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METHODICAL APPROACH TO THE INTEGRAL ASSESSMENT OF FINANCIAL SAFETY OF MACHINE-BUILDING CORPORATIONS

Abstract. The article deals with development of methodical approach to the integral assessment of financial safety position of machine-building corporations with reference to defining safety margins of the certain indicators chosen for the research in order to simplify the analysis and to the fullest extent possible to highlight special features of financial and economic activity of the abovementioned business entities, their organizational and legal form and production life cycle. The research suggests making calculations of the integral value of financial safety by summing up margin safety values for each sub aggregates taking into account their weight coefficient in the concerned assessment that will contribute to smoothing the trend line of the integral value in the dynamic development and increasing the reliability and the accuracy of analysis.

Drawing up of methodology for the integral assessment of financial safety at machine-building corporations has been carried out by applying progressive methods of financial and economic analysis and modern approaches to organizing scientific researches and investigations as well as with strict observance of certain stages of the analysis. The concept of a safety margin has been introduced, it is a relative value that shows the real status of financial safety at an enterprise according to a certain characteristic and is calculated in diverse ways depending on the standard value of the analyzed indicator. We offer to set threshold values for a safety margin of financial safety indicators taking into account their possible increase to a certain limit defined by expert means or on the principle of choosing the largest real value of a particular indicator. The rates of weight have been introduced and they enable to adjust a value of the integral indicator in view of technical and technological special features of production and sales of machine-building production.

The scientifically-based approach allows assessing financial safety in a completely new format and comparing economic development potential of machine-building corporations which are different in size, equity, branches of activities.

Keywords: financial safety, integral indicator, financial state indicators, safety margin, corporations.

JEL Classification C51, G32

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МЕТОДИЧНИЙ ПІДХІД ДО ІНТЕГРАЛЬНОЇ ОЦІНКИ ФІНАНСОВОЇ БЕЗПЕКИ АКЦІОНЕРНИХ ТОВАРИСТВ МАШИНОБУДУВАННЯ

Анотація. Розроблено методичний підхід до інтегральної оцінки стану фінансової безпеки акціонерних товариств машинобудування на основі визначення запасу міцності окремих індикаторів, обраних для дослідження, з метою спрощення аналізу та якнайповнішого висвітлення особливостей фінансово-господарської діяльності згаданих суб'єктів господарювання, їхньої організаційно-правової форми та життєвого циклу продукції. Розрахунок інтегрального значення фінансової безпеки запропоновано здійснювати сумуванням величин запасу міцностей за кожним проміжним показником з урахуванням його вагомості для цієї оцінки, що сприятиме згладжуванню лінії тренду інтегрального показника в динаміці та підвищенню достовірності аналізу.

Формування методології інтегральної оцінки фінансової безпеки акціонерних товариств машинобудівної галузі здійснено з використанням прогресивних методів фінансово-економічного аналізу та модерних підходів до організації наукових досліджень, а також з чітким дотриманням певних етапів аналізування. Введено поняття запасу міцності, що є відносною величиною, котра відображає фактичний стан фінансової безпеки підприємства за певною характеристикою та розраховується по-різному залежно від нормативного значення аналізованого індикатора. Запропоновано встановлювати порогові величини запасу міцності індикаторів фінансової безпеки з урахуванням можливого їх збільшення до певної межі, визначеної експертним шляхом або за принципом вибору найбільшого фактичного значення певного індикатора. Введено показники вагомості, котрі дозволяють скорегувати значення інтегрального показника залежно від техніко-технологічних особливостей виробництва та реалізації продукції машинобудування.

Обгрунтований підхід дозволяє провести оцінку фінансової безпеки в цілком новому форматі та порівняти потенціал економічного розвитку різних за розмірами, капіталом, видами діяльності акціонерних товариств машинобудівного комплексу.

Ключові слова: фінансова безпека, інтегральний показник, індикатори фінансового стану, запас міцності, акціонерні товариства.

