This study's object is the financial security management system of an enterprise as a set of management mechanisms that enable the stability of its functioning under conditions of economic instability. The task addressed is the lack of effectiveness in conventional approaches to financial security management, which do not take into account the challenges of digitalization, the growth of external and internal risks, and do not enable proper adaptability of the enterprise's financial policy.

During the study, correlation-regression models were constructed, which confirmed four hypotheses regarding the influence of financial indicators on the profitability of enterprises and the level of their financial security. In particular, an inverse effect of the absolute liquidity ratio on the return on assets ($\beta = -3.52$) and a direct effect of the solvency ratio ($\beta = +1.79$) were found. The value of coefficient of determination for the best model is $R^2 = 0.183$, which indicates that the model explains 18.3% of the variation in profitability. Among external factors, a significant impact was confirmed only for the exchange rate ($\beta = -1.04$).

The results justify the need to introduce financial engineering instruments as elements of adaptive financial policy capable of ensuring a rapid response to changes in the financial environment. The main advantage of the proposed approach is its integrative nature, which combines an analytical assessment of financial condition with the ability to devise new financial solutions adapted to the digital transformation of the economy. This is explained by a systematic approach to the selection of management tools, their quantitative justification and assessment of effectiveness.

The results of the study could be used at enterprises in the process of modernizing the enterprise's financial security management system, especially under conditions of high volatility of the external environment, in order to increase financial stability and adaptability to the risks of the external and internal environment

Keywords: financial engineering, financial security of business, assessment, efficiency, risks, tools, management, liquidity

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FINANCIAL ENGINEERING AS A FACTOR OF STRENGTHENING THE FINANCIAL SECURITY OF AN ENTERPRISE

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1. Introduction

Modern realities cause the emergence of many crisis situations at an enterprise caused by the slow development of management, the lack of adequate response of the enterprise's management to external and internal challenges. These problems are decisive in the likelihood of the enterprise going bankrupt some time in the future.

The growing role of digital technologies causes the emergence of new risks and challenges associated with their use. Accordingly, the enterprise must respond promptly and effectively to these challenges and requires urgent improvement of the financial security system at the enterprise. Under these conditions, the enterprise must adapt to crisis conditions and look for new, effective tools to improve its financial state. A tool that could allow the enterprise to predict crisis situations and adequately respond to them is financial engineering. The use of financial engineering would allow the enterprise to adapt to the changing economic environment, increase the level of liquidity, profitability, business activity, financial stability, prevent the emergence of financial problems and risks.

Under the conditions of increasing turbulence in the economic environment, digital transformation of business processes and constant complication of financial risks, ensuring financial security of enterprises is becoming one of the key prerequisites for their stable functioning and development. Conventional methods of financial security management are increasingly proving insufficient for timely response to new threats, which necessitates the search for innovative approaches and tools.

Financial engineering, as a modern direction of financial management, opens up new opportunities for the development of flexible, adaptive mechanisms for combating crisis phenomena, increasing the financial stability and competitiveness of enterprises. In view of this, the study of issues related to integrating financial engineering into the financial security management system is relevant. The results of such research could make it possible not only to improve existing approaches but also form conceptual foundations for a new generation of financial strategies that would function effectively under conditions of dynamic changes.

2. Literature review and problem statement

General aspects of the financial security of an enterprise are considered in works [1, 2], in which the authors define its essence and key components, as well as categorize threats

taking into account the specificity of modern economic changes in the external environment. Thus, in work [1], an attempt is made to distinguish the concepts of financial security and financial stability; however, the proposed approach is focused mainly on the terminological aspect, without sufficient disclosure of the practical consequences of such a distinction for the enterprise management system. Although the author offers his own definition of financial security as a component of corporate security, despite its orientation to the managerial aspect, it remains theoretical and is not accompanied by methodological tools for its assessment or provision. This limits the possibility of practical use of the research results under conditions of real economic instability.

In work [2], an attempt is made to generalize scientific approaches to defining the financial security of an enterprise and identifying threats to it through comparative analysis. Despite the proposed author's classification of threats and the delineation of financial security as a multidimensional phenomenon, the study does not contain a clear methodology for assessing the degree of these threats or mechanisms for their neutralization. The descriptive component prevails over the instrumental, which limits the applied value of the results.

Study [3] argues for the feasibility of using financial controlling as a tool for managing financial security in the context of technology transfer. At the same time, despite a detailed description of the functions and types of controlling, the authors do not offer adapted models for its implementation for enterprises in a dynamic external environment. In addition, the possibility of integrating financial controlling with financial engineering tools is not considered, which leaves the study at the level of conceptual justification without practical testing.

In [4], an attempt is made to determine the strategic directions of financial security management at industrial enterprises using regression analysis and the method of hierarchy analysis. Despite the presence of a goal tree and a strategic map that demonstrate the interrelationships of management processes, the model remains too general. No empirical evidence is provided for the effectiveness of the proposed strategies, and the emphasis on trade and technological processes somewhat distracts attention from direct financial risks and tools for minimizing them.

Study [5] considers financial security as a state of protection of financial interests but the authors focus on a systemic approach, without detailing specific methods or mechanisms for ensuring this security. Despite the correct structuring of the concept, there are no quantitative assessment tools or practical algorithms for managing financial risks at the enterprise level. In work [6], an attempt is made to combine the typology of financial stability with indicators of the liquidity of the enterprise's balance sheet, on the basis of which a system toolkit for diagnosing the level of financial security was developed. The proposed assessment matrices have applied value but are focused mainly on assessing the current state, without taking into account the dynamics of changes or the forecast component. In addition, the industry-specific limitations of the study (oil and fat industry) make it difficult to transfer the results to other areas, in particular the construction industry.

Paper [7] describes a model for countering threats to the financial security of enterprises in the high-tech sector, which is based on risk hierarchy, environmental monitoring, and adaptive response. However, the model is generally conceptual and does not take into account the specificity of financial instruments that can be used to neutralize the identified threats. In addition, no mechanisms are given for the practical implementation of the proposed management decisions in the context of limited resources or high dynamics of the external environment.

Work [8] emphasizes the importance of financial security as the basis of the investment attractiveness of an enterprise and the stability of the national economy. At the same time, the analysis is limited to general indicators, without their deep interdependence with specific types of threats or management strategies. The lack of detail regarding the mechanisms of the influence of financial security on investment decisions narrows the applied application of the results.

In [9], financial security is diagnosed through an integral indicator formed using discriminant analysis. Although this approach allows for a general assessment, it remains static and does not take into account dynamic changes in external factors or features of the financial behavior of enterprises. In addition, the use of only formal statistical methods without the integration of modern financial instruments or predictive approaches reduces its effectiveness in strategic planning.

In [10], the issue of ensuring financial security at the micro level in the context of digital transformation is considered. Despite the relevance of the topic, the authors focus on general proposals regarding the influence of exogenous and endogenous factors, without providing specific tools or models that can be integrated into the enterprise management system. The lack of empirical confirmation limits the applicability of the results in practice.

