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EDITORIAL

MODIFICATION OF THE FINANCIAL SECURITY DATABASE IN RUSSIAN INDUSTRIAL ORGANIZATIONS

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Abstract

Definition of interconnected compositions in the context of the national and economic security of Russia is one of the constituent positions of strengthening the competitiveness and financial independence of Russian industrial organizations. Verification of the data array information flow is largely a tool base for determining key facts when challenges and threats arise. Therefore, the main goals of the article are building the database and mathematical definition of the relationship among indicators to establish the level of the financial security of Russian industrial enterprises. Dialectical research methods determine the fundamental foundations of the issue under study. The proposed methods for integral evaluation of the financial security reflect individual positions in the system of financial risk evaluation and combine both positive and negative features of the industrial production development. The groups for the financial risk evaluation at industrial organizations have been identified in the article as a result of the multicriteria evaluation and the calculated integral indicator, which became the basis for evaluating the competitiveness and financial sustainability both at the current time and in the forecast future.

Keywords

Financial security – Indicator – Industrial productions – Toolkit – Block

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Introduction

Ensuring the national and economic interests of Russia in the international community is based on overcoming various emerging challenges and threats in order to strengthen the country's economic space and its components. The concept of the security system of organizations is revealed in the elimination of economic threats to counter challenges by creating a risk management system. It is comprehensive and balanced, not excluding the evaluation of the resource potential of economic security and public administration[1]. According to the Federal State Statistics Service, Russia has more than doubled its gross domestic product over the past decade from 2010 to 2019, but the average annual increase in the volume index does not exceed 10 %. Industrial production accounts for more than 20 % of the gross value added in gross domestic product. As a result, the need to develop a tool base aimed at risk prevention should be targeted and determined by the efficient use of resources[2]. The issue of economic security, both from the standpoint of the national economy and in the regional and economic context, is becoming relevant against this background.

Creation of the modern information resources that allow to quickly and accurately evaluate the economic development of Russian industrial organizations includes innovations in various areas of monitoring for the financial security evaluation. The main specifics of the problems in information functioning and the tool base in relation to reducing risks and threats to economic security are observed in some works of foreign and domestic researchers on theoretical and practical aspects[3]. Conclusions on the use of integral evaluation as one of the options for monitoring the financial security of organizations are well-reasoned[4]. There

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are several reasons for conducting an integral evaluation of the financial security: to determine the potential in business cooperation, to evaluate the efficiency of investments at the state and regional levels, and to take managerial decisions to improve or stabilize the work of a particular type of economic activity and economic agent[5]. Given this, it can be concluded that the following most common tasks are solved in the study of the financial security: timely and objective diagnosis of the financial condition of an economic agent, the establishment of its problem issues and the study of the reasons for their occurrence; the search for reserves to improve solvency and financial stability; the development of specific activities aimed at a more efficient use of resources and strengthening financial positions; as well as forecasting possible financial results and developing financial condition models for various options for using resources[6]. These issues determine the need for a substantive study of the list of parameters related to conceptual issues of ensuring the financial security of Russian industrial organizations.

Methods

The problem of developing methods for building a comprehensive evaluation of the financial condition based on the integral indicator is quite relevant. The issue of developing a system of indicators for financial analysis has been repeatedly raised in economic science[7]. Therefore, only the indicators and characteristics that can reflect the financial security of Russian industrial organizations independently or in combination with other indicators should be selected when building a system of diagnostic indicators. The authors used a systematic approach to studying the content of the organization's economic security and the possibility of using the existing methods to evaluate the financial security indicators, because the functioning of an economic agent is described by a set of criteria with a relative

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value, which can be managed only by influencing certain parts and processes. Modification of traditional indicators of the financial state of organizations allowed the authors to identify three blocks of the financial security in calculating the integral indicator. Each block includes basic indicators of the financial security, which meet the principles of visibility and reliability. The works of Russian and foreign scientists on the development of industrial production and of the tool base for evaluating the above indicators of the financial security in the field under study served as the theoretical basis. Such methods as deduction and induction, economic statistical method, analysis and synthesis, scientific abstraction, formalization, and grouping were used in the study when analyzing specific situations and identifying key patterns.