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МЕТОДИЧНЫЙ ПОДХОД К ИНТЕГРАЛЬНОЙ ОЦЕНКЕ ФИНАНСОВОЙ БЕЗОПАСНОСТИ АКЦИОНЕРНЫХ ОБЩЕСТВ МАШИНОСТРОЕНИЯ

Аннотация. Разработан методичный подход к интегральной оценки состояния финансовой безопасности акционерных обществ машиностроения на основе определения

запаса прочности отдельных индикаторов, выбранных для исследования. Это значительно упрощает анализ, а также способствует наиболее полному исследованию особенностей финансово-хозяйственной деятельности упомянутых субъектов хозяйствования, их организационно-правовой формы и жизненного цикла продукции. Расчет интегрального значения финансовой безопасности предложено осуществлять суммированием величин запаса прочности по каждому промежуточному показателю с учетом его значимости для данной оценки, что будет способствовать сглаживанию линии тренда интегрального показателя в динамике и повышению достоверности анализа.

Ключевые слова: финансовая безопасность, интегральный показатель, индикаторы финансового состояния, запас прочности, акционерные общества.

Формул: 3; рис.: 0; табл.: 1; библ.: 9.

Introduction. In national and foreign research literature methodological aspects of financial safety level determination of enterprises have been thoroughly studied on the ground of express diagnostics that allows assessing the efficiency of formation and use of financial resources at business entities and it is manifested in keynotes or risks of their finance and economic position. That frequently leads to the situation when values of certain coefficients in one group are up to the standards, but in the other group there is no compliance or we can observe a single deviation of indices in different groups or on the whole, values of almost all coefficients fall out of the recommended range. Thus, the issue of integral analysis of financial security of corporations needs updating, despite the fact that it defines the general condition of security in the specific period and in development, it should take into consideration peculiar features of functioning for business entities with corporate form of propriety.

Research analysis. The issues of integral assessment methods for business entities financial security are extensively covered in studies of scientists and practitioners, among which are I.Babets [1], L. Bekhter [2], O. Baranovskyi [3], O. Blazhevych, Yu. Vorobiov, O. Vorobiova [4], T. Larikova [5], Yu. Pavliuk [6], N. Poida-Nosyk [7], I. Yaremko [8] and others. However, the scientific and theoretical approach to the assessment of financial security needs to be improved most notably for corporations and it should involve ex-ante features of their functioning and reflect the general level of financial security as well as its changes within a certain period of time.

Research results. In modern financial science there are a number of methods for the integral assessment of business entities financial safety and they can be combined into 6 groups, namely indicator, resource and function, program-targeted, rank-order (score), cost, strategically purpose-oriented [7] and others. Each of them has its own peculiarities as well as advantages and disadvantages which are limited mainly by presence or absence of a subjective factor while making calculations, and also simplicity or complexity of mathematical (at times economic and mathematical) tools. From our point of view it is due to the process of scientific cognition: 1) economic substance of research subject; 2) tasks taken as a basis of such assessment; 3) industry special features and organizational and legal form of business entities; 4) statistical information exhaustiveness for the analysis etc.

With this in mind, we are going to give reasons for our own approach to the integral assessment of financial safety for joint-stock partnerships in the machine industry using tools of indicator and rank-order approaches in the symbiosis in light of the limited statistical information about their financial and economic activities given in forms of financial data reporting № 1-4. In general, the algorithm to define the integral indicator includes 4 stages: 1) selection of coefficients that most reflect special features of financial and economic activities of corporations in the machine industry and their calculation; 2) determination of a safety margin for each indicator; 3) assignment of significance (weight) rate for each indicator in the system of integral value; 4) calculation of the integral value for the indicator to assess the financial safety of joint-stock partnerships in the machine industry.

Thus, we consider it necessary to introduce into the system of initial economic values (on the basis of which the integral value will be calculated) only those indicators of property status,

profitability, financial sustainability, liquidity, business and market activity that most show the specific nature of financial and economic activities, product life cycle and organizational and legal form of these business entities. In the meantime, despite the importance of market activity indicators on the basis of which the effectiveness of joint-stock partnerships operating can be exactly characterized, we will take into consideration only the indicator of re-investment and return on joint stock capital (it is calculated on the basis of book value of shares) because other indicators are impossible to define owning to insufficiency of data about market value of shares for the majority of national joint-stock companies.