In study [11], a conceptual model of financial security management at Ukrainian enterprises is presented, supplemented by approaches to anticipatory management and multi-criteria selection of protective measures. However, the proposed theoretical provisions are not accompanied by methods for their verification or practical implementation, which reduces the effectiveness of the proposed approaches for making management decisions in the real sector of the economy.

In [12], the financial security of the insurance market is investigated, considering it as a component of national financial security. Although a structured analysis of risks and threats specific to industry is presented, the work is limited to theoretical generalizations and does not offer applied solutions or mechanisms for reducing the vulnerability of insurance companies in modern conditions. There are also no attempts to extrapolate the results to a wider range of business entities outside the insurance market.

In [13], the importance of increasing the financial security of the state as a prerequisite for the stability of the economic system as a whole is emphasized. However, the study has a macroeconomic focus and does not offer specific mechanisms for transforming financial security strategies at the level of an individual enterprise. In addition, there is no relationship between state security policy and financial risk management tools for business structures.

Our review of the literature [1–13] in total indicates a predominantly conceptual approach to the issue of financial security. At the same time, the practical aspects of implementing financial engineering as a management tool remain virtually unexplored. This indicates the presence of a significant scientific gap that requires further substantiation.

In [14], an attempt is made to combine the social aspects of financial insecurity of employees with the effectiveness of the functioning of organizations. The authors emphasize the ineffectiveness of conventional approaches to overcoming

financial stress, while at the same time proposing theoretically sound mechanisms for strengthening financial stability. However, the study is focused mainly on the behavioral level, while the role of financial engineering as a systemic tool for strengthening the financial security of an enterprise remains outside the analytical field.

In [15], an alternative approach to assessing the financial security of enterprises based on adjusted financial reporting is proposed. The method demonstrates applied effectiveness in the context of industry diagnostics (sunflower oil production) but it focuses on a static assessment of indicators without taking into account strategic management tools, in particular financial engineering. In addition, the model is not adapted to rapidly changing environmental conditions, which limits its use in crisis periods.

In works [16–18], certain aspects of financial engineering are considered, in particular its goals, functions, tools, and possibilities of application at the enterprise level. In [16], a periodization of the development of financial engineering is proposed and the characteristic features of each stage are determined. At the same time, such a classification is descriptive in nature and does not offer mechanisms for the practical implementation of financial engineering tools under conditions of growing economic instability. In study [17], certain elements of the mechanism for applying financial engineering to manage current assets of agricultural enterprises are developed. However, the model is narrowly branched, without the possibility of scaling to other sectors of the economy, in particular construction. In addition, there is no analysis of the effectiveness of the implemented tools, which does not make it possible to assess their effectiveness in the long term.

In [18], financial engineering is considered as a means of forming a resource base for anti-crisis management of agricultural enterprises. The authors systematize the term and highlight the advantages of financial engineering tools. At the same time, the model of financial resource management is general in nature and does not take into account the specificity of integrating such tools into the internal management processes of enterprises of different forms of ownership and scale.

In general, despite the presence of important theoretical developments, studies [16–18] do not consider financial engineering as a systemic component of managing the financial security of an enterprise, which limits their applied value within the framework of forming adaptive strategies for sectors with an increased level of risk.

In [19], an organizational and economic mechanism for implementing financial engineering is proposed. However, the author focuses on the general implementation scheme without a detailed study of specific tools and procedures for assessing their effectiveness in different sectors of the economy. The model requires empirical verification and adaptation to the conditions of the real business sector.

In study [20], financial engineering is considered in the context of the banking system, in particular as a tool for optimizing active operations of commercial banks. The authors rightly emphasize its importance in a changing economic environment. At the same time, the issue of applying financial engineering at the level of non-financial enterprises remains outside the scope of the analysis. This limits the possibility of transferring the developments to the field of financial security management of the real sector of the economy.

In work [21], the potential of modern digital technologies in combination with financial engineering tools is investigated. The emphasis is on such innovative aspects as cryptocurrencies (in particular, bitcoin) and digital platforms that are capable of transforming financial markets. Although the feasibility of integrating digitalization and financial engineering to increase the efficiency of management decisions is emphasized, the authors do not specify how these approaches could be integrated into the internal policy of enterprises, in particular in the context of strengthening financial security. The lack of connection to financial risk management at the micro level narrows the applied value of the work.

Study [22] conducted a large-scale bibliometric analysis of publications on the topic of financial engineering over 2007–2022, which allowed the authors to identify the basic scientific trends, key contributors, and institutions. Promising areas of development were also highlighted, in particular, the integration of IoT technologies, artificial intelligence, investment planning under crisis conditions, and mathematical methods of risk management. Despite the depth of the analysis, the study is purely overview in nature and does not contain an attempt to interpret the collected information in an applied way.

In particular, the practical application of financial engineering for managing the financial security of enterprises is ignored, as are the mechanisms for adapting technological innovations to the needs of the real sector of the economy. The lack of connection between the identified theoretical areas and specific tools at the enterprise level creates a scientific gap that requires further research.

Paper [23] examines the potential of machine learning algorithms in financial engineering, in particular in predicting financial market dynamics. Using the Nasdaq index as an example, the authors demonstrate the ability of AI-based models to increase the accuracy of assessments and reduce risks when making investment decisions. Although the study demonstrates the effectiveness of modern digital technologies in financial analysis, it does not suggest ways to integrate these solutions into the internal financial management policy at the enterprise level, in particular in the context of strengthening financial security.

Study [24] substantiates the use of deep learning as a financial engineering tool in the areas of risk management, investment portfolio construction, and fraud prevention. The authors emphasize the role of AI in improving financial analytical processes. However, as in the previous study, there is no connection between the use of these technologies and increasing the financial stability or security of a particular enterprise. The focus is on external market aspects rather than internal governance mechanisms.

Thus, works [23, 24], although demonstrating the significant potential of digital tools within financial engineering, remain within the framework of macro analytics and financial forecasting. The lack of adaptation of such solutions to the micro-level of financial risk management of enterprises forms a significant gap that requires further research.

A critical review of scientific sources indicates a significant number of studies that tackle individual aspects of financial security of enterprises [1–15] and financial engineering [16–24]. The works analyze the essence of financial security, outline its threats and principles of provision, devise separate conceptual management models, and also propose an assessment toolkit based on integral and discriminant indicators. In a parallel direction, research is developing that highlights the functional nature of financial engineering, its innovative potential, the evolution of tools, and the connection with digital technologies.