Certain types of industrial production are positioned based on the comparative and dynamic analysis. The use of this kind of monitoring the financial security provides an opportunity to expand the visualization of the obtained data on a specific group of indicators. A set of indicators describing the financial security is a time series from 2009 to 2018, which describes the change in certain parameters over this period. For the convenience of presenting the information, each type of economic activity in industrial production is assigned a code with the division by class. Application of the Pareto principle allows to form an efficient set of selected indicators during the multicriteria evaluation of the financial security of industrial organizations. The use of these methods allows to identify and illustrate the main positions of the financial security of Russian industrial organizations and identify the key threats.

Results

System of the financial security indicators

The economic development of organizations is part of a single socioeconomic system of the country and its regions. At the same time, economic agents are a special structure, which is described by its own distinctive features in the resource-based, production, scientific and technological, and financial sectors. The position is presented quite reasonably that the level of the financial security of Russian industrial organizations is determined in relation to the tasks of identifying and evaluating the entire complex of threats describing reliable protection against external and internal factors that impede functioning[8]. The designation of the financial sector elements used for evaluating the financial security of organizations is determined by the reliability of the available information, which allows to build a system of indicators that evaluate the consequences of the enterprise activities[9]. However, the most accessible approach for the authors is the one that interprets the concept of "financial security" in the context of its division into indicators of several blocks. In the authors' version, the system of the financial security indicators has three blocks covering different angles. For this purpose, it is proposed to take into account the following selected areas of the integral indicator:

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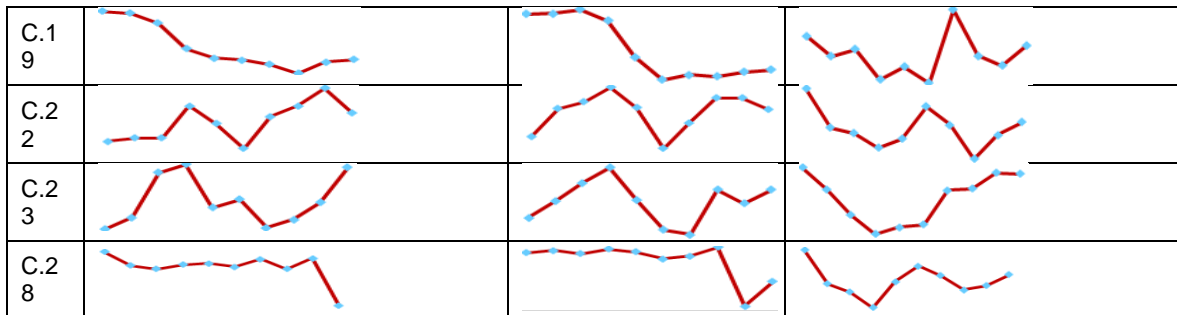PH. D. (C) VERA TIHONOVNA GRISHINA / PH. D. (C) IRINA KIMOVNA ZAKHARENKO

1.   Property of organizations and sources of its formation represent the scope of the production capacity of organizations. The first indicator of the property security is "Growth rate of the property of organizations to the value of the previous year, % ($GRpo$)", which determines the increase in the expected economic benefits of organizations in the current year compared to the base one. The indicator "Growth rate of funds of organizations to the value of the previous year, % (GRf)" was studied to expand the dynamic range of the financial security results of industrial organizations. The indicator "Share of overdue accounts payable in the total amount of accounts payable of organizations, % (d_{OdAP})" was selected to provide an opportunity to evaluate the financial well-being and competitiveness of organizations. It must be noted that a high proportion of overdue accounts payable in itself is not a clear signal of bankruptcy for organizations; therefore, an analysis of a time range is more relevant than that of a quantitative value. Another indicator, "Ratio of slow assets to quick assets of organizations, % (Rs/q)", aggregates information on the balance of financial resources required by the enterprise for creating the assets it needs from the perspective of financial and economic activities.

