



Research article

Determinants of enterprise's financial security

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Abstract: Our main purpose of the article was to substantiate the methodical approach to assess the enterprise's financial security based on the use of a model set for determining its parameters depending on the characteristics of financing activities and the associated level of risk. The proposed approach created opportunities to determine the parameters of the enterprise's financial security on the scale "level – status – position – zone" in the process of current and strategic management of not only financial security, but also the success of the enterprise as a whole. Based on the financial statements of Ukrainian enterprises by type of economic activity, the key financial indicators calculated and the parameters of their financial security over the past 9 years were determined. The research confirmed the decisive impact on the enterprise's financial security, the features of financing their activities, and the associated risk level. The practical use of the proposed approach proved that it is a convenient, understandable and informative tool for determining the parameters of the enterprise's financial security by the major indicators: Financial stability, liquidity, profitability, and activity financing risk.

Keywords: financial security level; financial security status; financial security position; zones of financial security; activity financing risk; bankruptcy risk

JEL Codes: D25, G32, G33, M21

1. Introduction

The increase in the number of risk factors in modern economic conditions and the need to eliminate the impact of various external and internal threats to the functioning of the enterprise necessitate the formation of a financial security system, one of the major elements of which is the mechanism to assess its parameters. In a generalized form, the enterprise's financial security is characterized by effective indicators of its functioning in terms of its ability to effectively respond to risks and threats of activity: Resistance to internal and external negative influences; ability to function effectively; and ensuring economic growth in the future.

The issue of assessing the enterprise's financial security in recent decades is the most problematic and controversial among scientists and practitioners. Research analysis of this problem indicates the lack of a unified approach to the methodology for diagnosing the enterprise's financial security. Scientists dealing with the problems of financial security substantiate various mechanisms and offer a diverse set of indicators to assess the financial security of the enterprise as the main entity. To date, the major approaches to assess the enterprise's financial security can be considered: Ratio approach (Safargaliev, 2019; Gonchar, et al., 2020; Naranchimeg and Enkhamgalan, 2020; Nguyen and Nguyen, 2020; Vaitkus and Vasiliauskaite, 2022; Hrynyuk et al., 2023 and others); integral, which involves the definition of an integral financial security indicator (Kharchuk et al., 2020; Azarenkova et al., 2021; Onyshchenko, 2021 and others); discriminant (regression) – in the context of crisis management or financial risk management (Foo, 2015; Jimeno-García et al., 2017; Mahmood et al., 2018; Räscolen, 2019; Valaskova et al., 2020; Rossi et al., 2020 and others).

Without diminishing the importance of existing approaches, their focus on individual/discrete factors of influence on the enterprise's financial security should be noted. According to the authors, the enterprise's financial security is primarily determined by an integrated set of components and factors that determine the major aspects of its financial independence and efficiency of operation. The need consider the complex impact of all factors determines the relevance of further improvement of approaches to assess the enterprise's financial security.

Justification of criteria requirements for the determination of the enterprise's financial security should be determined by a system of individual indicators that reflect the quantitative and qualitative characteristics of its condition. In a generalized form, the assessment of the enterprise's financial security level should be based on the definition of possible (or existing) damage due to the onset of hazards. The most theoretically generalized characteristics of the enterprise's financial security indicator assume its compliance with the following major characteristics: Measurability, validity, sustainability, and accessibility. The choice of the right indicators for assessing the enterprise financial security is a complex process and, according to the authors, in addition to generalized requirements, should be consistent with the peculiarities of the functioning of the enterprise, including: Correspond to

the enterprise strategic goals; take into account the stage of the enterprise life cycle; and take into account the specifics and individuality of threats to the financial security of each individual enterprise.

Therefore, the determination of the enterprise's financial security requires a multidimensional assessment, determining the boundaries (values) of zones of varying degrees of risk/security in terms of the potential for the realization of vital interests. The use of certain signs, signals, and symptoms to assess the parameters of the enterprise financial security will quickly determine the sources, nature, directions, and scale of the onset of hazards. Assessment of the parameters of the enterprise's financial security should, first of all, contribute to the localization and neutralization of existing or potential threats, the development of effective measures to overcome, and prevention of crisis phenomena in their functioning. In a generalized form, the main purpose of determining the parameters of financial security can be considered as obtaining objective information about certain aspects of the activities of financial security entities: The degree of satisfaction of financial needs, the state of realization of their financial interests, the level of achievement or loss of the limit mark of certain indicators, and finding out the reasons for the identified deviations.

Thus, our main purpose of the article is to substantiate the methodical approach to assessing the enterprise's financial security based on the use of a models set for determining its parameters depending on the characteristics of activities financing and the associated level of risk.

Accordingly, the major objectives of the research should be considered: Justification of quantitative and qualitative indicative values of the main elements (indicators) of the enterprise's financial security system; development of a mechanism for determining the parameters of enterprise's financial security based on mathematical methods of comparative and discriminant analysis; development of a system of models and matrices for determining the parameters of enterprise's financial security on the scale "level – status– position – zone"; and testing of the proposed approach for determination of financial security on the example of Ukrainian enterprises by the types of economic activity.

The importance of this study lies in the fact that the proposed approach provides opportunities for determining the integrated positions of the enterprise's financial security and their appropriate zoning, depending on the combined impact of the major types of risks associated with the characteristics of financing activities and performance.

Today's global economic challenges against the background of the vulnerability of Ukraine's economy determine the need to ensure and maintain an adequate financial security level of Ukrainian enterprises from the point of view of their financial ability to withstand possible risks and dangers. The sectorial structure and peculiarities of financing activity determine the low financial security level of Ukrainian enterprises in most types of economic activity. Differences in performance indicators of enterprises by various types of economic activity in Ukraine testify to the decisive influence of the features of financing their activities on financial security and the associated level of risk. Thus, this study is relevant.

2. Literature review

The issues of managing the enterprise's financial security and the problems of its evaluation are devoted to a significant number of scientific works of authors from all over the world. Increased interest in this category has been observed since the end of the twentieth century and does not lose its relevance today. Moreover, one of the most controversial issues today is the process and tools for

assessing the enterprise financial security. The basis of modern approaches to the diagnosis of financial security of the enterprise is the assessment of a certain set of financial indicators, which authors group in different ways.

First of all, using individual financial ratios to assess the enterprise's financial security level is the most popular approach in modern practice. According to Poyda-Nosyk (2021) and Onyshchenko (2021), to assess the effectiveness of the enterprise's financial security system, it is necessary to cover four projections: Financial sustainability, liquidity, profitability, and business activity. To determine the level of financial security, scientists propose to use separate financial ratios, for example, Davydenko et al. (2021) – the indicators of liquidity, financial stability and business activity; Hryhoruk et al. (2019) evaluate level financial security based on the double use of Harrington's desirability scale based on liquidity, solvency, and financial stability ratios; and Samorodov et al. (2020) level of enterprise financial security are determined on the basis of simulation modeling tools, namely the Monte Carlo simulation method using liquidity, financial stability, and profitability indicators.