The next stage of the integral analysis is determination of a safety margin for each of initial economic indicators that characterizes a value of its stability. In addition, in order to avoid a significant difference in indicators of various machine-building business entities due to their specific character of settlements with debtors and creditors, stock management policies, stages of product life cycle etc., we found it necessary to calculate a relative safety margin. Namely, we took the theory of properties of solids as a base for calculation of a safety margin, in particular, the safety coefficient of parts and machines that is calculated in the following way: the correlation between the maximum (boundary) stress, which is characteristic of a given material, and its real value, in case, when a real value of stress should be less than the clearly defined magnitude which is regulatory, a safety margin is determined according to the boundary stress [9, с. 8—9].

Having extrapolated the above indicated into peculiarities of calculation of financial state coefficients, we will use it to calculate a safety margin of those coefficients the value of which has to be less than the clearly defined limit. In case that values of indicators, on the contrary, have to increase in dynamics in the absence of the maximum permissible limit, a safety margin will be calculated as the ratio of their real (or regulatory defined different from zero limit) value to maximum permissible — determination of a safety margin according to the boundary stress.

Thus, under condition when the recommended value of an indicator has to be less than the certain number that is a safety limit, it will be calculated according to the formula:

$$Z_i = K_0 / K_n \quad (1)$$

In case if the normative value of an indicator is moving towards an increase at the defined limit or in the absence of the clearly defined limit, a safety margin is calculated according to the formula:

$$Z_i = K_n / K_0, \quad (2)$$

where k_n — the real value of an indicator, k_0 — boundary (normative) value of an indicator (known quantity or not clearly defined).

The integral indicator of financial safety for joint-stock companies is a sum of a safety margin for each indicator introduced into the population of those on basis of which it is calculated in the certain period and this sum is adjusted to its weight rate assigned in the sample of coefficients:

$$Z = \sum_{i=1}^{n} Z_i \times q_i, \quad (3)$$

where Z — the integral indicator of financial safety for joint-stock companies in the certain period of time;

Z_i — a safety factor according to i-th indicator;

n — number of indicators making up the integral indicator (14);

q_i — weight rate of each indicator in the value of safety margin integral variable (from 2 to 5).

In addition we will note that assigning weight to each coefficient is intended to smooth out values of safety margin which will be (sometimes markedly) different at the analyzed corporations under the influence of the above mentioned factors. In general, the structure and algorithm of a safety margin calculation according to these indicators are shown in Table 1.

Let’s explain in greater detail the way how we calculate a value of safety margin which is in fact a stock of increase or decrease of the appropriate indicator by means of determining the limit

value of deviation of the real indicator value from the (normative) recommended one. In this connection, a safety margin will be calculated for each of the defined indicators in diverse ways.

So, as the limit value of depreciation coefficient exceeding of which is a threat to the level of financial safety we took the threshold of its increase — 0,5, that is why a safety margin for it will be calculated using formula 1, namely $z_1=0,5/k_1$.

Indicators of profitability in return on assets, sales and return of equity shall be greater than zero and rise in the dynamics. Therefore, safety margins for them will de defined according to formula 2. Considering that the upper bound for increase of the given indicators has not been determined, we consider it necessary to determine them by expert means taking into account their development potential. The upper bound for return on assets is considered 50%, assuming that the business entities are likely to provide gaining of the profit that makes up half the cost of all assets. Taking the same principle for determination of the upper bound as a basis, it amounts to 0,7 for profitability of sales and return on equity. Hence, safety margins for the referred indicators will be determined by formula 2, namely $z_2=k_2/0,5$, $z_3= k_3/0,7$, $z_4=k_4/0,7$.

