

Economics and Business Management

16(1), 183-197

Journal homepage: <https://economicscience.com.ua/en>

Received: 27.09.2024 Revised: 08.01.2025 Accepted: 27.02.2025

UDC 330.322:330.131.7:336.648

DOI: 10.31548/economics/1.2025.183

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Investment projects in conditions of economic instability: Forecasting financial risks

Abstract. In conditions of unprecedented economic turbulence and increasing global financial instability, there is a growing need to improve approaches to forecasting financial risks of investment projects, which will ensure their viability and effectiveness in the long term. The aim of this work was to develop a comprehensive methodology for assessing and forecasting financial risks that takes into account multiple factors of uncertainty and improves the quality of investment decisions. Using the example of the project "Restoration of the material and technical base and infrastructure facilities of the State Enterprise "International Children's Centre "Artek", an analysis of key risk factors was carried out, among which the most significant were macroeconomic indicators (57.4%), political and institutional factors (29.6%), and project risks (13%). The developed integrated forecasting model combines quantitative and qualitative risk assessment methods, taking into account their interaction and multiplicative effects. The proposed early warning system allows detecting signs of increased risk 3-6 months before the actual impact on the project. Monte Carlo modelling has shown that for high levels of economic instability, the most effective strategy is to minimise risk through phased financing and diversification of sources, which can reduce the probability of project termination by 40-45%. For medium levels of instability, it is recommended to apply balanced management using reserve funds and public-private partnership mechanisms. The impact of the digital transformation of the economy on the risk structure was also studied,

Suggested Citation:

Muzychenko, A., Huz, M., & Chukhlib, A. (2025). Investment projects in conditions of economic instability: Forecasting financial risks. *Economics and Business Management*, 16(1), 183-197. doi: 10.31548/economics/1.2025.183.

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and methods for adapting investment strategies to new technological challenges in the context of growing global competition were proposed. The practical value of the results lies in the possibility of using them to improve the efficiency of investment project management in various sectors of the economy in conditions of uncertainty, which is particularly relevant for projects with long investment cycles and public funding

Keywords: analysis; forecasting; diversification; multiplier effects; integrated model

INTRODUCTION

The current investment environment is characterised by an unprecedented level of uncertainty and increased volatility, which poses significant challenges for investment entities. The global economic turmoil of recent years, including pandemic restrictions, geopolitical conflicts, energy crises and inflationary surges, has significantly transformed approaches to risk assessment of investment projects. Assessing and forecasting the financial risks of investment projects in the context of economic instability is becoming a priority task to ensure the effectiveness of investment decisions and the achievement of planned results, especially for projects with a long investment cycle.

According to a World Bank study (2023), global economic uncertainty has increased by 38% compared to the pre-pandemic period, which has directly affected the volume and quality of investment globally. In the context of economic turbulence, traditional methods of assessing the financial risks of investment projects are limited in their effectiveness. According to S.A. Al-Thaqeb & B.G. Algharabali (2019), classical models based on historical data and the assumption of a normal risk distribution often fail to take into account structural breaks and regime changes that are typical of periods of economic instability. The authors analysed more than 50 studies on economic uncertainty and found that traditional approaches do not sufficiently account for the non-linear relationships between different types of risks. The problem is compounded by the fact that investment projects, especially long-term ones, face multiple sources of risk, including economic policy risks, interest rate fluctuations, currency risks, and inflationary shocks.

Significant contributions to the study of the impact of economic uncertainty on investment decisions have been made by F. Wen *et al.* (2021), who developed a theoretical framework for

assessing corporate risks in the face of macroeconomic instability. Their approach focuses on the relationship between indicators of economic political uncertainty and corporate investment decision-making. The researchers analysed data from 1937 Chinese companies over the period 2009-2018 and proved that a 1% increase in the economic political uncertainty index leads to a 0.5-0.7% reduction in corporate investment.

In turn, Q. Kong *et al.* (2022) expanded on this concept by considering investment decisions as a dilemma between risk and opportunity, where economic instability can create both threats and potential opportunities for investors. The researchers proposed a two-dimensional model for evaluating investment decisions that simultaneously takes into account both the negative impact of uncertainty through the risk factor and the positive impact of opportunities. Based on an empirical analysis of 2,106 companies, they proved that those organisations that use periods of uncertainty for strategic investments demonstrate better financial results in the long term.