2.   Solvency and financial sustainability. This component represents circumstances reflecting the degree of security of investment in the enterprise. Four reference indicators are identified that adequately reflect various aspects of solvency and financial sustainability of industrial enterprises. The first indicator "Current liquidity ratio, % (R_{CL})" is one of the main indicators reflecting the degree of coverage of the organization's debt obligations with its assets. The next indicator in this block is "Equity ratio, % (R_E)", which illustrates the financial independence of economic agents. The indicator "Turnover of the working assets of organizations, days (T_{WA})" represents the rationality and intensity of using the working capital as the most mobile part of the property of organizations. The final indicator is "Turnover of accounts payable of organizations, days (T_{AP})". This parameter is used to evaluate the organization's cash flows and the rationality of settlement transactions.

3.   Financial results of organizations, the efficiency of using assets and sources of their formation. Compliance with intrafirm obligations at the microlevel by transforming practical results in the financial sector is required to ensure the financial security of organizations. In the opinion of the authors, this is one of the key blocks in the financial security of organizations. Similar to the above blocks of the financial security of industrial organizations, it is proposed to use three factors to analyze the financial results of organizations, the efficient use of assets, and the sources of their formation. They describe financial activities from different angles. The factor "Return on products (goods, works, services) sold by organizations, % (R_P)" indicates threats in the field of the financial security and the evaluation of enterprises in a specific type of economic activity. The indicator "Return on assets of organizations, % (R_A)" collects information on the efficiency of using property of the enterprise as a fundamental resource. The indicator "Share of unprofitable organizations, % in the total number of organizations (d_u)" with a two-sided nature in the management of the organization is final in the presented block. On the one hand, the number of unprofitable organizations largely describes the level of the financial security of the Russian industry, while on the other hand, their presence denies the concept of increasing the value of assets and the sources of their formation.

As part of this work, the authors presented the generation of a large amount of data by type of industrial productions in Russia in a specific sample as sparklines (Table 1).

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Type code for industrial	Property of organizations and sources of its formation			
	Growth rate of the property of organizations to the value of the previous year, % (*GRpo*)	Growth rate of funds of organizations to the value of the previous year, % (*GRf*)	Share of overdue accounts payable in the total amount of accounts payable of organizations, % (*dOdAP*)	Ratio of slow assets to quick assets of organizations, % (*Rs/q*)
B.05 – B.06				
C.10 – C.12				
C.16				
C.26 – C.27				
D.35				
	Solvency and financial sustainability			
	Current liquidity ratio, % (*RCL*)	Equity ratio, % (*RE*)	Turnover of the working assets of organizations, days (*TWA*)	Turnover of accounts payable of organizations, days (*TAP*)
B.07 – B.09				
C.17 – C.18				
C.20 – C.21				
C.24 – C.25				
C.29 – C.30				
	Financial results of organizations, the efficiency of using assets and sources of their formation			
	Return on products (goods, works, services) sold by organizations, % (*RP*)	Return on assets of organizations, % (*RA*)	Share of unprofitable organizations, % in the total number of organizations (*du*)	
C.13 – C.14				
C.15				

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C.1 9			
C.2 2			
C.2 3			
C.2 8			

Source: Calculated using the data from the Russian Federal State Statistics Service according to the classifier of codes OKVED OK 029-2007

Table 1

Sparklines of indicators describing the financial security of Russian industrial organizations