In turn, Kvasnytska et al. (2019) and Stashchuk et al. (2020) assess financial security risks based on profitability, liquidity, solvency, and turnover ratios; and Delas et al. (2015) add asset management ratio and debt management ratios to them. Varnalii and Mekhed (2022) consider a comprehensive assessment of the enterprise's financial security level based on industry ranking, bank ranking, ballot score, probability of bankruptcy analysis, cash flow assessment, and ratio analysis. However, in Pronoza et al. (2022), the basis for ensuring the enterprise's financial security is laid only by the profitability level and the degree of influence of factors on it is assessed using correlation-regression analysis; Tursunov (2020) is only a financial stability factor, and Mulyk (2017) is only a liquidity factor. Koleda and Lāce (2008) use the financial stability ratio, solvency ratio, profitability of equity, and total capital as a basis or the assessment of financial stability and consider it from the position of internal and external influencing factors.

Hrynyuk et al. (2021) and Dokiienko et al. (2021) proposed to determine not only the level of financial security, but also the position and zones of financial security of both operational activities and the enterprise as a whole based on a combination of indicators of degree and type of liquidity and financial stability; and identification of financial security level, position, and zone of the enterprise based on two factors: Financial stability and profitability (Dokiienko and Hrynyuk, 2022).

The second approach is the development of a regression model based on individual financial indicators for assessing the enterprise's financial security. Thus, Nguyen and Nguyen (2020) assess the enterprise's financial security developed regression models, which included liquidity ratios, cash flows, profitability ratios, debt management ratios, asset management ratios, and firm size; Zimon et al. (2020), regarding the regression model of financial security assessment, propose to build on the basis of current financial liquidity ratio, return on sales, and operating cycle; Zwolak (2017) evaluate the enterprise's financial security using the Cobb Douglas curvilinear power regression model and, as a key indicator, use profit on sales and the level of profitability of enterprises.

Third – calculation of the integral indicator of the enterprise's financial security on the basis of individual financial indicators. An integral indicator of financial security is proposed to be calculated by Cherep et al. (2020) based on group integral indicators of financial sustainability, liquidity and solvency, business sentiment, profitability, investment attractiveness, and innovative development; Myachin et al. (2021), based on a combination of coefficients financial sustainability, liquidity, profitability with using a fuzzy-logical approach; Azarenkova et al. (2021), based on integral indicator of property status, liquidity, financial independence, business activity, and profitability;

Sylkin et al. (2020) add quality indicators to them and Ganushchak (2017) the efficiency of the property state and propose to determine, on their basis, an integral indicator of the enterprise's financial security. The original is the comprehensive financial security assessment index developed by Jiao et al. (2015), which includes assessment indicators of macroeconomic environmental security impacts, assessment indicators of financial financing security implications, and assessment indicators of the financial investment security implications.

The fourth approach is diagnosis of the probability of bankruptcy as the main threat to the enterprise's financial security. To assess the enterprise's financial security, some authors (Foo, 2015; Jimeno-García et al., 2017; Mahmood et al., 2018; Răscolen, 2019; Achkasova, 2020; Valaskova et al., 2020; Korepanov et al., 2020; Sylkin et al., 2020; Rossi et al., 2020; Pasternak-Malicka et al., 2021) also suggest using not partial financial indicators or a generalizing integral indicator, but discriminant models for diagnosing the probability of bankruptcy and, in most works, it is the Altman model that is considered.

Some authors combine partial financial indicators with bankruptcy risk assessment, for example, Wieczorek-Kosmala et al. (2018) use incorporate liquidity and/or debt capacity constraint in the aftermath of risk occurrence and the company's ability to self-resist the risk outcomes; Lukason and Camacho-Miñano (2019) use performance indicators such as liquidity, profitability and insolvency analyze the bankruptcy risk; and Buzgurescu and Negru (2020) assess the interrelationship of liquidity, profitability, financial stability indicators with the risk of bankruptcy, and also relate them to delays in the submission of financial statements.

Thus, it should be noted that in recent years, research tools for assessing the enterprise's financial security are becoming increasingly popular. Furthermore, the classic determinants remain at the basis of the definition of financial security: Liquidity, solvency, financial stability, profitability, business activity with some additions, and the use of various tools for their application. However, despite a fairly large number of scientific publications confirming the relevance of this study, a number of theoretical and practical aspects of this multidimensional problem are insufficiently investigated and require improvement.

That is why, in this research, we propose to focus on substantiating the methodological approach to assess the enterprise's financial security based on the use of a set of models for determining its parameters depending on the characteristics of financing their activities and the associated level of risk. The basis of the developed approach is a combination of three factors that characterize the peculiarities and risk of financing the enterprise's activities: Financial stability, liquidity, and profitability, which will allow us to determine the level, status, and position of the enterprise's financial security; as well as an assessment of the bankruptcy risk level based on Altman, Springate's, Taffler and Tisshaw and Lis's models, which will allow us to determine the enterprise's financial security position according to the proposed scale of integral indicators of the probability of bankruptcy. Thus, we believe that the combination of financial security positions based on the three-factor model and the bankruptcy probability assessment model will allow us to determine the location of the enterprise in the security-risk zone or in the unclear zoning sector with a predominant bankruptcy risk or activity financing risk, respectively.

3. Materials and methods

An important element of managing the enterprise's financial security is the formation of an indicator system and the substantiation of its evaluation criterions. In a generalized form, the financial security of the enterprise is determined by the effectiveness of the financing processes management of its activity (both in general and of each type), aimed at achieving the fundamental indicators of the success of the operation: Financial stability, liquidity, and profitability.

Taking into account the determining role of the above indicators for assessing the enterprise's financial security, we suggest using a three-factor model, which provides a step-by-step algorithm for determining the enterprise's financial security level within the limits of the corresponding one-factor model.

The model proposed by the authors is based on: First, taking into account the interdependence of the major components of the enterprise's financial security; second, the unified mechanism of the structurally directed influence of each factor according to the algorithm: "Degree of influence of the factor \rightarrow financial security level". We have developed single-factor models for assessing the influence of the major indicators of the success of the enterprise's functioning as factors in determining the level of its financial security: Financial stability indicators – for the general structure of financing activities; liquidity indicators – for the structure of financing current activities; indicators of return on capital – for the efficiency of financing activities. On the basis of the deviations of the basic indicators' values from the generally recommended criteria, our toolkit of deterministic assessment of the influence of each selected factor on the enterprise's financial security level is substantiated (Figure 1).

The first step is a model to assess the enterprise's financial security level based on the structure of financing activities. To determine the enterprise's financial stability degree, we developed an indicative scale based on the values of the basic indicators of financial stability: Financial autonomy ratio (FAR) – equity to assets; financial stability ratio (FSR) – equity and long-term liabilities to assets; capital maneuverability ratio (CMR) – net working capital to equity. The financial stability degree of the enterprise is determined based on the identification of the financial situation, depending on the possible options for deviation of the above coefficients from the generally known recommended values: $FAR \geq 0.5$; $FSR \geq 0.75$; $CMR \geq 0.2$. The content of financial situations determines the enterprise's financial stability degree on the scale "high – normal – relative – financial instability", which, in turn, determines the appropriate financial security level of the enterprise (FSEFS) within the values of the scale "high (HFS) – normal (NFS) – satisfactory (SFS) – low (LFS)".

The second step is a model to assess the enterprise's financial security level based on the structure of financing current activities. The basis for determining the enterprise's liquidity degree is the classification of financial situations depending on the sufficiency of the volume and structure of the enterprise's current assets to repay its current liabilities. Taking into account the reasonableness of the recommended values for well-known liquidity indicators: Current ratio (CUR) – $CUR > 2$; the quick ratio (QR) – $QR > 1$; and the cash ratio (CAR) – $CAR > 0.2$, we proposed a scale of indicative values for each coefficient, the variability of the ratio of which determines the enterprise's liquidity degree on the scale "high – normal – relative – illiquidity". The determined liquidity degree causes the corresponding enterprise's financial security level (FSEL) within the values of the scale "high (HL) – normal (NL) – satisfactory (SL) – low (LL)".