However, despite a significant amount of research in the field of risk management of investment projects, there are significant gaps in understanding the interaction of different types of risks in the context of systemic economic instability. As noted by V. Yilanci & E.N. Kilci (2021) note that most existing models consider different types of risks in isolation, without taking into account the effect of their mutual reinforcement or compensation. The authors analysed the relationship between economic and political uncertainty and precious metals prices for the period 1997-2020 and found nonlinear and asymmetric relationships that cannot be detected by traditional risk assessment methods. Their research demonstrates the need to introduce more flexible methods that can take into account the changing nature of causal relationships.

In addition, as emphasised by C. Zhang *et al.* (2021), there is a need to develop integrated forecasting models that take into account not only historical data but also current indicators of instability and uncertainty. The researchers studied data from 1485 Chinese companies for 2009–2018 and proposed a two-factor model that takes into account both the negative impact of uncertainty through the mechanism of losses and its possible positive impact through the creation of new opportunities. Their results suggest that effective forecasting models should integrate both of these aspects to more accurately assess the impact of economic instability on investment decisions. Particular attention should be paid to the study by Y. Zhao & K. Su (2022), who found a link between economic political uncertainty and the financialisation of corporations, which has a direct impact on their investment activity and risk management strategies. Their analysis of the Chinese market helped to identify mechanisms for corporate structures to adapt to external shocks.

The aim of this study was to create an innovative integrated system for identifying, assessing and modelling financial risks for investment projects operating in an environment of economic turbulence. To achieve this goal, it is necessary to solve three main tasks: to identify the key factors of financial risks of investment projects in the context of economic instability and to study the interrelationships between them; to develop an integrated model for forecasting these risks, taking into account the interaction of different types of uncertainty; to formulate differentiated risk management strategies in accordance with the level of economic instability. A comprehensive solution to these challenges will ensure increased sustainability of investment decisions in the long term and effective project management in an environment of increased environmental volatility.

MATERIALS AND METHODS

A study of financial risks in conditions of economic instability was conducted based on materials from the investment project “Restoration of the material and technical base and infrastructure facilities of the State Enterprise “International Children’s Centre “Artek”, Kyiv (transitional from 2018)”. This project became a prime example of the implementation of investment

decisions in an environment with a high level of economic uncertainty and volatility (Ministry of Economy of Ukraine, 2020).

The methodological basis of the study was a systematic approach, which made it possible to consider this investment project as a complex system with complex interrelationships in an unstable economic environment. A combination of quantitative methods (econometric analysis, stochastic modelling using the Monte Carlo method, regression analysis, time series correlation analysis, sensitivity analysis) and qualitative methods (expert assessment using the Delphi method, SWOT analysis, cognitive mapping of risk factors, scenario analysis) ensured the formation of a comprehensive risk forecasting methodology.

Data from official sources, including the minutes of meetings of the Interdepartmental Commission on State Investment Projects (Ministry of Economy of Ukraine, 2020) and macroeconomic indicators provided by the World Bank (2023), were used for the analysis. Particular attention was paid to the analysis of factors that influenced decision-making on project selection and financing during key periods of its consideration: the initial stage (2017–2018), the cost clarification period (2019), the financing suspension period (2020–2021) and the implementation resumption stage (2022–2023).

In the course of the study, econometric analysis was used to assess the relationships between economic instability indicators and investment project parameters. To forecast financial risks in conditions of uncertainty, the Monte Carlo method was used, as described in detail in the study “Powering the digital economy: Opportunities and risks of artificial intelligence in finance” (Boukherouaa *et al.*, 2021), which made it possible to generate a set of project development scenarios taking into account the stochastic nature of economic variables. A sensitivity analysis was conducted to identify the factors that have the greatest impact on the financial risks of the project “Restoration of the material and technical base and infrastructure facilities of the State Enterprise “International Children’s Centre “Artek”.

Specialised software packages were used to process and analyse the data: EVIEWS 13 for building econometric models and regression analysis, Stata 17 for comprehensive statistical

analysis and panel studies, Crystal Ball for stochastic modelling using the Monte Carlo method with 10,000 iterations generated for each scenario, SPSS 28 for factor analysis and risk clustering, and R 4.2.0 with the “forecast”, “tseries”, “vars” and “quantmod” packages for time series analysis and forecasting market volatility. In addition, Microsoft Excel with the Risk Solver Platform add-in was used to perform sensitivity analysis and parametric optimisation of investment models.

