the field of security and to strengthen the arguments for financing protective measures, it is important to choose a model for assessing the state of economic security and its information basis.
2) To model the state of economic security of agricultural enterprises, a modification of the risk-oriented approach is proposed, the practical implementation of which includes the following stages:

1) defining the management accounting tools as evaluating indicators that serve as indicators of the risk of reducing the level of economic security and formalising their calculation; 2) forming the boundary values of evaluating indicators; 3) standardising analytical procedures aimed at assessing the level of impact of business risks on the capital of agricultural enterprises and reducing the level of their economic security.

3) When substantiating the management accounting tools, we proceed from the following positions: maximum satisfaction of the information needs of security specialists in assessing the level of protection of a company from the impact of risks and threats; expediency and the possibility of using the tools, taking into account the existing information base of the company; consistency of the tools with each other.

Thus, the key management tools used as indicators for assessing the riskiness of agricultural enterprises include: contribution margin, margin of safety, breakeven point, and operating leverage factor.

4) The use of the proposed approach to assessing the state of economic security of agricultural enterprises actualizes the issue of establishing the significance of the impact of the level of entrepreneurial risk on the state of economic security. Depending on this influence, a normal (stable) state, a crisis (critical) state and a catastrophic state of economic security are distinguished.

5) Approbation of the proposed approach to modelling the state of economic security allowed to identify catastrophic risks associated with the inefficient cost structure of domestic agrarian enterprises, which, in the condition of a decline in the market for agricultural products, leads to a sharp increase in the unprofitability of their activities and a drop in the level of economic security.

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