Note: B.05 – B.06: Coal mining. Crude oil and natural gas production; B.07 – B.09: Mining of metal ores. Extraction of other minerals. Provision of services in mining; C.10 – C.12: Food production. Beverage production. Production of tobacco products; C.13 – C.14: Production of textiles. Production of clothing; C.15: Production of leather and leather products; C.16: Wood processing and production of wood and cork products, except furniture, production of straw products and weaving materials; C.17 – C.18: Production of paper and paper products. Printing and copying of information media; C.19: Production of coke and petroleum products; C.20 – C.21: Production of chemicals and chemical products. Production of medicines and materials used for medical purposes; C.22: Production of rubber and plastic products; C.23: Production of other nonmetallic mineral products; C.24 – C.25: Iron and steel production. Production of fabricated metal products, except machinery and equipment; C.26 – C.27: Production of computers, electronic, and optical products. Production of electrical equipment; C.28: Production of machinery and equipment not included in other groups; C.29 – C.30: Production of motor vehicles, trailers, and semitrailers. Production of other vehicles and equipment; D.35: Supply of electric power, gas, and steam; air conditioning.

An analysis of indicators in dynamics allows to draw the following conclusions: some indicators have a positive trend: they include a reduction in the number of unprofitable organizations in the total number of organizations (from 1.6 % to 20.5 %), an increase in the return on products (goods, works, services) sold (from 0.8 % to 19.5 %) and return on assets (from 0.1 % to 8.6 %); the negative dynamics in the annual growth rate of property (from 0.8 % to 23.1 %) and funds (from 2.4 % to 51.6 %) are observed, which is reflected in an increase in the working capital turnover of organizations and causes the financial security risks; despite the unstable policy of settlement relations with creditors, the share of overdue debt is reduced (from 0.3 % to 11.4 %), which stabilizes the solvency of organizations. The authors' system of indicators describes the generating financial security provisions inherent in most types of the Russian industrial production.

Toolkit for the evaluation of the financial security

Due to the significant amount of the source data, the information field is unstructured, and the indicators determining the financial security of industrial organizations have a variety of units and dimensions. Therefore, a relevant authors' position is proposed for calculating the integral indicator for the collection and processing of information using a four-level hierarchy of statistical indicators, which generalizes the scale measurement to a single standardized value, as illustrated in Figure 1.

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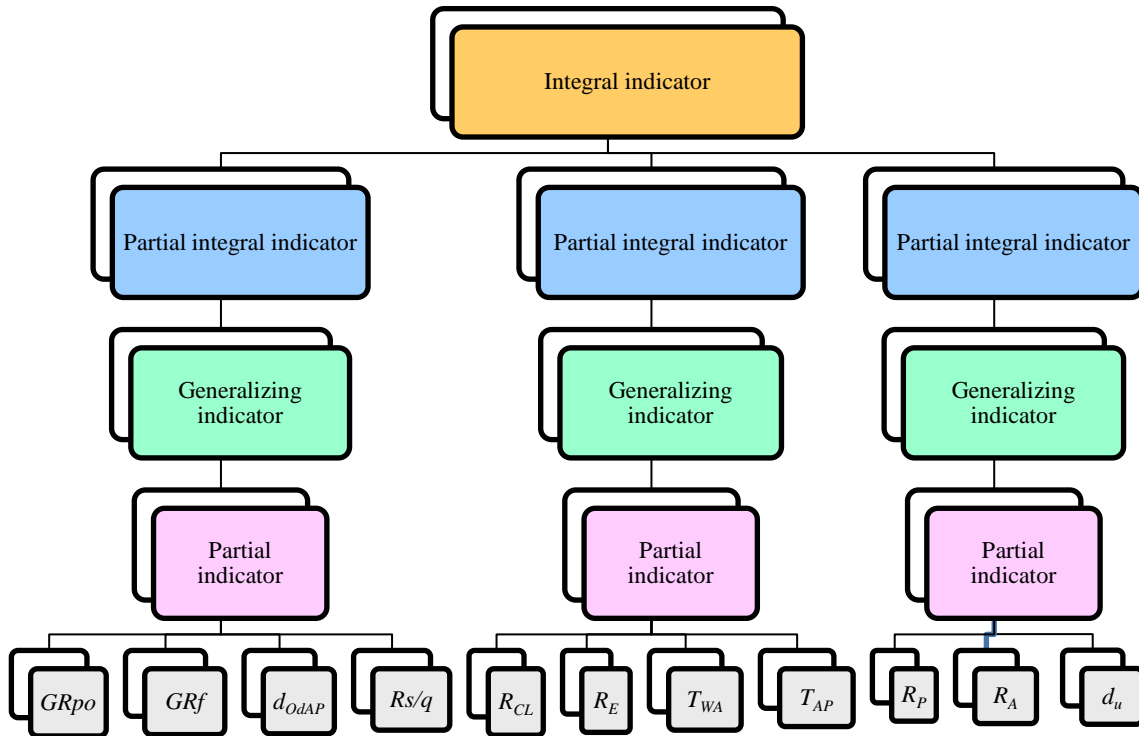
Figure 1
Flowchart of indicators in evaluating the financial security
of industrial organizations in Russia