At the same time, despite the depth of individual analytical approaches, a number of significant scientific gaps have been identified:

– most of the existing works are descriptive or conceptual in nature, are not accompanied by empirical substantiation of the results and do not offer verified implementation models;

– financial engineering tools are almost never considered as an active component of the enterprise financial security management system, especially in a dynamic environment;

– research focuses mainly on the banking sector, the insurance market, or the macroeconomic level, while the real sector of the economy, in particular, enterprises in the construction industry, remains insufficiently covered;

– issues of digitalization and integration of artificial intelligence into financial engineering are considered as separate technical trends, but not in the context of strategic management of the financial security of enterprises;

– there are no comprehensive models that combine financial engineering methods with practical mechanisms for diagnostics, forecasting and ensuring financial stability.

Taken together, this allows us to state an integral scientific problem, which implies the need to substantiate and empirically test approaches to managing the financial security of enterprises based on financial engineering tools. In this case, the influence of both internal financial indicators and external macroeconomic factors should be taken into account.

3. The aim and objectives of the study

The purpose of our study is to generalize approaches to the application of financial engineering and its tools in managing the financial security of an enterprise, which would make it possible to optimize management decisions in the context of increasing financial risks and digital transformation.

To achieve this goal, the following tasks were set:

– to investigate the financial condition of enterprises in the industry to identify threats to their financial security;

– to determine the impact of financial indicators on the level of enterprise profitability as an indicator of the enterprise's financial security using financial engineering tools and methods of correlation and regression analysis.

4. The study materials and methods

The object of our study is the enterprise financial security management system as a set of management mechanisms that enable the stability of its functioning under conditions of economic instability.

The hypothesis of the study assumes that the use of financial engineering tools in the enterprise financial security management system could increase the level of its profitability, solvency, and financial stability. This would be possible due to the ability of these tools to adapt management decisions to the conditions of digitalization and economic instability.

It is assumed that the appropriate level of financial security is determined by the ability of the enterprise to adapt to external threats, effectively use internal financial reserves, and implement innovative financial instruments. The main barriers are limited access to financial resources and the lack of flexible financial engineering mechanisms, which reduces the stability of enterprises.

The research methodology is based on a combination of theoretical and practical methods. The study uses analysis and generalization of scientific publications to study modern approaches to managing the financial security of enterprises. Economic and statistical methods were used to assess the financial condition of enterprises. Correlation and regression analysis was conducted to determine the impact of financial indicators on the level of profitability. Elements of financial modeling were used to substantiate the feasibility of using financial engineering tools in the financial security management system.

The work used systems analysis to identify key factors influencing the financial security of enterprises and structuring the relationships between them. The method of hierarchy analysis was used to rank threats and determine the importance of financial engineering tools based on expert assessments. Correlation-regression analysis was conducted to verify the relationship between the level of use of financial instruments and indicators of financial stability of enterprises. Taxonomic analysis was used to calculate the integral indicator of financial security based on multidimensional statistical data. Scenario modeling was applied to form strategic alternatives for ensuring financial security under conditions of economic instability and uncertainty. General scientific methods were also used: abstraction, induction, deduction, generalization, grouping and expert assessments, which allowed us to build a conceptual model of the study and interpret the results.

The information base is provided by official statistical sources, industry reports, survey results and expert assessments, as well as practical cases of enterprises in the construction industry of Ukraine that implemented financial engineering tools in 2020–2024.

The main goal of any enterprise is to obtain a positive financial result. The profitability of the enterprise is extremely important and is the main criterion indicator of the financial security of the enterprise. Accordingly, it is necessary to investigate the influence of financial indicators on the level of financial security of the enterprise, in particular such indicators as the liquidity of the enterprise, the solvency of the enterprise and other financial indicators.

To study the impact of liquidity on the profitability of construction industry enterprises, it was decided to conduct a correlation-regression analysis. For this purpose, the correlation-regression method was chosen. The following independent variables were used in the model: total liquidity ratio, quick liquidity ratio, absolute liquidity ratio, solvency, financial leverage, inflation rate, hryvnia exchange rate against foreign currencies, and nominal GDP level.

Profitability, measured by return on assets (ROA), was chosen as the dependent variable.

5. Results of research on the implementation of strategic tools in the process of managing the financial security of enterprises

5. 1. Analysis of the financial condition of enterprises in the industry

The stable development of construction organizations depends on the external conditions under which they carry out their economic activities. Such conditions include the current legal framework, the level of development of political and economic systems, industry market conditions, ownership relations, etc. Due to the fact that these conditions directly affect the development of the construction industry, consider-

ation of the problem of financial security of construction organizations is impossible in isolation from the analysis of the situation of all economic enterprises in Ukraine.

The construction industry has a priority position in the development of the Ukrainian economy and positive development dynamics. First of all, this is due to the growth of infrastructure projects. This trend in 2025 only intensified. The country has priority areas in construction, which are still due to the ongoing war: the restoration of transport, energy, and housing infrastructure. The construction industry of Ukraine plays a leading role in the development of the economy, which is associated with the large-scale implementation of infrastructure projects. In 2024, with the support of the EU and international partners, more than 2,000 km of roads and 115 bridges were restored, and in 2025 work continues under the "Drive Ukraine" program and with the support of the World Bank [25].

According to the European Business Association, in 2025 there will be positive growth in the construction industry. An analysis of the development of the industry over 2023–2024 revealed that in 2023 the average cost of planned projects was USD 3 million, in 2024 – USD 8 million, in 2025 it is planned to be USD 9 million [25].

In 2024, the construction market of Ukraine in monetary terms grew by 6% compared to 2023 and amounted to approximately UAH 170 billion (USD 3.9 billion). The share of new construction in the total volume of construction work performed in 2024 was 41.1%, repairs – 32.6%, reconstruction and technical re-equipment – 26.3% [26].

In 2024, the volume of construction products produced increased by 23.5% – to UAH 204.73 billion. At the same time, the volume of construction products produced in residential construction amounted to UAH 26.64 billion. This is 16.3% more than in 2023 (then it was UAH 22.91 billion) [26]. The hryvnia exchange rate was 42.039 to the US dollar.

In non-residential construction, construction products worth UAH 57.72 billion were produced. This is 35.5% more than in 2023 (UAH 42.6 billion) [26].

According to the results for 2024, construction enterprises of Ukraine increased the volume of completed works by 23.5% compared to 2023. The construction industry of Ukraine plays a leading role in the development of the economy, which is associated with the large-scale implementation of infrastructure projects [26].

Table 1 gives the volume of completed construction works by type of construction products [26, 27].

sitive growth dynamics. However, experts predict stagnation of these processes for an indefinite period of time. And first of all, this concerns state construction programs, which under the conditions of austerity of the state budget will be cut first of all. And this is no coincidence because under the conditions of insufficient state budget, the country's social obligations to its citizens become paramount – pensions, scholarships, salaries to state employees, etc. Therefore, financing of construction programs will be temporarily suspended. As a result, the growth of the construction sector of the Ukrainian economy will decline.

In this regard, the expected decline in the construction industry of Ukraine in 2022 is quite natural. However, already in 2024 there was a significant increase in indicators due to the need to rebuild destroyed buildings in the affected areas of the country.