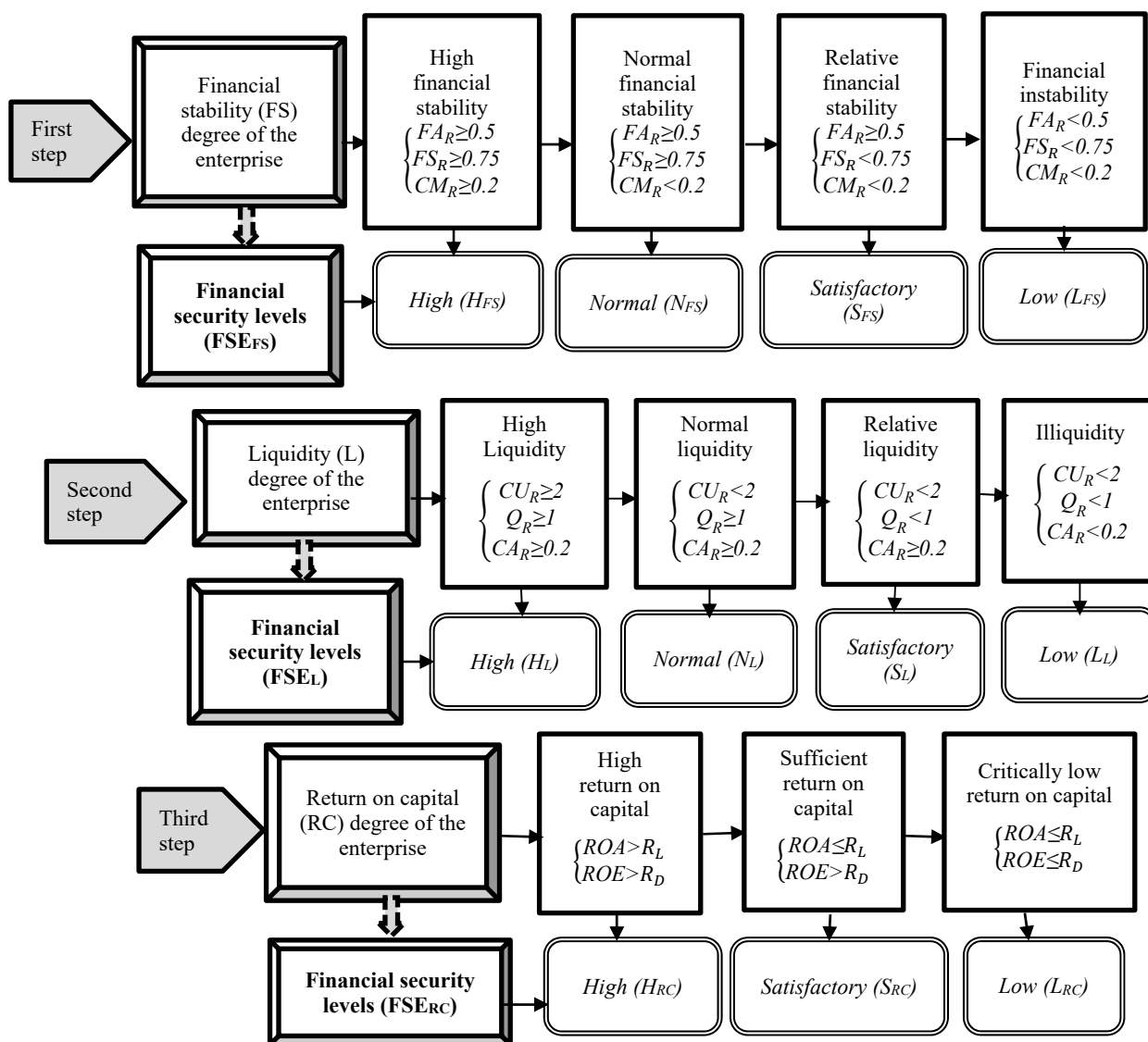


Figure 1. A three-factor model for assessing the enterprise's financial security level.

The third step is a model to assess the enterprise's financial security level based on indicators of return on capital. Taking into account the informativeness of the final financial efficiency of the invested resources, we put the value of the major financial return indicators of the formed resources (capital): Return on assets (ROA) and return on equity (ROE) on the basis of the developed indicative scale for determining the enterprise's return on capital degree. Depending on the possible options for comparing the actual values of the indicators with the well-known criteria for each of them, respectively: Based on the size of the lending rate (R_L) and the size of the deposit rate (R_D), financial situations are identified that allow us to determine the enterprise's capital profitability degree on the scale "high – sufficient – critical low". The determined enterprise's capital profitability degree serves as the basis for assessing the appropriate of its financial security level (FSE_{RC}) on the scale "high (H_{RC}) – satisfactory (S_{RC}) – low (L_{RC})".

Taking into account the compatibility of the determined financial security levels of the above-mentioned components of the three-factor model, we laid the basis of the algorithm for identifying the generalized status of enterprise's financial security. In turn, the set of multiple variants of the

financial security status became a prerequisite for the clustering of the financial security positions of the enterprise depending on the features of financing its activities within the values of the scale “high (H_{FSE^F}) – sufficient ($S_{U_{FSE^F}}$) – acceptable (A_{FSE^F}) – satisfactory ($S_{A_{FSE^F}}$) – low (L_{FSE^F})”. On the basis of possible options for combining the previously determined financial security levels, we outlined the multiplicity of its integrated status and developed the author’s approach to grouping the enterprise’s financial security positions (Table 1).

Table 1. Matrix of positioning of integrated status enterprise’s financial security depending on peculiarities of activity financing.

Financial security position	High (H_{FSE^F})	Sufficient ($S_{U_{FSE^F}}$)	Acceptable (A_{FSE^F})	Satisfactory ($S_{A_{FSE^F}}$)	Low (L_{FSE^F})
Integrated status	$H_{FS} H_L H_{RC}$	$H_{FS} S_L H_{RC}$	$H_{FS} H_L S_{RC}$	$H_{FS} S_L S_{RC}$	$H_{FS} L_L L_{RC}$
	$H_{FS} N_L H_{RC}$	$H_{FS} L_L H_{RC}$	$H_{FS} H_L L_{RC}$	$H_{FS} S_L L_{RC}$	$N_{FS} L_L L_{RC}$
	$N_{FS} H_L H_{RC}$	$N_{FS} H_L S_{RC}$	$H_{FS} N_L S_{RC}$	$H_{FS} L_L S_{RC}$	$S_{FS} S_L L_{RC}$
	$N_{FS} N_L H_{RC}$	$N_{FS} S_L H_{RC}$	$H_{FS} N_L L_{RC}$	$N_{FS} S_L L_{RC}$	$S_{FS} L_L L_{RC}$
		$N_{FS} L_L H_{RC}$	$N_{FS} H_L L_{RC}$	$N_{FS} L_L S_{RC}$	$L_{FS} N_L L_{RC}$
		$S_{FS} H_L H_{RC}$	$N_{FS} N_L S_{RC}$	$S_{FS} H_L L_{RC}$	$L_{FS} S_L L_{RC}$
		$S_{FS} N_L H_{RC}$	$N_{FS} N_L L_{RC}$	$S_{FS} N_L S_{RC}$	$L_{FS} L_L S_{RC}$
		$L_{FS} H_L H_{RC}$	$N_{FS} S_L S_{RC}$	$S_{FS} N_L L_{RC}$	$L_{FS} L_L L_{RC}$
		$L_{FS} N_L H_{RC}$	$S_{FS} H_L S_{RC}$	$S_{FS} S_L S_{RC}$	
			$S_{FS} S_L H_{RC}$	$S_{FS} L_L S_{RC}$	
			$S_{FS} L_L H_{RC}$	$L_{FS} H_L L_{RC}$	
			$L_{FS} H_L S_{RC}$	$L_{FS} S_L S_{RC}$	
			$L_{FS} N_L S_{RC}$	$L_{FS} L_L H_{RC}$	
			$L_{FS} S_L H_{RC}$		