The integral indicator of the w-th type of economic activity in industrial production (I_w) was calculated based on the additive model using the following formula:

$$I\_w = \sum\nolimits_{(i=1)}^{I} r\_{wi}\ p\_i, \quad (1)$$

where w was the number of types of economic activity of industrial production, $w = \overline{1,W}$;

i was the number of partial integral indicators, $i = \overline{1,I}$;

r_{wi} was the i-th private integral indicator of the w-th type of economic activity in industrial production; and

p_i was the expert weight of the i-th private integral indicator.

The authors studied various options for determining weights when defining the contribution of the partial integral indicators in the above blocks to the general integral indicator of the financial security. The choice of a scale for the partial integrated indicators is justified by the analysis of the existing external and internal threats to the financial security of industrial organizations. The logic of the presented approach is based on the fact that the indicators posing a threat to the loss of competitiveness, nonpayments, and transformation of fixed capital are the most important.

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The formula for determining the i-th partial integral indicator of the w-th type of economic activity in industrial production (r_{wi}) is as follows:

$$r_{wi} = \prod_{j=1}^{J_i} l_{wij} \,, (2)$$

l_{wij} is the j-th generalizing indicator of the i-th partial integral indicator of the w-th type of economic activity in industrial production.

The following indicators were used to determine the j-th generalizing indicator of the i-th partial integral indicator of the w-th type of economic activity in industrial production (l_{wij}):

– direct generalizing indicator:

$$l_{wij} = \frac{\overline{PI}_{wij}}{max\{\overline{PI}_{wij}\}} \,, (3)$$

– inverse generalizing indicator:

$$l_{wij} = \frac{min\{\overline{PI}_{wij}\}}{\overline{PI}_{wij}} \,(4)$$

– normative generalizing indicator:

$$l_{wij} = \frac{\overline{PI}_{wij}}{opt(PI)}, (5)$$

where $\overline{PI}_{wij}$ was the average value of the partial indicator for the j-th generalizing indicator of the i-th partial integral indicator of the w-th type of economic activity in industrial production.

The authors transformed the selected system of indicators using the algorithm of the average value of the partial indicator for the j-th generalizing indicator of the i-th partial integral indicator of the w-th type of economic activity in industrial production ($\overline{PI}_{wij}$) based on the geometric mean value:

$$\overline{PI}_{wij} = \sqrt[T]{\prod_{t=1}^{T} PI_{wijt}} \,, (6)$$

where t was the period of the study, $t = \overline{1,T}$; and

PI_{wijt} was the partial indicator for the t period of the study for the j-th generalizing indicator of the i-th partial integral indicator of the w-th type of economic activity in industrial production.