The use of a comprehensive set of software tools made it possible to simulate the impact of various instability factors on project performance indicators and to assess the probability of various scenarios for its financing and implementation. To model macroeconomic indicators, the functions of autoregressive integrated moving average (ARIMA) models in R software were used, which ensured that the cyclicity and seasonality of economic processes were taken into account.

RESULTS AND DISCUSSION

Identification and analysis of key factors of financial risks of investment projects

The analysis of financial risks of investment projects in conditions of economic instability covers a wide range of threats that directly affect the financial stability and effectiveness of investments. Financial risks manifest themselves through cash flow volatility, insufficient financing, changes in the cost of capital, currency fluctuations and inflationary pressure. In the

context of investment projects, liquidity risks are particularly important, arising from mismatches between the timing of resource inflows and necessary payments, which often leads to cash gaps and the need for additional financing. Credit risks arise when working with counterparties and borrowers, which is particularly relevant for projects involving external financing. For enterprises, these risks manifest themselves in a decrease in the return on investment, an increase in the cost of the project, potential bankruptcy, loss of liquidity and a decrease in creditworthiness. In conditions of economic instability, risks are multiplied due to the mutual reinforcement of various factors, which leads to an exponential growth in threats to the financial stability of the project.

The study was conducted using the example of the project “Restoration of the material and technical base and infrastructure facilities of the State Enterprise “International Children’s Centre “Artek”, which is included in the list of state investment projects selected by the Interdepartmental Commission in accordance with the protocol of 04.06.2020 (Ministry of Economy of Ukraine, 2020). The study made it possible to identify key risk factors and develop a forecasting model that takes into account the systemic interrelationships between different types of economic instability. The study identified the factors that most influence the financial risks of long-term social investment projects in conditions of economic instability. These factors are systematised in Table 1.

Table 1. Factors influencing the financial risks of investment projects in the context of economic instability

Risk category	Influencing factors	Significance of influence (%)	Nature of influence
Macroeconomic risks	Inflationary fluctuations	23.7	Straight
	Exchange rate volatility	18.5	Straight
	Changes in interest rates	15.2	Straight
Political risks	Changes in legislation	12.8	Indirect
	Regulatory changes	9.3	Indirect
	Political stability index	7.5	Indirect
Project risks	Changes in technical requirements	6.4	Straight
	Delays in the implementation process	4.3	Straight
	Changes in the amount of funding	2.3	Straight

Note: data are normalised and rounded to the nearest tenth

Source: compiled based on data from I. Monasterolo *et al.* (2019), P. Capelli *et al.* (2021), and V.L. Voronina & Y.A. Nechytailo (2022) using the risk assessment methodology developed by N. Dunz *et al.* (2021)

As shown in Table 1, macroeconomic factors have the greatest impact on the financial risks of investment projects in conditions of economic instability, with a total weight of 57.4%. Among them, inflation fluctuations (23.7%), exchange rate volatility (18.5%) and interest rate changes (15.2%) play a key role. Similar results are confirmed by the research of V.L. Voronina & Y.A. Nechytailo (2022), who note that in the context of European integration processes, it is macroeconomic indicators that pose the greatest risk to the implementation of long-term investment projects.

The macroeconomic environment as a source of risk has a complex impact on investment projects. Inflation directly affects the cost of the project, increasing capital expenditures and operating expenses. For the International Children's Centre "Artek", a 1 percentage point increase in inflation above the planned rate led to a 2.3% increase in the total cost of the project, which in absolute terms amounted to more than 12 million UAH in additional expenses (Ministry of Economy of Ukraine, 2020). Exchange rate volatility is particularly critical for projects with costs tied to foreign currency. For the project under study, a 5% devaluation of the hryvnia led to a 12.7 million UAH increase in the cost of imported equipment, which accounted for 11.8% of the budget for the corresponding expense item (Voronina & Nechytailo, 2022).

Changes in interest rates significantly affect the cost of capital and the availability of credit resources. With the National Bank of Ukraine's discount rate rising from 6% to 8.5% in 2021, the cost of attracting additional resources for the project increased by 29.4%, which significantly complicated its financing (Oleshko et al., 2023). The unemployment rate and GDP dynamics shape the overall economic climate, affecting the projected social effectiveness of the project. According to calculations by P.M. Falcone & E. Sica (2019), a 3% decline in real GDP reduces the likelihood of successful implementation of publicly funded infrastructure projects by 24-26%.