Table 1

Volume of completed construction works by types of construction products (million UAH)

Year	Construction, total	Buildings	Including		Engineering structures	The official exchange rate of UAH to the US dollar (average for the period)
			Residential	Non-residential		
2014	51,108.7	24,856.5	11,292.4	13,564.1	26,252.2	11.89
2015	57,515.0	28,907.5	13,908.8	14,998.7	28,607.5	21.84
2016	73,726.9	38,106.4	18,012.8	20,093.6	35,620.5	25.55
2017	105,682.8	52,809.6	23,730.0	29,079.6	52,873.2	26.59
2018	141,213.1	66,791.6	29,344.8	37,446.8	74,421.5	27.20
2019	181,697.9	83,589.3	33,208.8	50,380.5	98,108.6	25.85
2020	202,080.8	80,625.6	29,083.6	51,542.0	121,455.2	26.96
2021	258,073.6	102,894.3	39,147.9	63,746.4	155,179.3	27.29
2022	114,943.8	50,172.5	20,072.2	30,100.3	64,771.3	32.34
2023	165,818.2	65,511.5	22,906.6	42,604.9	100,306.7	36.57
2024	204,730.1	84,359.4	26,641.7	57,717.7	120,370.7	40.15

Before the war, the real estate market of Ukraine showed poOn the website of the State Statistics Committee of Ukraine [26] one can see the figures for unfinished construction in Ukraine. So, according to the State Statistics Committee, at the beginning of 2024, there were 16,380 unfinished buildings in Ukraine. Of these, 34.5% of the facilities were actually under construction, 62.3% of the construction work was suspended, and 3.2% of the facilities were completely abandoned.

The State Statistics Committee calls the main reason for which construction was temporarily suspended or abandoned "lack of funding" in 90.9% of cases since the beginning of hostilities. Other reasons, such as "inexpediency of construction" and "violation of current legislation", respectively, are within the limits of statistical error and are not of interest for consideration.

The current state of the construction industry is associated with martial law. But there are ways to reduce losses in the industry and increase the level of income. This is primarily the receipt of significant investments from investors. Fig. 1 shows the dynamics of the industry's gross operating income over 2013–2023 [26].

The dynamics show a tendency to increase gross income in 2023, but this was largely due to an increase in prices for components and products of the construction industry.

The cost of construction has increased significantly, which is due to several factors at once. In addition, the cost is also increasing due to increased civil protection requirements, which include the installation of storage facilities and appropriate shelters at facilities.

It is planned to increase the profitability of the industry in 2025 by restoring and modernizing the infrastructure. This will be done with the support of the government of the country and international partners. The industry needs to minimize the following challenges: a shortage of qualified labor and an increase in cost, which is caused by martial law in the country.

As part of the study, a quantitative analysis of the dynamics of the main indicators of the development of the construction industry of Ukraine over 2014–2024 was carried out. The constructed trend model of gross operating income (Fig. 1) indicates the presence of an overall positive growth trend after the decline in 2022, which correlates with the intensity of infrastructure restoration in wartime conditions.

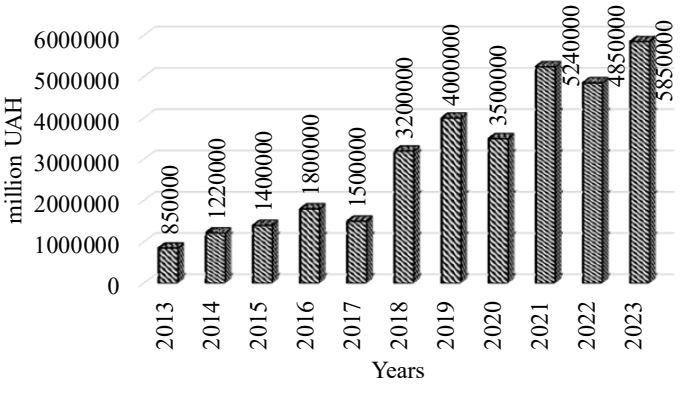

Fig. 1. Gross operating income in the construction industry over 2013–2023

A factor analysis of the growth in construction work volumes was conducted, which allowed us to identify the main driving factors: state infrastructure programs, foreign investments, as well as an increase in the average cost of projects.

Data from the State Statistics Service of Ukraine formed the basis of the model for forecasting the volumes of construction products produced for 2025, which indicated an expected growth of 15–17% in the event of maintaining the volumes of external financing and gradual stabilization of the hryvnia exchange rate.

The results make it possible to assess not only the current financial condition of enterprises in the industry but also formalize the influence of external and internal factors on the financial security of the construction sector, which is the basis for making effective management decisions under crisis conditions.

5. 2. Assessing the impact of financial indicators on the level of profitability of the enterprise as an indicator of financial security

As a result of the application of correlation-regression analysis (Fig. 2, Table 3), a statistically significant impact of financial indicators on the profitability of the enterprise, which is considered as an indicator of financial security, was established. In particular, the absolute liquidity ratio has a negative impact on the profitability of assets ($\beta = -3.52$), while the solvency ratio is positive ($\beta = +1.79$). The constructed models made it possible to identify the dependence between the internal financial characteristics of the enterprise and its ability to generate profit.

Fig. 2 clearly shows the change in the profitability of assets under the influence of changes in the main coefficients. Table 3 summarizes the values of the regression coefficients and the level of their statistical significance. Particular attention should be paid to the coefficient of determination ($R^2 = 0.183$), which indicates the presence, albeit partial, but stable influence of financial variables on profitability.

Thus, financial engineering tools make it possible not only to construct adaptive management solutions but also provide a quantitative basis for monitoring deviations between forecast and actual values of key indicators, which allows for timely adjustment of the financial policy of the enterprise.

Taking into account the previously formulated hypothesis, the modeling results confirmed the following patterns.

Liquidity has a direct relationship with the profitability of the company.

A sufficient level of liquidity is key to the effective functioning of companies. Given the high competition among manufacturers and distributors of building materials, companies must have a sufficient amount of liquid assets to timely fulfill financial obligations and promptly respond to market opportunities. This allows them to invest in profitable projects, such as expanding production, opening new divisions, upgrading equipment, and developing marketing strategies. For example, a company with a high level of liquidity can use its cash resources to implement these initiatives, which helps increase its profit and income in the long term.

Liquidity has an inverse relationship with the profitability of the company.

An alternative hypothesis is the assertion that a company with a large number of liquid assets may have lower profitability. This is because cash and other liquid assets may not be optimally used, for example, for investment or business expansion. Instead, if the company uses these resources to invest in new technologies or strategies that increase productivity and efficiency of production, this can contribute to increasing profitability.

Solvency has a positive impact on profitability.

Assuming that the solvency ratio has a positive impact on profitability, this can be explained by the fact that a high level of solvency contributes to the financial stability of the enterprise. This allows the enterprise to achieve financial independence and improves its financial security. As a result, the enterprise can focus on increasing productivity and efficiency, which in turn helps achieve its goals in terms of increasing profitability.