Each of the partial integral indicators contributed to the general indicator of the financial security of the system under evaluation when they were calculated. The visualization of information for individual blocks of the financial security by the types of industrial production is presented as a radar chart in Figure 2.
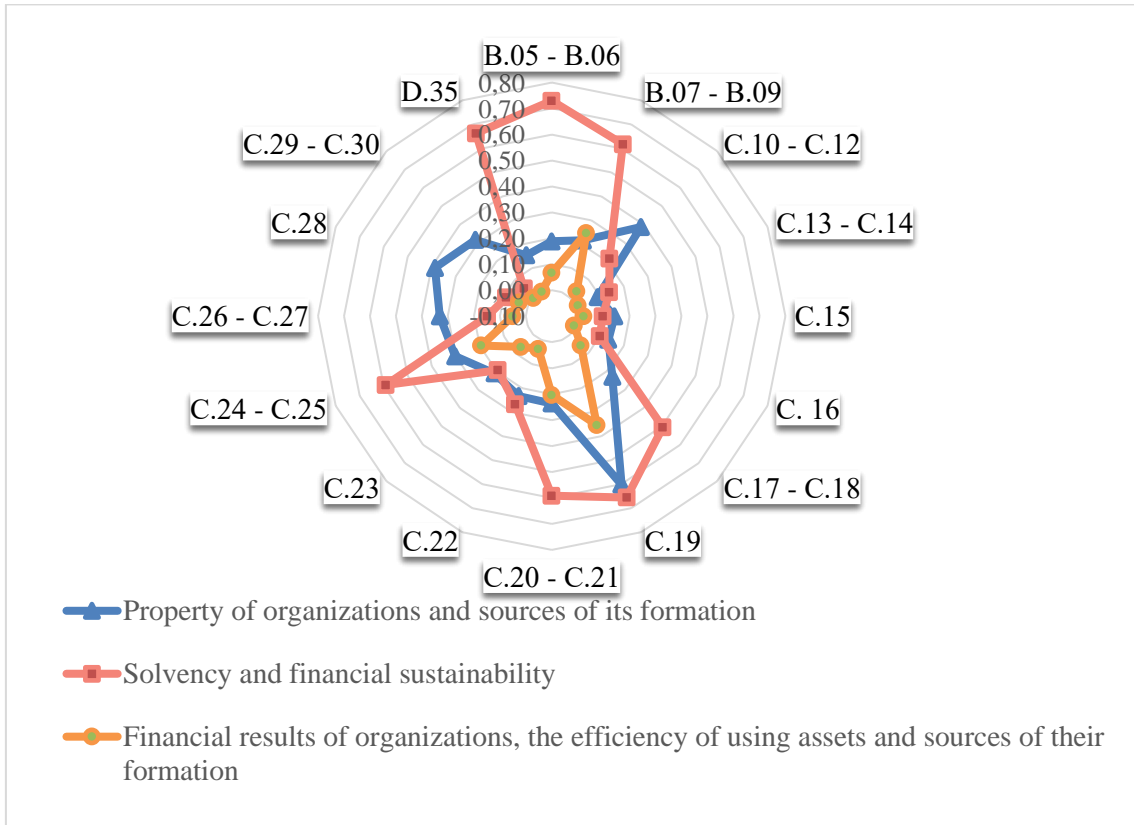
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Source: Calculated using the data from the Russian Federal State Statistics Service according to the classifier of codes OKVED OK 029-2007

Figure 2

Partial integral indicators of the financial security of Russian industrial organizations

The presented data demonstrate a significant differentiation of the industrial production types in the areas of the financial security. A significant imbalance is observed in the block of solvency and financial sustainability. The mining types of industrial production; provision of electric power, gas, and steam: air conditioning; production of coke and petroleum products; production of chemicals and chemical products, medicines and materials used for medical purposes; iron and steel production, and production of finished metal products, except machinery and equipment, are the undoubted leaders in it. The most catastrophic situation regarding the financial results of organizations, the efficiency of using assets and sources of their formation is observed in the processing of wood and the production of wood products; production of textiles and clothing; and production of motor vehicles, trailers, and semitrailers. The financial security in the use of property and sources of its formation is described by the ordered value of the partial integral indicator, with the exception of enterprises engaged in the production of food, beverages, tobacco products, and the production of coke and petroleum products.