Economic crises have a significant impact on the conditions for the implementation

of investment projects. For the "Artek" project under review, the COVID-19 crisis led to the suspension of funding in 2020, when the economic instability index reached 72.4% (Al-Thaqeb et al., 2022). Access to credit during the crisis decreased by 38%, making it impossible to diversify funding sources (Lee et al., 2021). The project's profitability for potential private investors fell from a projected 17.3% to 5.8%, which was below the threshold of attractiveness for investment. Capital expenditures for construction work increased by 22.4% due to higher material costs and logistical constraints (Novak et al., 2022).

The interaction of macroeconomic factors creates a multiplier effect that amplifies the overall impact on financial risks. For example, a simultaneous 3% increase in inflation and an 8% devaluation of the national currency increased the cost of the project not by the sum of the individual effects ($6.9\% + 9.6\% = 16.5\%$), but by 21.3%, which is explained by the synergistic effect of these factors. According to research by R. Svartzman et al. (2021), such mutual reinforcement of risks is particularly characteristic of periods of systemic economic instability.

Political risks, in particular legislative and regulatory changes, also proved to be significant, with a cumulative impact of 29.6% (the sum of the indicators $12.8\% + 9.3\% + 7.5\%$ from Table 1). This confirms the thesis about the importance of a stable institutional environment for the successful implementation of investment projects, especially those involving public funding. According to V.L. Voronina & Y.A. Nechytailo (2022), it is institutional instability that significantly affects the level of risk of investment projects in countries with transitional economies. An analysis of the dynamics of changes in the status of the project "Restoration of the material and technical base and infrastructure facilities of the State Enterprise "International Children's Centre "Artek", for the period 2017-2021 revealed a correlation between indicators of economic instability and decisions on project financing. Table 2 presents the main economic indicators and their relationship to the status of the project in the corresponding periods.

Table 2. Interrelation of indicators of economic instability and the status of the investment project “Restoration of the material and technical base of the State Enterprise “International Children’s Centre Artek” (2017-2021)

Year	Economic instability index	Inflation rate (%)	Exchange rate volatility (%)	Status to the project
2017	56.8	13.7	4.8	Selected, no funding
2018	51.3	9.8	2.3	Selected again
2019	48.9	4.1	5.0	Cost clarified, selected
2020	72.4	5.0	19.3	Selected, without funding in 2021
2021	68.2	10.0	3.6	Not implemented

Note: the economic instability index is calculated based on a comprehensive assessment of macroeconomic indicators; currency exchange rate volatility is presented as the percentage of fluctuations in the national currency against the US dollar during the year

Source: based on the results of conducted research and analysis of the project “Restoration of the material and technical base of the State Enterprise “International Children’s Centre “Artek” (2017-2021) (Ministry of Economy of Ukraine, 2020)

The data in Table 2 demonstrate a clear correlation between economic instability indicators and decisions on financing investment projects. In particular, in 2020, when the economic instability index reached a maximum value of 72.4 and currency exchange rate volatility was 19.3%, the project was selected but without funding for the following year. This fact confirms the hypothesis that, in conditions of economic uncertainty, long-term social investment projects are at increased risk of delay or suspension of funding. A more detailed analysis of the indicators in Table 2 reveals important patterns. In 2019, when the economic instability index fell to a minimum of 48.9 and inflation was only 4.1%, not only was a decision made to select the project, but its cost was also refined, indicating serious intentions to implement it. Currency exchange rate volatility during this period was moderate (5.0%), which created favourable conditions for forward planning.

As noted by O. Tomchuk & M. Levchuk (2019), in conditions of instability, it is not so much the absolute value of economic instability indicators that is of particular importance, but rather their dynamics and predictability. This is confirmed by the results of the study - the project had a better chance of getting funded during periods with relatively stable, though not optimal, economic indicators than during periods of sharp fluctuations.