Source: compiled by the authors

Depending on the possible combination of financial security levels, due to the influence of the major factors “the financial security level based on the structure of financing activities (FSE_{FS}); the financial security level based on the current activity financing structure (FSE_L); the financial security level based on indicators of return on capital (FSE_{RC})”, the grouping of integrated enterprise’s financial security status within the following positions is proposed:

- A high financial security position (H_{FSE^F}) is characterized by the status ratio “[high (H_{FS}) – normal (N_{FS})]; [high (H_L) – normal (N_L)]; high (H_{RC})”;
- The sufficient financial security position ($S_{U_{FSE^F}}$) is characterized by a combination of status indicators: “high (H_{FS}); [satisfactory (S_L) – low (L_L)]; high (H_{RC})”; “normal (N_{FS}); high (H_L); satisfactory (S_{RC})”; “normal (N_{FS}); [satisfactory (S_L) – low (L_L)]; high (H_{RC})”; “[satisfactory (S_{FS}) – low (L_{FS})]; [high (H_L) – normal (N_L)]; high (H_{RC})”;
- An acceptable financial security position (A_{FSE^F}) is characterized by the ratio of components: “[high (H_{FS}) – normal (N_{FS})]; [high (H_L) – normal (N_L)]; [satisfactory (S_{RC}) – low (L_{RC})]”; “normal (N_{FS}); satisfactory (S_L); satisfactory (S_{RC})”; “satisfactory (S_{FS}); high (H_L); satisfactory (S_{RC})”; “satisfactory (S_{FS}); [satisfactory (S_L) – low (L_L)]; high (H_{RC})”; “low (L_{FS}); [high (H_L) – normal (N_L)]; satisfactory (S_{RC})”; “low (L_{FS}); satisfactory (S_L); high (H_{RC})”;
- A satisfactory financial security position ($S_{A_{FSE^F}}$) is determined by combinations of: “high (H_{FS}); satisfactory (S_L); [satisfactory (S_{RC}) – low (L_{RC})]”; “high (H_{FS}); low (L_L); satisfactory (S_{RC})”;

“normal (N_{FS}); satisfactory (S_L); low (L_{RC})”; “normal (N_{FS}); low (L_L); satisfactory (S_{RC})”; “satisfactory (S_{FS}); high (H_L); low (L_{RC})”; “satisfactory (S_{FS}); normal (N_L); [satisfactory (S_{RC}) – low (L_{RC})]”; “satisfactory (S_{FS}); [satisfactory (S_L) – low (L_L)]; satisfactory (S_{RC})”; “low (L_{FS}); high (H_L); low (L_{RC})”; “low (L_{FS}); satisfactory (S_L); satisfactory (S_{RC})”; “low (L_{FS}); low (L_L); high (H_{RC})”;

– A low financial security position (L_{FSE^F}) is determined by the predominance of most satisfactory/low levels: “[high (H_{FS}) – normal (N_{FS})]; low (L_L); low (L_{RC})”; “satisfactory (S_{FS}); [satisfactory (S_L) – low (L_L)]; low (L_{RC})”; “low (L_{FS}); [normal (N_L) – satisfactory (S_L)]; low (L_{RC})”; “low (L_{FS}); low (L_L); [Satisfactory (S_{RC}) – Low (L_{RC})”.

In a generalized form, the location of the enterprise within the proposed financial security positions, in turn, can serve as a reflection of the activity financing risk. Taking into account the meaningful relationship and interdependence of the proposed positioning of the integrated status of enterprise’s financial security with the well-known bankruptcy risk assessment tools, we developed a zoning matrix of consolidated financial security positions of the enterprise. Taking into account the interdependence of the parameters of the enterprise’s financial security with the level of bankruptcy risk, using basic discriminant statistical models, we applied a unified approach to assess the impact of certain types of risk on the enterprise’s financial security (Figure 2).

			Financial security position (THREE-FACTOR MODEL)(P _{FSE^F})				
			High financial security (H _{FSE^F})	Sufficient financial security (S _{FSE^F})	Acceptable (A _{FSE^F})/ Satisfactory financial security (S _{A_{FSE^F})}	Low financial security (L _{FSE^F})	
Financial security position (BANKRUPTCY MODELS) (P _{FSE^B})	Low financial security (L _{FSE^B})	$\begin{cases} Z_A \leq 1.23 \\ Z_{TT} < 0.2 \\ Z_S < 0.862 \\ Z_L < 0.037 \end{cases}$					
	Acceptable(A _{FSE^B}) / Satisfactory financial security (S _{A_{FSE^B})}	$\begin{cases} 1.23 < Z_A \leq 2.5 \\ 0.2 < Z_{TT} < 0.3 \end{cases}$					
	Sufficient financial security (S _{FSE^B})	$\begin{cases} 2.5 < Z_A \leq 2.89 \\ 0.862 < Z_S < 2.451 \end{cases}$					
	High financial security (H _{FSE^B})	$\begin{cases} Z_A > 2.9 \\ Z_{TT} > 0.3 \\ Z_S > 2.451 \\ Z_L > 0.037 \end{cases}$					

Figure 2. Zoning matrix of consolidated financial security positions of the enterprise. Notes:

*in the upper left corner: Fuzzy zoning sector with a prevailing bankruptcy risk (SBR).

**bottom right: Fuzzy zoning sector with predominant activity financing risk (SAFR)

The algorithm for positioning the enterprise's financial security depending on the risk of bankruptcy is based on the value of integral indicators of the probability of bankruptcy, identified on the basis of the major discriminant statistical models (5-factor model of Altman (Z_A) for companies whose shares are not traded on the stock market (Altman et al., 1983); Springate's model (Z_S) (Springate & Gordon, 1978); model of Taffler and Tisshaw (Z_{TT}) (Taffler & Tisshaw, 1977); Lis's model (Z_L) (Lis, 1972). Taking into account the essential features of each of the selected models and their well-known criterion values, the authors proposed a bankruptcy probability scale, the limit values of which made it possible to determine the enterprise's financial security status within the "high – sufficient – satisfactory – low" (Appendix A, Table A.1).