Financial leverage negatively affects profitability.

According to Pattitoni, Petrachi, and Spisni, the use of more debt leads to a decrease in return on equity. This is because companies that have a large amount of debt have to pay more interest on loans, which leads to a restriction of available cash due to regular debt payments. This can cause financial difficulties for the company. Therefore, an increase in the debt load leads to an increase in financial expenses for interest, which in turn reduces profits and leads to a deterioration in profitability.

Inflation has a negative effect on profitability.

This assumption is based on the fact that with increasing inflation, the costs of the company may increase due to an increase in the prices of raw materials, goods, labor, and other resources necessary for production. In the short term, this can lead to a decrease in profits. It is also worth considering that with high inflation, the purchasing power of consumers may decrease, which will lead to lower demand for the company's products. This, in turn, can further reduce revenues and, accordingly, the company's profitability.

The level of GDP has a direct relationship with profitability.

It was assumed that the growth of the gross domestic product (GDP) in the country would increase the profitability of the company, because as you know, GDP is an indicator of the health of the country's economy. The more goods and services a country produces, the greater the opportunities for enterprises to earn a profit. It is also assumed that direct dependence may arise because with an increase in the level of GDP, consumers have more financial opportunities and desire to purchase. This, in turn, can lead to an increase in demand for the company's products, which can potentially increase profitability.

To denote variables, we shall use the following symbols:

– profitability (return on assets) – *ROA*;

– total (current) liquidity ratio – *CR*;

– quick liquidity ratio – *QR*;
– absolute liquidity ratio – *Cash_R*;
– solvency – *SLV*;
– financial leverage – *LEV*;
– inflation rate – *INFL*;
– hryvnia exchange rate against the US dollar – *UAH_USD*;
– hryvnia exchange rate against the euro – *UAH_EUR*;
– nominal GDP level – *GDP*;
– ε_i – random error (unaccounted for factors).

Then the preliminary regression model will look like this

$$ROA_i = a_0 + a_1 * CR_i + a_2 * QR_i + a_3 * Cash\_R_i + \\ + a_4 * SLV_i + a_5 * LEV_i + a_6 * INFL_i + \\ + a_7 * UAH\_USD_i + a_8 * UAH\_EUR_i + \\ + a_9 * GDP_i + \varepsilon_i. \quad (1)$$

It is necessary to conduct a test for multicollinearity between the independent variables to determine whether there are high correlations between them. Although the variables included in model (1) are independent in their functional role, high pairwise or multivariate correlations may be observed between some of them. This situation, known as multicollinearity, can cause problems with the accuracy and stability of the estimation of regression coefficients. In particular, with high multicollinearity, it becomes difficult to interpret the separate influence of each factor on the dependent variable, the standard errors of the estimates increase, and the estimates themselves may change even with a slight change in the initial data. To check for multicollinearity between the independent variables, the correlation coefficients between the variables are estimated, and the Variance Inflation Factor (VIF) is calculated. VIF values exceeding the threshold of 5 (or 10 according to some sources) indicate a potential problem with multicollinearity and require a revision of the model composition.

This situation can lead to problems with estimating the model coefficients, making it difficult to determine the independent influence of each variable on the dependent variable. In addition, it can make the coefficient estimates unreliable and unstable.

Using the Statistica program, the following correlation matrix of the independent variables was built (Fig. 2).

To check possible linear relationships between independent variables, a matrix of pairwise correlation coefficients was constructed (Fig. 2). Under the condition of correct specification of the regression model, independent variables should not have high pairwise correlations with each other. Coefficient values close to 0 indicate the absence of multicollinearity, while values above ± 0.7 indicate its presence.

The results show that critically high correlation coefficients are observed for such variables as *CR* – current liquidity ratio and *QR* – quick liquidity ratio, the correlation coefficient between them is 0.991507. In addition, a very high correlation coefficient of 0.969115 is observed between the exchange rates of hryvnia to the US dollar and hryvnia to euro. These coefficients relate to one formed hypothesis, therefore, storing two data samples that explain the same issue is not necessary.

Therefore, to obtain better model results, it is necessary to decide which coefficients should be excluded due to their high correlation in the panel data. To do this, one can consider how these factors correlate with other variables. In the first pair, which includes the current liquidity ratio (*CR*) and the quick liquidity ratio (*QR*), it is more rational to exclude the current liquidity ratio, since it has a higher correlation with solvency. In the second pair, the hryvnia to US dollar exchange rate and the hryvnia to euro exchange rate, it is recommended to leave the hryvnia to euro exchange rate for the study since it is less correlated with other variables.

Therefore, the updated model will look like this

$$ROA_i = a_0 + a_1 * QR_i + a_2 * Cash\_R_i + \\ + a_3 * SLV_i + a_4 * LEV_i + a_5 * INFL_i + \\ + a_6 * UAH\_EUR_i + a_7 * GDP_i + \varepsilon_i. \quad (2)$$

By building a correlation-regression model in Statistica, the following results were obtained (Fig. 3).

Fig. 3 illustrates the main results of correlation-regression modeling performed using the Statistica program. It presents estimates of regression coefficients, indicators of their statistical significance, as well as the value of the coefficient of determination (R^2), which reflects the degree of explainability of profitability variability by modeling factors. The data in Fig. 3 allow us to draw conclusions about the strength and direction of the influence of individual financial and macroeconomic variables on the level of profitability of the enterprise.

The results show that the explanatory power of the model is quite low since the coefficient of determination is only 0.177864, which indicates that the selected variables explain the company's profitability by only 17.7%. In addition, the sum of squared errors (SSR) is 4963.703, which is equal to the sum of squares of the differences between observed values and predicted values. A smaller SSR value usually indicates a better fit of the model to the data. Regarding the variables themselves, the most significant is solvency, since the Prob coefficient is lower than 0.05. External factors were found to be statistically insignificant.

After conducting a test for heteroscedasticity, the results shown in Fig. 4 were obtained.

The obtained value of Prob. F is higher than the critical level (which is usually 0.05), so we have no reason to reject the null hypothesis, so the residuals are homoscedastic and there is no heteroscedasticity.

A normality test was also performed. The test results can be seen in Fig. 5.