The authors applied the Pareto principle to conduct a multicriteria evaluation of the financial security for Russian industrial organizations. As a result, an efficient set of economic activities was created in terms of the selected blocks (Table 2). The numbers indicate the place of the economic activity type of industrial production for each block of the financial security. Green colors reflect the classification of industrial production in the first

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category according to the rules of the multicriteria evaluation, while red colors reflect the classification in the last category.

Type code for industrial production	Property of organizations and sources of its formation	Solvency and financial sustainability	Financial results of organizations, the efficiency of using assets and sources of their formation
B.05 – B.06	12	1	6
B.07 – B.09	10	4	2
C.10 – C.12	3	9	10
C.13 – C.14	16	12	13
C.15	14	14	12
C. 16	15	13	16
C.17 – C.18	9	7	7
C.19	1	3	3
C.20 – C.21	7	6	3
C.22	8	8	11
C.23	11	10	5
C.24 – C.25	6	5	4
C.26 – C.27	4	11	8
C.28	2	15	9
C.29 – C.30	5	16	15
D.35	13	2	14

Table 2
Industrial production ranking by the financial security blocks

According to the obtained data, it can be concluded that generalized partial integral indicators for all the financial security blocks have leading positions in four types of industrial production. Two types of industrial production stand out as lagging production types, which implies problems in financial development explained as threats to the financial security. In some cases, the industrial production types with low partial indicators for one of the financial security blocks have high or average values for the other blocks. In the property block of industrial organizations and sources of its formation, 62.5 % of the industrial production types are included in the first category, while the middle and the last fields of the financial security account for 18.75 % each, accordingly. In many types of industrial production, there is a trend of unsatisfactory solvency and financial stability – 25 %, as well as unsatisfactory financial results and efficiency of using assets and sources of their formation – 37.5 % of the total number of Russian industrial enterprises. The use of partial integral indicators allows to trace the general situation in certain areas of the financial security of Russian industry.

Method of the financial security analysis

The types of industrial production are classified by the level of the financial security based on an additive time series model. The Russian industrial enterprises are grouped into four associations according to the level of the financial security, depending on the chosen level of financial condition and according to the threshold values of the integral indicator established by the calculation method (Table 3). The resulting stratification should be considered as one of the threats and risks to the national security of Russia to the greatest extent, which requires reasonable directions for their prevention and neutralization.

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Level of the financial security	Criteria	Description
Dangerous	<0.216	Organizations are subject to high financial risk. The area of a dangerous condition is where all partial integral indicators, or most of them, are in the last category according to the results of an effective set.
Problem	0.216 – 0.347	Organizations are in a problem zone when one of the partial integral indicators is assigned to the first category of an effective set, but there are blocks of the financial security that are located in or close to the area of a dangerous condition.
Potential	0.347 – 0.478	An area of the potential financial security, where individual blocks are in the first rank of an effective set in the leading positions, but the degree of return on individual parameters does not reflect a favorable value.
Favorable	>0.478	Partial integral indicators are located in the first positions of an effective set, the degree of use of the indicators used meets the financial security of industrial organizations.

Table 3
Evaluation of the financial security of industrial production in Russia

The average values of the selected indicators were calculated based on the obtained data in order to evaluate the financial security of industrial organizations over time for 2009 – 2018 (Table 4). A significant stratification of the financial security of industrial production is observed in the block "Financial results of organizations, the efficiency of using assets and sources of their formation" for the presented indicators. For example, the level of return on products (goods, works, services) sold for the "favorable" zone of the financial security demonstrates a difference of 15.8 % from the "dangerous" zone. It must be noted that the high level of the share of unprofitable organizations by type of economic activity in the total number of organizations is a distinctive feature of the industrial production types assigned to the "potential" level of the financial security. The main types of production for this zone are mining of metal ores and other minerals, as well as the production of coke and petroleum products. Obviously, the main reasons are regional and technological monopolism, private-state partnership in the implementation of projects, and the preservation of cross subsidization. The opposite pattern is observed in some indicators for the "dangerous" zone of the financial security in Russian industrial organizations. For example, the value of slow assets in relation to quick assets is 8.15 times higher than the value recorded for the "favorable" zone.