Taking into account the correctness of the combination of comparative degrees of financial security, determined according to the selected bankruptcy models, we suggest grouping the integrated financial security statuses of the enterprise within the following positions:

- A high financial security position (H_{FSE}^B) is achieved under the condition that $Z_A > 2.9$; $Z_S > 2.451$; $Z_{TT} > 0.3$; $Z_L > 0.037$;
- a sufficient financial security position (SU_{FSE}^B) is characterized by values of integral indicators within $2.5 < Z_A \leq 2.89$; $0.862 \leq Z_S \leq 2.451$;
- An acceptable (A_{FSE}^B)/satisfactory (SA_{FSE}^B) financial security position is conditioned by the ratios $1.23 < Z_A \leq 2.5$; $0.2 \leq Z_{TT} \leq 0.3$;
- Low financial security position (LF_{FSE}^B) is determined by the following conditions $Z_A \leq 1.23$; $Z_S < 0.862$; $Z_{TT} < 0.2$; $Z_L \leq 0.037$.

The above-grounded interdependence of the enterprise's financial security status of the uniformity of the tools for their positioning allowed us to determine the consolidated financial security position of the enterprise in the zones of their possible location.

Provided that the financial security positions of the enterprise, identified on the basis of the three-factor model and bankruptcy models of the developed matrix, are meaningfully matched, the enterprise will be located on the target line of the change of security zones: The zone of optimal security (H_{FSE}^F and H_{FSE}^B), the zone of guaranteed security (SU_{FSE}^F and SU_{FSE}^B), tension zone (A_{FSE}^F/SA_{FSE}^B and A_{FSE}^B/SA_{FSE}^B), and crisis zone (LF_{FSE}^F and LF_{FSE}^B).

Differences in the financial security positions determine the location of the enterprise on the plane of the matrix in the sector of unclear zoning, determined depending on the prevailing type of risk:

- In the sector of unclear zoning with a predominant of bankruptcy risk, enterprises are located, which, accordingly, have been identified with a higher degree of danger of bankruptcy compared to the riskiness of financing activities: " H_{FSE}^F and [$SU_{FSE}^B-LF_{FSE}^B$]", " SU_{FSE}^F and [$A_{FSE}^B / SA_{FSE}^B-LF_{FSE}^B$]", " A_{FSE}^F / SA_{FSE}^F and LF_{FSE}^B ";
- In the sector of unclear zoning with a predominant activity financing risk, enterprises are located, the main danger for which is precisely the peculiarities of financing their activities: " $[SU_{FSE}^F-LF_{FSE}^F]$ and H_{FSE}^B ", " $[A_{FSE}^F / SA_{FSE}^F-LF_{FSE}^F]$ and SU_{FSE}^B ", " LF_{FSE}^F and A_{FSE}^B / SA_{FSE}^B ".

The proposed approach is universal and can be used in any country by enterprises of various types of activity. All enterprises of Ukraine, grouped by the types of economic activity, for the period 2013–2021, were selected to test the proposed model. For calculations of all indicators of the proposed model, official statistical data from State Statistics Service of Ukraine (<http://www.ukrstat.gov.ua>) were used and formed based on the results of the activities of all Ukrainian enterprises by type of economic activity (according to official financial reporting).

4. Results

Today's global economic challenges combined with the vulnerability of Ukraine's economy determine the urgent need to ensure and maintain an adequate financial security level of national enterprises from the point of view of their financial ability to withstand possible risks and dangers.

The positioning of the integrated statuses of financial security of Ukrainian enterprises by types of economic activity (Table 2) was carried out, initially on the basis of a three-factor model by determining the financial security levels within the limits of the corresponding one-factor models: Assessing the financial stability degree (Appendix B, Table B.1.), the liquidity degree (Appendix B, Table B.2.), and the capital profitability level (Appendix B, Table B.3., Table B.4.).

Table 2. The positioning of the integrated statuses of financial security of Ukrainian enterprises by types of economic activity (based on a three-factor model).

Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Agriculture, forestry and fishing	FSE _{FS}	N _{FS}	S _{FS}	S _{FS}	S _{FS}	N _{FS}	N _{FS}	N _{FS}	N _{FS}	N _{FS}
	FSE _L	N _L	N _L	N _L	N _L	N _L	N _L	S _L	N _L	N _L
	FSE _{RC}	L _{RC}	S _{RC}	S _{RC}	S _{RC}	S _{RC}	S _{RC}	S _{RC}	S _{RC}	H _{RC}
	Position	A _{FSE^F}	A _{FSE^F}	A _{FSE^F}	A _{FSE^F}	SU _{FSE^F}	A _{FSE^F}	A _{FSE^F}	A _{FSE^F}	A _{FSE^F}
Industry	FSE _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}
	FSE _L	L _L	L _L	L _L	L _L	L _L	L _L	L _L	L _L	L _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	S _{RC}	S _{RC}	S _{RC}	L _{RC}	S _{RC}
	Position	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}
Construction	FSE _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}
	FSE _L	S _L	S _L	L _L	L _L	L _L	L _L	L _L	L _L	L _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	S _{RC}
	Position	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}
Wholesale and retail trade	FSE _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}
	FSE _L	S _L	L _L	L _L	L _L	L _L	L _L	L _L	L _L	L _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	S _{RC}	S _{RC}	S _{RC}	S _{RC}	S _{RC}
	Position	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}
Transportation and storage	FSE _{FS}	L _{FS}	L _{FS}	N _{FS}	N _{FS}	N _{FS}	S _{FS}	S _{FS}	S _{FS}	S _{FS}
	FSE _L	S _L	L _L	S _L	L _L	L _L	S _L	L _L	S _L	L _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	S _{RC}
	Position	L _{FSE^F}	L _{FSE^F}	SA _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}
Accommodation and food service activities	FSE _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}
	FSE _L	L _L	L _L	L _L	L _L	L _L	L _L	S _L	L _L	L _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	H _{RC}	H _{RC}	L _{RC}	H _{RC}
	Position	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	SA _{FSE^F}	A _{FSE^F}	L _{FSE^F}	L _{FSE^F}
Information and communication	FSE _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}
	FSE _L	S _L	S _L	S _L	S _L	S _L	S _L	S _L	S _L	S _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	S _{RC}	S _{RC}	S _{RC}	S _{RC}	S _{RC}	H _{RC}
	Position	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}

Continued on next page

Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Financial and insurance activities	FSE _{FS}	N _{FS}	S _{FS}	S _{FS}	S _{FS}	S _{FS}	S _{FS}	S _{FS}	S _{FS}	S _{FS}
	FSE _L	H _L	N _L	N _L	N _L	N _L	N _L	N _L	N _L	N _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	S _{RC}	S _{RC}	S _{RC}	S _{RC}	S _{RC}
	Position	A _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}
Real estate activities	FSE _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}
	FSE _L	S _L	L _L	L _L	L _L	L _L	L _L	L _L	L _L	L _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	S _{RC}	L _{RC}	S _{RC}
Professional, scientific and technical activities	Position	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}
	FSE _{FS}	L _{FS}	L _{FS}	S _{FS}	S _{FS}	S _{FS}	S _{FS}	S _{FS}	S _{FS}	S _{FS}
	FSE _L	S _L	N _L	S _L	S _L	L _L	S _L	N _L	S _L	N _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	S _{RC}	L _{RC}	S _{RC}
Administrative and support service activities	Position	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	SA _{FSE^F}	L _{FSE^F}	SA _{FSE^F}
	FSE _{FS}	H _{FS}	H _{FS}	S _{FS}	S _{FS}	S _{FS}	S _{FS}	L _{FS}	L _{FS}	L _{FS}
	FSE _L	N _L	N _L	S _L	S _L	L _L	L _L	L _L	L _L	L _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	S _{RC}
Education	Position	A _{FSE^F}	A _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}
	FSE _{FS}	H _{FS}	H _{FS}	N _{FS}	N _{FS}	N _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}
	FSE _L	N _L	N _L	S _L	S _L	S _L	S _L	S _L	S _L	S _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	S _{RC}	L _{RC}	L _{RC}
Human health and social work activities	Position	A _{FSE^F}	A _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	SA _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}
	FSE _{FS}	S _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	S _{FS}	N _{FS}	N _{FS}	N _{FS}
	FSE _L	S _L	L _L	L _L	S _L	S _L	S _L	S _L	S _L	S _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	H _{RC}	S _{RC}
Arts, entertainment and recreation	Position	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	SU _{FSE^F}	A _{FSE^F}
	FSE _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}
	FSE _L	S _L	L _L	S _L	S _L	L _L	L _L	L _L	L _L	L _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}
Other service activities	Position	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}	L _{FSE^F}
	FSE _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}	L _{FS}
	FSE _L	L _L	L _L	L _L	S _L	L _L	L _L	L _L	L _L	L _L
	FSE _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}	L _{RC}