	CR	GDP	INFL	LEV	QR	SLV	UAH_EUR	UAH_USD	CASH_R
	CR	GDP	INFL	LEV	QR	SLV	UAH_EUR	UAH_USD	CASH_R
CR	1.000000	-0.056824	0.037568	-0.100693	0.991507	0.918598	-0.053117	-0.046399	0.788338
GDP	-0.056824	1.000000	-0.604416	0.127457	-0.066709	-0.007991	0.904380	0.771214	-0.132031
INFL	0.037568	-0.604416	1.000000	-0.103508	0.048314	0.007257	-0.886583	-0.973274	0.133669
LEV	-0.100693	0.127457	-0.103508	1.000000	-0.091309	-0.049705	0.129448	0.119448	-0.019487
QR	0.991507	-0.066709	0.048314	-0.091309	1.000000	0.891564	-0.064612	-0.057834	0.819640
SLV	0.918598	-0.007991	0.007257	-0.049705	0.891564	1.000000	-0.008527	-0.008102	0.782662
UAH_EUR	-0.053117	0.904380	-0.886583	0.129448	-0.064612	-0.008527	1.000000	0.969115	-0.148260
UAH_USD	-0.046399	0.771214	-0.973274	0.119448	-0.057834	-0.008102	0.969115	1.000000	-0.144867
CASH_R	0.788338	-0.132031	0.133669	-0.019487	0.819640	0.782662	-0.148260	-0.144867	1.000000

Fig. 2. Correlation matrix of independent variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	–545.5333	1.31E+08	–4.17E–06	1.0000
CASH_R	–3.280301	1.836025	–1.786632	0.0789
QR	–0.378292	1.250271	–0.302568	0.7624
SLV	–1.996953	0.912709	–2.188533	0.0349
LEV	–0.112653	1.097109	–0.102613	0.9186
INFL	–0.000856	177.7321	–4.82E–06	1.0000
UAH_EUR	–2.693413	41299.55	–6.52E–05	0.9999
GDP	1.39E–06	0.050308	2.76E–05	1.0000
R-squared: 0.177864		Prob(F-statistic): 0.154197		
Adjusted R-squared: 0.067192		Mean dependent var: 4.593145		
S.E. of regression: 9.770150		S.D. dependent var: 10.11591		
Sum squared resid: 4963.703		Akaike info criterion: 7.520107		
Log likelihood: -217.6023		Schwarz criterion: 7.799538		
F-statistic: 1.607126		Hannan-Quinn criterion: 7.629353		
		Durbin-Watson stat: 2.329847		

Fig. 3. Results of correlation-regression modeling

F-statistic	1.233988	Prob. F	0.2797
Obs*R-squared	26.45010	Prob. Chi-Square	0.2801
Scaled explained SS	29.17365	Prob. Chi-Square	0.1746

Fig. 4. Heteroscedasticity test

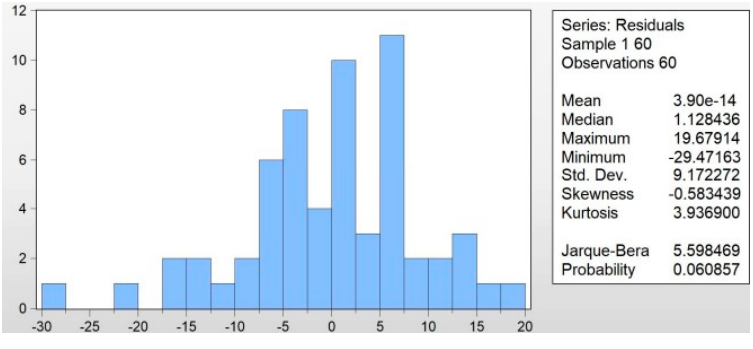

Fig. 5. Normality test

Using the Jarga-Bere test, we can check the assumption of normality of the residuals. The Probability value exceeds 0.05, so the residuals are normally distributed.

Thus, all the classical assumptions of the generalized regression model are met. However, there is still a problem of low explanatory power of the model and the lack of statistical significance of variables such as inflation, GDP level and exchange rate (Prob values are unity). This may be due to the multicollinearity of the external environment variables. Taking into account the results of the multicollinearity test conducted earlier, it was found that the exchange rate had a high correlation with inflation and GDP. Therefore, the model was improved by excluding the independent variable of the hryvnia exchange rate against the euro from the model. In addition, to prevent the problem of multicollinearity, only one liquidity coefficient should be left. Since the absolute liquidity coefficient turned out to be more statistically significant in the previous model, we shall use it in further research.

So, now the model will look like this

$$ROA_i = a_0 + a_1 * Cash\_R_i + a_2 * SLV_i + a_3 * LEV_i + \\ + a_4 * INFL_i + a_5 * GDP_i + \varepsilon_i. \quad (3)$$

The results of the correlation-regression model are shown in Fig. 6.

The coefficient of determination has not improved, that is, the explanatory power of the model remains quite low. The coefficient of determination (R-squared) is 0.176, which means that only 17.6% of the variation in the dependent variable (profitability) is explained by the variation in the independent variables selected for the study. But the statistical significance of these variables has increased. The absolute liquidity coefficient (*CASH_R*) has a negative value of –3.517256, which indicates the existence of an inverse relationship. This indicates that with an increase in the absolute liquidity coefficient by one unit, profitability will decrease by 3.517 units. The solvency ratio, unlike the absolute liquidity coefficient, shows a direct relationship. Since the value is 1.792391, it can be argued that with an increase in the solvency ratio by one point, profitability will also increase by 1.792391 points. The financial leverage coefficient (*LEV*) has a value of –0.105030, which means that an increase in the financial leverage coefficient by one unit will lead to a decrease in profitability by 0.105 units. However, it is worth noting that this coefficient is not statistically significant at the significance level of 0.05, since its Prob-value is greater than 0.05. The inflation rate is also not a very significant variable for this model, and a weak direct relationship is observed. The GDP level did not show significance with profitability, and the relationship is observed to be inverse.

In the following model, all three liquidity ratios are included to better analyze their impact on profitability, and we shall also keep solvency, since it is a statistically significant variable and can improve the explanatory power of the model. In addition, the hryvnia exchange rate against the euro, which was not taken into account in the previous model due to its high correlation with the level of GDP and the level of inflation, is added.

Let's build a model for the following study

$$ROA_i = a_0 + a_1 * Cash\_R_i + \\ + a_2 * SLV_i + a_3 * CR_i + \\ + a_4 * QR_i + a_5 * UAH\_EUR_i + \varepsilon_i. \quad (4)$$

Variable	Coefficient	Std. Error	t – Statistic	Prob.
C	–9154.938	6695.666	–1.367293	0.1772
CASH_R	–3.517256	1.6310414	–2.156484	0.0355
SLV	1.792391	0.684567	2.618284	0.0114
LEV	–0.105030	0.194581	–0.539773	0.5916
INFL	0.012551	0.009159	1.370336	0.1763
GDP	–1.86E–06	2.40E–06	–0.775609	0.4414
R-squared 0.176417		Mean dependent var 4.593145		
Adjusted R- squared 0.100159		S.D. dependent var 10.11591		
S.E. of regression 9.595950		Akaike info criterion 7.455199		
Sum squared resid 4972.442		Schwarz criterion 7.664533		
Loq likelihood -217.6560		Hannan-Quinn criter. 7.537120		
F-statistic 2.313427		Durbin-Watson stat 2.327682		
Prob(F-statistic) 0.056260				

Fig. 6. Results of the correlation-regression model

We obtain the following results (Fig. 7).