Table 1

The system of indicators for the integral assessment of financial safety of machine-building corporations and the algorithm of calculation of their safety margin

№ s/n	Name of indicator	Normative value of indicator, K	Real value of indicator, K_n	Safety factor		Weight, q_i
				Threshold of safety facor, K_0	Formula of calculation, Z_i	
1	Depreciation coefficient	<0,5, decrease	k_1	0,5	$0,5/k_1$	3
2	Coefficient of return on assets	>0, increase	k_2	0,5	$k_2/0,5$	5
3	Profitability of sales	>0, increase	k_3	0,7	$k_3/0,7$	4
4	Return on equity	>0, increase	k_4	0,7	$k_4/0,7$	5
5	Cover ratio	>1, increase	k_5	1	$k_5/1$	4
6	Equity ratio (business solvency)	>0,5 increase	k_6	0,5	$k_6/0,5$	4
7	Financing coefficient	<1, decrease	k_7	1	$1/k_7$	5
8	Asset turnover coefficient	>0, increase	k_8	2	$k_8/2$	3
9	Inventory turnover coefficient	>0, increase	k_9	5	$k_9/5$	2
10	Property assets turnover coefficient (return on assets ratio)	>1, increase	k_{10}	1	$k_{10}/1$	3
11	Accounts receivable turnover coefficient	>0, increase	k_{11}	43	$k_{11}/43$	2
12	Accounts payable turnover coefficient	>0, increase	k_{12}	14	$k_{12}/14$	2
13	Re-investment coefficient	>0, increase	k_{13}	3	$k_{13}/3$	4
14	Coefficient of return on stockholders' equity	>0, increase	k_{14}	16	$k_{14}/16$	4

Note: original authors' work.

The boundary value for the cover ratio is 1, exceeding of which proves effectiveness of formation and use of financial recourses at a corporation that meets their financial obligations in a timely manner. If that value is less than 1, an enterprise is illiquid. A safety margin for this coefficient is calculated from formula 2, that is $z_5=k_5/1$.

According to this formula a safety margin for equity ratio is calculated and it is equal to $k_6/0,5$, as its value has to be > 0,5 (at the margin of safety — 0,5), and for financing formula 1 is

applied, substituting the data in which we have $z_7=1/k_7$ (at $k_0 = 1$).

We will calculate a safety margin for asset turnover and inventory turnover coefficients in the same way, as these indicators were introduced into the calculation of the integral indicator, and their values have to be more than zero and rise in the dynamics. However, with the purpose to make the required calculations let's set the ceiling (threshold) values at level of 2 and 5 for them again by expert means taking into account the potential for their development. Correspondingly we have for asset turnover — $z_8=k_8/2$, for inventory turnover — $z_9=k_9/5$.

The same formula (2) is used to calculate a safety margin for the coefficient of return on assets — $z_{10}= k_{10}/1$, considering that its value shall be >1 (at $k_0=1$) (see *Table 1*).

We want to underline again that the hypothetical limit values of these coefficients are established in view of their exterior maximum values obtained by analyzing national machine-building corporations with due account for the potential of their increase. Thus, 43 can be considered as the threshold value for the indicator of receivable turnover, the boundary value for accounts payable indicator is 14. Hence, the safety margins for coefficients of accounts receivable and payable turnover are calculated by formula 2, according to which we have: for the first indicator $z_{11}=k_{11}/43$, for the second one — $z_{12}=k_{12}/14$.

In relation to the market-value ratio which we use to calculate the integral indicator of financial safety, their safety margin is also calculated according formula 2. In the absence of regulatory values for these indicators, we consider it necessary to set it at a level of 3 for the re-investment coefficient and 16 — for return on stockholders' equity bearing in view the above mentioned mechanism of calculation of threshold values for a safety margin based on the choice of the highest value among them taking into account the potential of their increase, in order to justify the grounds for development of a business entity or its financial safety upgrade. Consequently, for the re-investment indicator formula 2 is evolved into $z_{13}=k_{13}/3$, for the coefficient of return on stockholders' equity into $z_{14}=k_{14}/16$ correspondingly. In addition, we will note: the re-investment coefficient is deemed to be equal to 0 for unprofitable enterprises because it is not calculated under the conditions of meeting losses, so their safety margin is also equal to 0.