The analysis of the positioning of the integrated statuses of financial security of Ukrainian enterprises by types of economic activity testified that during the research period, enterprises of only three industries (agriculture, information and communication, human health, and social work activities) demonstrated a clear tendency to improve the financial security position. The main factor of positive influence on the change of positions in the “Agriculture” (from “acceptable” to “high”)

and “Information and communication” (from “low” to “sufficient”) was a significant increase in the financial security level due to the profitability of capital (from “low” to “high”).

A rather ambiguous situation arose with the change in the financial security position of enterprises in the field of human health & social work activities. As a result of a sharp increase in the financial security level due to the profitability of capital (from “low” in 2013 to “high” in 2020), even against the background of worsening financial security levels of financing general and current activities, the financial security position of enterprises in the “Human health & social work activities” improved from “low” to “sufficient”. In the future, the decrease in the profitability of capital to a “satisfactory” financial security level led to a deterioration to an “acceptable” generalized financial security position of enterprises from this type of economic activity.

Unfortunately, the enterprises of “Financial and insurance activities” could not maintain a sufficiently safe “acceptable” financial security position and fell to a “satisfactory” position, and also witnessed a negative trend towards the deterioration of “Education” and “Administrative and support service activities” and ended up in a “low” position of financial security. The main reason for this deterioration was a similar decrease in the level of financial security due to the peculiarities of financing general and current activities (against the background of a rather low level of financial security of the return on capital (within the range of “low–satisfactory”).

At an identical financial security level of capital profitability, consistently low positions of financial security (in the range of “low–satisfactory”) were occupied by enterprises of the following types of economic activity: “Transportation and storage”; “Accommodation and food service activities”; and “Professional, scientific and technical activities”. However, if in “Transportation and storage” such a situation is also caused by similar limits of financial security levels of financing general and current activities, then in the field of “Professional, scientific and technical activities” it is the result of their significant deterioration (from “high/normal” to “low”). Against the background of mainly “low” financial security levels of all components of the integrated status, positive changes in the financial security position of “Accommodation and food service activities” enterprises were determined by a sharp increase in the financial security level of capital profitability (to “high” in 2018–2019, 2021).

Unfortunately, it should be noted that during the period of the research, the enterprises of the majority of the system-forming types of economic activity of Ukraine: “Industry”, “Construction”, “Wholesale and retail trade”, “Real estate activities”, “Arts, entertainment and recreation”, and “Other service activities” consistently had a “low” position financial security as a result of a significant predominance of “low” financial security levels of all components of the integrated status.

The basis of the positioning of Ukrainian enterprises by types of economic activity, carried out on the basis of bankruptcy models (Table 3), is the assessment of the integrated status of their financial security, determined by indicating the level of activity risk according to the proposed scale of the probability of bankruptcy (Appendix B, Table B.5).

Table 3. The positioning of the integrated statuses of financial security of Ukrainian enterprises by types of economic activity (based on bankruptcy models).

Type of economic activity	2013	2014	2015	2016	2017	2018	2019	2020	2021
Agriculture, forestry and fishing	S _{UFSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B
Industry	S _{AFSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	H _{FSE} ^B
Construction	S _{AFSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	S _{AFSE} ^B	H _{FSE} ^B	H _{FSE} ^B	A _{FSE} ^B	H _{FSE} ^B
Wholesale and retail trade	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B	H _{FSE} ^B
Transportation and storage	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B
Accommodation and food service activities	L _{FSE} ^B	L _{FSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	S _{AFSE} ^B	A _{FSE} ^B
Information and communication	H _{FSE} ^B	S _{AFSE} ^B	L _{FSE} ^B	L _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B
Financial and insurance activities	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B
Real estate activities	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B
Professional, scientific and technical activities	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B
Administrative and support service activities	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B
Education	S _{AFSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	H _{FSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B
Human health and social work activities	L _{FSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	S _{AFSE} ^B	A _{FSE} ^B	A _{FSE} ^B
Arts, entertainment and recreation	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B
Other service activities	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B

The analysis of the positioning of the integrated statuses of financial security of Ukrainian enterprises by types of economic activity, carried out on the basis of bankruptcy models, in general, confirmed the above-mentioned trends. At the end of the analysis period, enterprises of only four types of economic activity (“Agriculture”, “Forestry and fishing”, “Industry”, and “Construction” and “Wholesale and retail trade”) had a “high” financial security position. Moreover, enterprises of the “Wholesale and retail trade” and “Agriculture, forestry and fishing” (except for 2013 year) held this position throughout the entire period under research. Enterprises of “Industry”, having demonstrated a clear upward trend during 2013–2020 within the “satisfactory – acceptable” position, only in 2021 year were able to occupy a “high” financial security position. The activity of “Construction” was characterized by sharp fluctuations in financial security positions (from “low” in 2014–2016 years to “high” in 2018–2019 years), which, however, ended with the fixation of a “high” position in the last year of the analyzed period.

“Accommodation and food service activities”, “Information and communication”, “Financial and insurance activities”, “Human health and social work activities”, and “Other service activities” enterprises ended 2021 with an “acceptable” financial security position. Enterprises of “Financial and insurance activities” and “Other service activities” had a stable position during the analyzed period. Enterprises of “Accommodation and food service activities” and “Human health and social work

activities” achieved such a result due to the consistent improvement of the “low” position. The activity of “Information and communication” enterprises was characterized by high vulnerability to an unfavorable financial situation: Losing its position from “high” in 2013 year to “low” in 2015–2016 years, were able to record an “acceptable” financial security position over the next five years.

The riskiest types of economic activity from the point of view of probability of bankruptcy were: “Education”, “Transportation and storage”, “Real estate activities”, “Professional, scientific and technical activities”, “Administrative and support service activities”, and “Arts, entertainment and recreation”. What is more, if “Education” enterprises during the research period occupied a “satisfactory” financial security position (except for 2017–“high”), then the enterprises of the rest of the above-mentioned types of activities, unfortunately, were constantly in a “low” financial security position.

The obtained results of the positioning of the integrated statuses of financial security of Ukrainian enterprises determined the identification of their consolidated position on the plane of the zoning matrix (Table 4).

Table 4. Zoning of consolidated financial security positions of Ukrainian enterprises by types of economic activity.

Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Agriculture, forestry and fishing	P _{FS} ^F	A _{FS} ^F	A _{FS} ^F	A _{FS} ^F	A _{FS} ^F	SU _{FS} ^F	A _{FS} ^F	A _{FS} ^F	A _{FS} ^F	H _{FS} ^F
	P _{FS} ^B	SU _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B
	Zone	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}
Industry	P _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F
	P _{FS} ^B	SA _{FS} ^B	SA _{FS} ^B	SA _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	H _{FS} ^B
	Zone	S _{RF}	S _{RF}	S _{RF}	S _{RF}	S _{RF}	S _{RF}	S _{RF}	S _{RF}	S _{RF}
Construction	P _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F
	P _{FS} ^B	SA _{FS} ^B	L _{FS} ^B	L _{FS} ^B	L _{FS} ^B	SA _{FS} ^B	H _{FS} ^B	H _{FS} ^B	A _{FS} ^B	H _{FS} ^B
	Zone	S _{AFR}	Z _C	Z _C	Z _C	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}
Wholesale and retail trade	P _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F
	P _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B	H _{FS} ^B
	Zone	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}
Transportation and storage	P _{FS} ^F	L _{FS} ^F	L _{FS} ^F	SA _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	SA _{FS} ^F
	P _{FS} ^B	L _{FS} ^B	L _{FS} ^B	L _{FS} ^B	L _{FS} ^B	L _{FS} ^B	L _{FS} ^B	L _{FS} ^B	L _{FS} ^B	L _{FS} ^B
	Zone	Z _C	Z _C	S _{BR}	Z _C	Z _C	Z _C	Z _C	Z _C	S _{BR}
Accommodation and food service activities	P _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	SA _{FS} ^F	A _{FS} ^F	L _{FS} ^F	SA _{FS} ^F
	P _{FS} ^B	L _{FS} ^B	L _{FS} ^B	SA _{FS} ^B	SA _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	SA _{FS} ^B	A _{FS} ^B
	Zone	Z _C	Z _C	S _{AFR}	S _{AFR}	S _{AFR}	Z _T	Z _T	S _{RF}	Z _T
Information and communication	P _{FS} ^F	L _{FS} ^F	L _{FS} ^F	L _{FS} ^F	SA _{FS} ^F	SA _{FS} ^F	SA _{FS} ^F	SA _{FS} ^F	SA _{FS} ^F	SU _{FS} ^F
	P _{FS} ^B	H _{FS} ^B	SA _{FS} ^B	L _{FS} ^B	L _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B
	Zone	S _{AFR}	S _{AFR}	Z _C	S _{BR}	Z _T	Z _T	Z _T	Z _T	S _{AFR}
Financial and insurance activities	P _{FS} ^F	A _{FS} ^F	SA _{FS} ^F	SA _{FS} ^F	SA _{FS} ^F	SA _{FS} ^F	SA _{FS} ^F	SA _{FS} ^F	SA _{FS} ^F	SA _{FS} ^F
	P _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B	A _{FS} ^B
	Zone	Z _T	Z _T	Z _T	Z _T	Z _T	Z _T	Z _T	Z _T	Z _T

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Type of economic activity	Indicator	2013	2014	2015	2016	2017	2018	2019	2020	2021
Real estate activities	P _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F
	P _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B
	Zone	Z _C	Z _C	Z _C	Z _C	Z _C	Z _C	Z _C	Z _C	Z _C
Professional, scientific and technical activities	P _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	S _{AFSE} ^F	L _{FSE} ^F	S _{AFSE} ^F
	P _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B
	Zone	Z _C	Z _C	Z _C	Z _C	Z _C	Z _C	S _{BR}	Z _C	S _{BR}
Administrative and support service activities	P _{FSE} ^F	A _{FSE} ^F	A _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F
	P _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B
	Zone	S _{BR}	S _{BR}	Z _C	Z _C	Z _C	Z _C	Z _C	Z _C	Z _C
Education	P _{FSE} ^F	A _{FSE} ^F	A _{FSE} ^F	S _{AFSE} ^F	S _{AFSE} ^F	S _{AFSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F
	P _{FSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	H _{FSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B
	Zone	Z _T	Z _T	Z _T	Z _T	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}
Human health and social work activities	P _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	S _{UFSE} ^F	A _{FSE} ^F
	P _{FSE} ^B	L _{FSE} ^B	S _{AFSE} ^B	S _{AFSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	S _{AFSE} ^B	A _{FSE} ^B	A _{FSE} ^B
	Zone	Z _C	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{BR}	Z _T
Arts, entertainment and recreation	P _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F
	P _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B	L _{FSE} ^B
	Zone	Z _C	Z _C	Z _C	Z _C	Z _C	Z _C	Z _C	Z _C	Z _C
Other service activities	P _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F	L _{FSE} ^F
	P _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B	A _{FSE} ^B
	Zone	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}	S _{AFR}

The analysis results of zoning of the consolidated positions of Ukrainian enterprises confirmed the decisive influence on the financial security of the peculiarities of the financing of their activities. It is the lower (compared to the threat of bankruptcy) financial security positions, determined by the structure and efficiency of financing activities, that determined the long-term stay of enterprises of most types of economic activities of Ukrainian in the corresponding sector of unclear zoning. In particular, as a result of the increased riskiness of financing, the established “low” financial security position of “Industry”, “Wholesale and retail trade”, and “Other service activities” led to their permanent stay in the above-mentioned sector. Only in 2021, due to the improvement of the financing of activities management to a “high” position, the “Agriculture, forestry and fishing” enterprises were moved to the zone of optimal security. The consequence of rather low financial security positions was being in the sector of unclear zoning with the prevailing risk of financing the activities of the enterprises by the types of economic activity: “Construction” (2013, 2017–2021 years), “Education” (2017–2021 years), and “Human health and social work activities” (2014–2019 years). An indicative situation has developed in the “Information and communication”: Constant fluctuations in the integrated statuses of financial security have led to the relocation of enterprises of this type of economic activity almost across the entire plane of the zoning matrix and ensured that they remained in the crisis zone throughout the research period (2015 year), the tension zone (2017–2020 years), sectors of unclear zoning with prevailing risks of bankruptcy (2016 year), and financing of activities (2013–2014, 2021 years).

Relatively low financial security positions, due to the influence of both types of risk, ensured, at the end of the studied period, the relocation of the enterprises “Accommodation and food service activities” and “Human health and social work activities” to the zone of tension and determined the permanent stay in this zone of the enterprises of the “Financial and insurance activities”.

The “low” position of financial security, associated with the increased probability of bankruptcy, combined with the not much lower risk of financing activities, determined the long stay in the crisis zone of the enterprises “Transportation and storage” (2013–2014, 2016–2020 years) and “Professional, scientific, and technical activities” (2013–2018, 2020 years), which in 2021 changed to a sector of unclear zoning with a prevailing risk of bankruptcy.

Unfortunately, the result of the high cumulative risk of functioning and, accordingly, equally “low” comprehensive financial security positions was the permanent stay in the crisis zone of the enterprises “Real estate activities”, “Arts, entertainment, and recreation”, and “Administrative and support service activities” (2015–2021 years).

5. Conclusions

In today’s economic conditions, one of the most relevant aspects of the functioning of business entities is the problem of their financial security managing. The need to neutralize the impact of various external and internal threats, as a consequence of the growing risks of the enterprise’s functioning, determines the need to form a system for ensuring financial security, one of the major elements of which is the mechanism for evaluating its parameters. Taking into account the most modern requirements for economic diagnostics, the formation of a methodological toolkit for determining the financial security parameters must comply with the principles of systematic, comprehensiveness, informativeness, and convenience.