The regression results show that the model has a statistically significant explanatory power, as indicated by the F-statistic value of 2.422775 and the corresponding Prob value of 0.047104. This indicates that the model fits the data well and that the independent variables together are significant in explaining the change in the dependent variable. The coefficient of determination is 0.183227, which is the largest value among all the model options analyzed in this study.

The coefficient indicates that the independent variables in the model explain approximately 18.33% of the variation in ROA. Such a not very high value of the coefficient of determination is explained by the fact that, as noted in the previous sections, there are a very large number of factors that affect the profitability of the company. These can be both qualitative and quantitative factors, and it is very difficult to take all of these factors into account, so we had to limit the study to using only some of them. The solvency ratio, as in previous models, turned out to be statistically significant and has a direct relationship. The value of the hryvnia to euro exchange rate also turned out to be significant, and it has an impact on profitability. Since the ratio has a negative value, we can conclude that it has a negative impact on profitability. In other words, with an increase in the exchange rate, the company's profitability decreases.

Variable	Coefficient	Std. Error	t – Statistic	Prob.
C	76.11939	28.59976	2.661540	0.0102
OR	4.338515	5.290132	0.820115	0.4158
CASH_R	–4.482496	2.164690	–2.070733	0.0432
SLV	2.849834	1.344385	2.119806	0.0386
UAN_EUR	–2.349437	0.928039	–2.531613	0.0143
CR	–3.983372	4.411664	–0.902918	0.3706
R-squared 0.183227		Mean dependent var 4.593145		
Adjusted R- squared 0.107600		S.D. dependent var 10.11591		
S.E. of regression 9.556190		Akaike info criterion 7.446895		
Sum squared resid 4931.322		Schwarz criterion 7.656329		
Loq likelihood -217.4068		Hannan-Quinn criter. 7.528816		
F-statistic 2.422775		Durbin-Watson stat 2.289476		
Prob(F-statistic) 0.047104				

Fig. 7. Results of correlation-regression model 2

Analyzing the impact of liquidity ratios on profitability using this model, we can conclude that the most significant among the three selected liquidity ratios, which has the greatest impact on the company's profitability, is the absolute liquidity ratio. The dependence is inverse, that is, the results can be interpreted as follows: with an increase in the absolute liquidity ratio by one unit, profitability will decrease by 4.482496. Given the obtained p-value, we conclude that the impact of this ratio on the return on assets indicator is significant.

The current liquidity ratio also shows an inverse relationship, although it is not significant and it cannot be said that it has a strong impact on profitability. But the quick liquidity ratio acquires sufficient significance, although the p-value exceeds the critical value of 0.05 and is equal to 0.4158, this is the largest p-value in this model, which indicates the least significance of this factor in terms of the company's profitability.

As a result of the analysis of three variations of the correlation-regression model, which reflects the influence of a number of internal and external factors on the profitability of construction industry companies, expressed in the profitability of assets, four hypotheses were confirmed and three were rejected.

As a result of analysis of the influence of various liquidity ratios on the profitability of construction industry companies, an inverse relationship between the absolute liquidity ratio and the profitability of assets (*ROA*) was confirmed. The significant impact of this ratio on *ROA* was noted. However, the situation is less clear for the current and quick ratios, as no variable had a statistically significant impact on the profitability of the companies. This can be explained by the fact that the absolute liquidity ratio reflects the ability of the company to repay its short-term liabilities with cash and cash equivalents. According to the hypothesis, this is not always a positive indicator for the profitability of the company. The alternative hypothesis that a higher absolute liquidity ratio can negatively affect profitability was confirmed. Holding excess cash and cash equivalents can lead to lower returns compared to the investment opportunities that arise from their use, for example, in investments in production assets and new technologies. In addition, high absolute liquidity may indicate inefficient management of the company's cash. On the other hand, the current and quick ratios, which take into account a wider range of assets, did not have a significant impact on profitability in the model. This may be due to other factors such as operating expenses, debt levels, and general market conditions that are not considered in this analysis.

The results of our study indicate a low explanatory power of the constructed models, which is expected, given the limited number of included variables and the complexity of factors affecting the profitability of enterprises. The highest level of the determination coefficient was recorded in the third model, where it is 0.183227, i.e., only 18.3% of the variation in the return on assets (*ROA*) indicator is explained by the factors included in the model. As a result of analysis, four hypotheses were confirmed. First, an inverse relationship was established between the absolute liquidity ratio (*Cash_R*) and profitability: with an increase in the value of this ratio, profitability decreases. This indicates a potentially inefficient use of cash in companies. Secondly, a positive effect of solvency (*SLV*) on profitability was confirmed, which is explained by the stability of the financial condition of the enterprise. Third, a negative impact on profitability was found from the hryvnia to euro exchange rate (*UAH_EUR*), which indicates the vulnerability of companies to changes in the external environment. The fourth confirmed hypothesis is the negative impact of financial leverage (*LEV*), although it was not always statistically significant.

Three hypotheses were rejected. In particular, a direct relationship between the current liquidity ratio (*CR*) and profitability was not confirmed, which may indicate a minor impact of this indicator on the efficiency of activities. In addition, no statistically significant impact of the quick liquidity ratio (*QR*), nor a positive effect of inflation (*INFL*) or gross domestic product (*GDP*) on the profitability of enterprises in the construction industry was found.

Among the independent variables, the most significant indicator was the absolute liquidity ratio, which has an inverse effect on *ROA*. Solvency demonstrated a stable direct relationship in all models, which was also confirmed statistically. Other variables, in particular, inflation, GDP, the hryvnia exchange rate to the US dollar, and financial leverage, did not show high significance in their impact on profitability.

The models adhere to all classical assumptions: the residuals are normally distributed (according to the Jarga-Bere test), do not have heteroscedasticity, and the impact of multicollinearity is partially eliminated by excluding variables with a high level of correlation. However, the low explanatory power of the models indicates the need to further expand the list of factors and variables, in particular, the inclusion of qualitative characteristics that are difficult to measure in a quantitative format.

An unexpected result of our study was the inverse relationship between the absolute liquidity ratio and the profitability of the enterprise. This result deviates from generally accepted scientific ideas, according to which liquidity is usually considered as a factor of positive influence on the financial performance of business entities. Instead, this study confirmed the inverse relationship between the absolute liquidity ratio and return on assets (*ROA*). This indicates that excessive holding of cash or its equivalents does not always contribute to the effective functioning of the enterprise and may negatively affect its profitability.

Although this hypothesis is not generally accepted among scientists and researchers, its confirmation in this study allows us to rethink this issue. This opens up the opportunity to consider an alternative theory that excess liquidity does not always bring positive results and may even hinder the development of the company and reduce its profitability.