To strengthen the reliability of the findings, let's introduce a weight rate for each indicator that will show its place in the integral value of financial safety and smooth out the difference between values of safety margins taking into account differences in volumes, peculiarities of economic management and life cycle of sold production at machine-building corporations. To complete this task let's use the method of expert assessments by means of assigning each coefficient a certain rate (from 2 point to 5 points).

The highest rate of 5 points is given to coefficients of return on assets, return on equity and financing. The referred indicators are sufficient to assess in general a level of financial safety for a corporation, placing emphasis on keynotes (or threats) of profitable (unprofitable) business, low (high) financial leverage.

We think that the following indicators allow making a deeper analysis and should be added to the above-mentioned indicators, in particular profitability of sales, return on stockholders' equity, business solvency, current liquidity ratio and reinvestment of profit. They are assigned the rate of 4 points. The analysis of these coefficients enables to systematize such keynotes (threats) as profitability (unprofitability) of core activities, ability (inability) to meet short-term financial obligations, availability (lack) of sufficient amount of costs to allocate into the current activity and reinvestment.

We consider indicators of depreciation of fixed assets, assets turnover, debit debt and return on assets as complementary to the abovementioned ones and they make possible to assess the efficiency of use of corporation assets. However, even in the conditions of operating at a loss they can be positive and enter the range of recommended values, so in order to avoid distorted results in the calculation of the integral value of financial safety let's give them less weight in the referred indicator — 3 points.

Considering the fact that machine-building corporations commonly have problems with sales of stocks and accounts receivable, there are some technical and technological special features

of production, type of production and its life cycle (as a result, their turnover indicator at unprofitable enterprises can be larger than at profitable ones) let's assign to the coefficients of inventory turnover and accounts receivable turnover the weight rate equal to 2 points.

The point is that, for example, the public corporation PAT Elektrotermometria sells devices and equipment to measure temperature and PAT SKF Ukraina sells conical roller and needle roller bearings and their components. It is obvious, that the purchase of such equipment does not require significant costs in comparison with the purchase of production of PAT Motor Sich that sells aircraft engines and gas turbine systems or PAT Turboatom that effects a sale of steam and hydraulic turbines and other power-generating equipment and which are included in the sample of compared enterprises. It means that production of PAT Elektrotermometria and SKF Ukraina, that has a shorter life cycle, is cheaper, debtors pay its cost practically at once after the purchase and the period of its sales is also shorter. Thus, such importance is placed on these coefficients to avoid a distortion in calculations caused by technical and technological specific features of certain corporations that are included in the sample for analysis.

The faster the production is sold and paid, the faster a business entity meets their financial obligations and it results in acceleration of accounts payable turnover. Considering the coefficient of accounts payable turnover as a complementary one to the abovementioned indicators of business activity, let's give it the same rate of 2 points (see *Table*).

It is appropriate to use Excel spreadsheets to make the calculation of the integral indicator, particularly when there is a large sample of corporations for the analysis.

Conclusions. Thus, the suggested approach to the integral assessment of financial safety of corporations is based on a broad combination of separate tools of possibility theory, expert and statistical methods and involves improvement of: 1) the algorithm of formation of initial indexes — the sample of indicators that most reflect special features of financial and business activity of economic operators in the machine-building industry, their organizational and legal form and production life cycle; 2) calculation of sub aggregates (intermediate indicators) that are included into the integral indicator on the basis of the theory of a safety margin of solids under conditions of their compression and stretching; 3) the procedure of formation of the integral value of financial safety on the basis of summing up the values of safety margins for each indicator that constitutes the initial base for making calculations and considering their weight rate. This approach enables to simplify the analysis of financial safety status, being limited to a small number of indicators; to introduce into their range even those indicators values of which are hypothetical but very important in view of the organizational and legal form of the study enterprises and also to show their financial safety status not only in the static setting but in the dynamics and to compare it with a level of financial and economic activity of other economic operators.

At the same time the suggested procedure of assessment of financial safety of corporations needs practical testing and can be improved depending on the goal and tasks of a research investigation.

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