In accordance with the above-mentioned principles, we have developed a complex mechanism for evaluating the enterprise’s financial security parameters on the “level – state – position – zone” scale, which is based on a system of interconnected indicators for its diagnosis.

In view of the fundamental influence of the financing processes of the enterprise’s activity, the authors developed a three-factor model for determining the financial security level, which is based on the cumulative effect: On the one hand, the interdependence of the major components of the enterprise’s financial security; on the other hand, a unified mechanism of structurally directed influence of each factor according to the algorithm: “degree of influence of the factor → financial security level”. Within the framework of the step-by-step algorithm for the implementation of the model, we proposed appropriate single-factor models for assessing the impact of the basic indicators for the success of the enterprise’s functioning as factors for determining the level of its financial security: financial stability indicators – for the general structure of financing activities; liquidity indicators – for the structure of financing current activities; indicators of return on capital – for the efficiency of financing activities.

Based on the well-known recommended values of the basic indicators of financial stability and liquidity, we developed indicative scales for identifying financial situations for each factor, which allow us to determine the degree of financial stability or liquidity of the enterprise within the limits of “high – normal – relative – financial instability/illiquidity”, which in turn determines the appropriate enterprise’s financial security level within the values of the scale “high – normal – satisfactory – low”. Based on the classical criteria for the major indicators of the financial return of

the formed resources (capital), we developed a scale of indicative values for the identification of financial situations, which determines the degree of enterprise's profitability of the capital within the limits of "high – sufficient – critically low" and determines the appropriate enterprise's financial security level according to the scale "high – satisfactory – low".

Taking into account the compatibility of the defined financial security levels of the components of the three-factor model, we developed an algorithm for identifying the integrated status of enterprise's financial security. Having substantiated the set of multiple variants of the financial security status through a possible combination of financial security levels, we proposed the clustering of the enterprise's financial security positions within the values of the scale "high – sufficient – acceptable – satisfactory – low" as a reflection of the activity financing risk. Taking into account the interdependence of the enterprise's financial security parameters with the level of bankruptcy risk, on the basis of the major discriminant statistical models and their well-known criterion values, we developed a bankruptcy probability scale, the limit values of which determine the status of the enterprise's financial security within the limits of "high – sufficient – satisfactory – low" and determine their positioning within similar limits.

Given the interrelationship of the proposed algorithms for positioning the enterprise's financial security depending on the activity financing risk and the bankruptcy risk, a zoning matrix of consolidated financial security positions of the enterprise was developed. Within the framework of the zoning matrix, we justified the possible location of the enterprise on the target line of the change of security zones within the limits of "optimal – guaranteed – tension – crisis" or the sector of unclear zoning, depending on the prevailing type of activity financing risk or bankruptcy risk.

As a result of approbation of the proposed approach, we calculated key financial indicators of the developed models based on financial reporting data of Ukrainian enterprises by type of economic activity and determined the parameters of their financial security over the past 9 years in accordance with the developed toolkit of zoning of consolidated financial security positions.

Our research confirmed the decisive influence on the enterprise's financial security, the features of financing their activities, and the associated risk level. The low financial security position, due to the structure and efficiency of financing activities, determined the long stay of enterprises of most types of economic activities of Ukraine in the sector of unclear zoning of financial security with the prevailing risk of financing activities. As a result of the increased risk of financing, the enterprises of "Industry", "Wholesale and retail trade", and "Other service activities" throughout the entire research period were in the sector of unclear zoning of financial security with a predominant risk of financing activities. Due to the improvement of the financing of activities management, in 2021, the "Agriculture, forestry, and fishing" enterprises were transferred to the zone of optimal security. The consequence of rather low financial security positions was being in the sector of unclear zoning with a predominant risk of financing the activities of enterprises: "Construction" (2013, 2017–2021 years), "Education" (2017–2021 years), "Human health and social work activities" (2014–2019 years), "Information and communication" (2013–2014, 2021 years), and "Accommodation and food service activities" (2015–2017, 2020 years).

The high riskiness of financing activities, reinforced by the negative impact of the bankruptcy risk, caused the presence of the following types of economic activity in the zones of increased danger: In the tension zone ("Financial and insurance activities" (2013–2021 years), "Accommodation and food service activities" (2018–2019, 2021 years), and "Human health and social work activities" (2014–2019 years) and crisis zones ("Transportation and storage" (2013–2014, 2016–2020 years),

“Professional, scientific and technical activities” (2013–2018, 2020 years), “Real estate activities” (2013–2021 years), “Arts, entertainment and recreation” (2013–2021 years), “Accommodation and food service activities” (2013–2015 years), and “Administrative and support service activities” (2015–2021 years).

Therefore, the obtained results proved the need to increase the efficiency of the financing of activities management in order to improve the parameters of the enterprises financial security of the major types of economic activities of Ukraine.

The approbation of the approach proposed by us to the assessment of parameters of the enterprise’s financial security demonstrated the effectiveness and informativeness of the developed toolkit for determining the financial security, which is based on the comprehensive consideration of fundamental factors of influence on the major performance indicators of its functioning: Financial stability, liquidity, profitability, and risk.

According to the authors, the advantages of the proposed approach are: First, the complex nature of the action of the selected indicators, which allows us to determine not only their individual impact (financial stability, liquidity, profitability, and risk) on the financial security level, but also the cumulative impact on its integrated statuses and consolidated position; second, the presence of ranged values of the selected indicators, which significantly increases the informativeness of the obtained calculations from the point of view of the degree of threats and dangers; third, the indicators “sectorality”, which allows us to determine the nature, sources, direction, scale, and possible dangers and threats; fourth, the interconnectedness of the proposed approach components, which creates opportunities to determine the parameters of the enterprise’s financial security on the scale “level – status – position – zone” in the process of current and strategic financial security management.

The disadvantages of the proposed approach to assessing the enterprise’s financial security include: The imperfection of the information base for making calculations based on existing financial statements (limited amount of necessary information, recording only events of past periods); the impossibility to more clearly take into account the industry-specific features of enterprises in the process of determining financial security; and well-known errors of discriminant statistical models of bankruptcy in the process of their application to enterprises of various industries.

Thus, the methodical approach proposed by us to assess the enterprise’s financial security based on the use of a models set to determine its parameters depending on the specifics of financing their activities and the associated level of risk makes it possible to determine the enterprise’s financial security position based on the major performance indicators of its functioning and the zone location of the enterprise depending on the influence of the major risk factors. The proposed methodological approach can be used not only as an effective tool for analyzing the enterprise’s financial security, but also as an important element of the mechanism of its forecasting and can serve as an indicator of the overall effectiveness of the enterprise’s response to threats and dangers of activity.

Further research is planned to focus on improving methodical approaches to the multi-level determination of parameters of the enterprise’s financial security and their detailing for enterprises of various industries; structuring and development of indicators set for assessing the enterprise’s financial security on the scale “level – status – position – zone”; and specification of the influence of the obtained determinants of financial security on increasing the efficiency of the enterprise as a whole.

Use of AI tools declaration

The authors affirm that no artificial intelligence (AI) tools were used in the creation of this work.

Conflict of interest

The authors declare no conflicts of interest in this paper.

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