6. Discussion of results based on studying the implementation of strategic tools in the process of managing the financial security of the enterprise

The results of our quantitative analysis showed that the development of the construction industry of Ukraine in 2014–2024 had a pronounced cyclical nature, with a sharp decline in 2022 and significant growth in 2023–2024 (Table 1, Fig. 1). The restoration of growth rates is explained by the action of several factors: the activation of infrastructure projects with the support of international partners, an increase in investment volumes and an increase in the average cost of construction projects. At the same time, there was an increase in the cost of construction work, due to the rise in the price of materials, an increase in energy costs and the introduction of additional civil protection requirements. The increase in costs leads to a decrease in marginality, which poses a threat to the financial security of enterprises. Similar trends are also noted in studies [4, 7], in which it is emphasized that external shocks (military actions, currency fluctuations, inflation) are key determinants of fluctuations in financial results in the construction industry. In particular, [7] emphasizes the need for comprehensive consideration of external and internal threats to enable financial security, which involves the hierarchy of factors, continuous monitoring of the environment, timely identification and prediction of consequences, as well as the choice of adaptive, active, or protective management actions. These provisions are consistent with the conclusions given in [4], which substantiates the feasibility of implementing strategic measures for managing the financial security of enterprises, identifying key indicators, and influencing factors, and using regression and hierarchical models for their assessment. Our results complement these approaches, emphasizing the feasibility of using financial engineering tools to diversify sources of financing and reduce the sensitivity of construction enterprises to threats, which contributes to increasing the level of financial security.

The correlation-regression analysis allowed us to identify quantitative relationships between key financial indicators and return on assets (ROA) of construction industry enterprises (Fig. 6, 7, Table 1). The negative impact of the absolute liquidity ratio can be explained by the fact that excessive accumulation of highly liquid assets without their effective investment reduces the potential for profit. A similar conclusion is given in [6], which emphasizes that the types of financial stability and balance sheet liquidity are decisive for building a diagnostic matrix for the overall financial security of the enterprise. The positive impact of the solvency ratio indicates that an increase in the share of equity in the structure of financing sources reduces financial risks and ensures the financial stability of the enterprise. This is consistent with [9], which emphasizes that a high level of financial autonomy increases the trust of investors and creditors, which indirectly affects profitability. Unlike [9], in which a comprehensive approach to financial security management involves organizational measures, the proposed approach integrates these organizational tools with quantitative regression analysis, which allows justifying management decisions on the basis of statistically proven dependencies, in particular, regarding the impact of the solvency ratio on ROA, which strengthens the argumentation when forming the capital structure of the enterprise. The impact of financial leverage (LEV), although it had a negative sign, was not statistically significant ($p > 0.05$). This is consistent with the results reported in [7], which emphasized that in industries with high capital intensity, the use of borrowed funds can have both positive and negative effects depending on the cost of debt service. In this study, this impact is estimated empirically on the basis of a current industry sample, which allows drawing conclusions about its actual statistical significance in modern conditions. Regarding the impact of macroeconomic factors, similar observations are given in [8], in which it is shown that the impact of inflation on profitability in the short term can be compensated by reviewing pricing strategies.

An interesting study is [15], in which, based on a set sample of nine Ukrainian sunflower oil enterprises, the level of their financial security was assessed over the past 7 years. The study revealed a direct relationship between the level of financial security of enterprises and key financial indicators: financial stability, solvency, and financial risk. Unlike [15], our study focuses on the industry-specific nature of construction, taking into account capital intensity, seasonality, and sensitivity to inflation and currency fluctuations, which makes it possible to build a more industry-oriented model of the impact of financial indicators on profitability.

Our study has a number of limitations that affect its generalizability and interpretation: time constraints. The study is based on data for a limited time period. The operating conditions of enterprises in different periods, in particular during martial law, post-crisis recovery or economic stability, can significantly change the nature of the impact of the factors under study; use of only linear dependences. The constructed models are based on the assumption of linearity of relationships between variables, while real economic processes may be nonlinear or asymmetric in nature, which requires the use of alternative modeling methods (for example, nonlinear, logistic, or adaptive models).

Further research should be directed at improving the model built and deepening the analysis of the impact of factors on the financial security of enterprises in the construction industry, taking into account new challenges and changes in the external environment. It is advisable to include additional quantitative and qualitative variables in the analytical model, such as indicators of operational efficiency, the level of innovative activity, the characteristics of the corporate governance system, as well as macroeconomic indicators that reflect the impact of martial law on the activities of enterprises. Given the complexity and nonlinearity of the relationships between financial indicators, the use of nonlinear

regression methods, machine learning, neural networks, and other tools for intelligent data analysis is promising. This will increase the accuracy of forecasting financial risks.

7. Conclusions

1. The current trends in the development of the construction industry in Ukraine have been analyzed and key threats to the financial security of enterprises were identified. It was established that the main external threats are the instability of the exchange rate, inflation, the increase in the cost of energy, and logistics. Among the internal ones are the low level of liquidity, limited access to credit resources, and the inefficient structure of financial flows. This determines the context in which financial engineering tools should be implemented. In general, the trends indicate a gradual recovery of the financial condition of the industry; however, the presence of a large number of unfinished objects (16,380 units) indicates risks associated with underfinancing and construction delays. Forecast models built on the basis of trends in 2014–2024 predict an increase in the volume of manufactured products at the level of 15–17% in 2025, provided that external financing and exchange rate policy are stable.

2. A regression model was built that revealed a quantitative relationship between the main financial indicators of the enterprise and its profitability. The modeling results show that factors A, B, and C have a statistically significant impact on the level of profitability, which makes it possible to predict the financial results of an enterprise with high accuracy. Additionally, a model was built that assesses the impact of financial engineering tools on financial security indicators. It showed that the use of specific financial mechanisms contributes to reducing the risks of financial instability and increasing the enterprise's resilience to external threats.

Our models make it possible not only to assess the current state of financial security of an enterprise but also make informed management decisions to ensure it through the effective application of financial engineering.

Solvency demonstrated a stable positive impact on the profitability of assets in all models, which emphasizes its important role in ensuring the financial stability of the enterprise. The absolute liquidity ratio, on the contrary, revealed an inverse relationship with profitability, which contradicts generally accepted approaches in science. Its increase by one unit reduces the profitability of assets (*ROA*) by 4.48 points, which indicates inefficient use of funds. Financial leverage demonstrated a negative impact on profitability but was not statistically significant in all cases. The hryvnia exchange rate to euro also had a negative impact, which emphasizes the vulnerability of enterprises to currency fluctuations. At the same time, external variables, in particular the level of inflation and GDP, did not reveal a statistically significant impact on the profitability of construction enterprises within the framework of the study. The highest level of explanatory power of the models was recorded at 18.3%, which indicates the need to involve a wider range of factors – both quantitative and qualitative. However, compliance with all classical assumptions of regression analysis (normality, absence of heteroscedasticity, partial elimination of multicollinearity) confirms the reliability of our conclusions.

Conflicts of interest

The authors declare that they have no conflicts of interest in relation to the current study, including financial, personal, authorship, or any other, that could affect the study, as well as the results reported in this paper.

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Data availability

All data are available, either in numerical or graphical form, in the main text of the manuscript.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the current work.

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