Indicator	Dangerous	Problem	Potential	Favorable
Growth rate of the property of organizations to the value of the previous year, %	108.6	108.8	110.3	113.6
Growth rate of funds of organizations to the value of the previous year, %	112.4	113.9	113.5	132.7
Share of overdue accounts payable in the total amount of accounts payable of organizations, %	6.0	5.1	8.6	7.8

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Ratio of slow assets to quick assets of organizations, %	2,114.2	2,096.4	1,475.6	1,299.1
Current liquidity ratio, %	139.9	137.7	150.0	149.9
Equity ratio, %	46.6	54.6	56.0	53.8
Turnover of the working assets of organizations, days	225.4	140.9	164.9	189.8
Turnover of accounts payable of organizations, days	106.8	74.7	62.4	56.1
Return on products (goods, works, services) sold by organizations, %	6.7	7.7	17.9	22.5
Return on assets of organizations, %	1.3	3.8	7.8	8.8
Share of unprofitable organizations, % in the total number of organizations	29.5	31.0	31.7	32.5

Source: Calculated using the data from the Russian Federal State Statistics Service according to the classifier of codes OKVED OK 029-2007

Table 4
Average value of the financial security indicators in Russian industrial organizations

This ratio influences the low turnover of the working assets, which most influences the occurrence of risks and threats in the flexibility and adaptation of the development of industrial production in the foreign and domestic markets. A sufficiently high level of growth rate of funds in industrial enterprises belonging to the "favorable" zone, in contrast to the industries classified as the financial security danger zone – more than 20 %, influences the differentiation of the current liquidity ratio by 10 %. The results of analyzing the financial security of industrial enterprises can be used to identify possible solutions to the existing risks and threats associated with a unified state development strategy aimed at developing cooperation among government agencies at all levels, the business community, and public organizations.

Discussion

The results of this study present reasonable basic elements of the financial security of Russian industrial organizations, which all together ensure the interaction among the property, solvent, and effective potential. The authors' hypothesis has been confirmed that the use of the described tool base allows to mathematically identify the interactions among individual components, which will reduce financial risks and threats in the further development of solutions. The study of methodological principles reflects the increased attention to the improvement and modification of methods in the analysis of complex systems. The system of the financial security indicators in Russian industrial organizations has been provided in the study, which allows to identify potential challenges in the allocated zones of the financial security. The resulting symbiosis of the partial integral indicators determines the stability and competitiveness both at the current time and with a forecast for the future. The authors' set of indicators covers the key positions of the issue under study, which are characteristic of most economic agents and can be applied to industrial production as a whole. The results are based on the comprehensive database that is acceptable for use by management bodies at various hierarchical levels for preventing risks and threats to the financial security of the Russian industrial production.

Conclusion

As such, the importance of each of the selected indicators is considered to be a necessary condition when evaluating the level of the financial security of the Russian industry. The authors have developed a toolkit to modify the financial security indicators and the composition of the partial integral indicators. At the same time, an integral approach to evaluating the financial security using interval boundaries has been formed on the basis of the block of organizations' property and sources of its formation, solvency and financial sustainability block, as well as financial results and the efficient use of assets and their sources. The model proposed by the authors contains a subjective evaluation for the monitoring and development methods of the financial security management toolkit for industrial organizations. Further state support should be targeted, taking into account the distinguished features and the integral indicator for certain types of economic activity of industrial production. The results of this study contribute to the development of theory and methodology in terms of identifying indicators that provide an evaluation of the companies' capabilities to reconfigure the existing resources, as well as the ability to analyze and respond to changes in the external and internal environment in order to ensure the national security of Russia.

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