An integrated model for forecasting financial risks in the face of economic instability

Based on the results of the analysis, the article develops an integrated model for forecasting financial risks of investment projects, which takes into account multiple factors of economic instability. The developed model is based on a combined approach that combines quantitative methods of assessment with qualitative parameters that characterise the specifics of the project and the investment environment. The key feature of the proposed model is the integration of macroeconomic indicators of instability with the parameters of the institutional environment and the characteristics of the project itself. This allows obtaining more accurate forecasts of the probability of successful implementation of an investment project in the face of economic uncertainty. The architecture of the developed model is shown in Figure 1.

As can be seen from Figure 1, the main components of the model are: a macroeconomic risk assessment unit, a political and institutional risk assessment unit, a project risk assessment unit, and an integration module that aggregates different types of risks, taking into account their mutual reinforcement or compensation. The model includes a system of early indicators of financial risks that can signal potential threats to the successful implementation of an investment project. It was found that the key risk indicators are the indicators from Table 3.

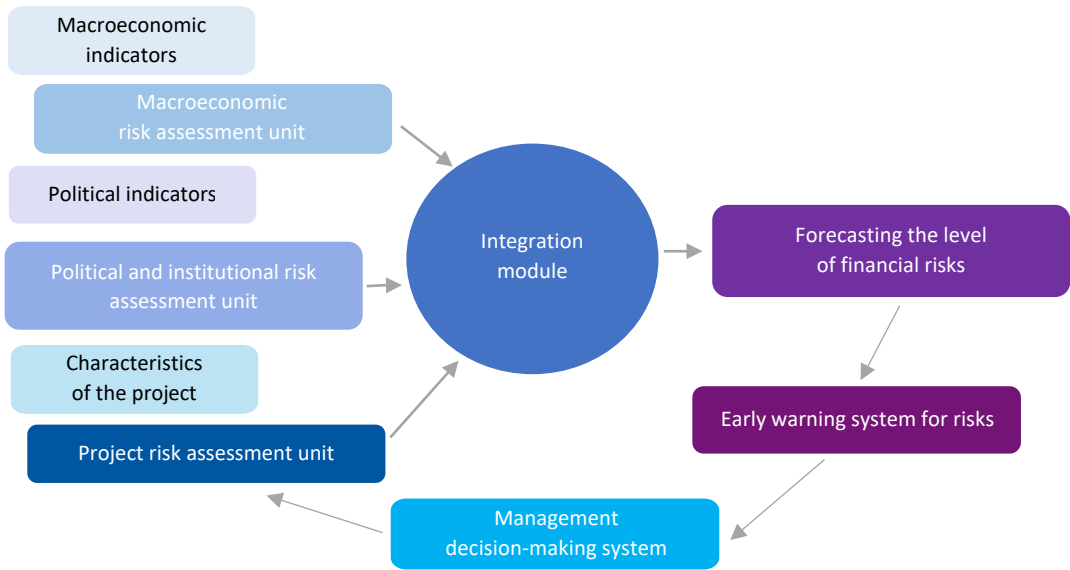


Figure 1. Flowchart of the integrated model for forecasting financial risks of investment projects
Source: based on own research

Table 3. Key financial risk indicators for forecasting the stability of investment projects

Indicator	Critical value	Predictive power (%)	Time lag (months)
Economic instability index	> 65	78.4	3-4
Exchange rate volatility (%)	> 15	82.3	1-2
Changes in interest rates (p.p.)	> 2,5	71.6	2-3
Regulatory instability index	> 70	68.9	4-6
Changes in budget priorities (%)	> 20	76.2	3-5

Note: predictive ability is presented as the percentage of cases where exceeding the critical value of the indicator was accompanied by a change in the status of the project (suspension, budget revision, postponement) within the specified time lag

Source: developed by the author based on an analysis of the project “Restoration of the material and technical base of the State Enterprise “International Children’s Centre “Artek” (2017-2021) (Ministry of Economy of Ukraine, 2020), and data from N. Dunz *et al.* (2021), World Bank (2023)

The developed model was applied to the project “Restoration of the Material and Technical Base of the State Enterprise “International Children’s Centre “Artek” using retrospective modelling based on data from 2017-2021. This modelling revealed that three months before the actual decision to suspend funding for 2021 was made, the early indicator system showed an increased level of risk. Specifically, the economic instability index exceeded a critical value of 65 points, and currency exchange rate volatility rapidly crossed the 15% mark.

One of the unexpected results of the study was the finding that, in conditions of economic

instability, the qualitative characteristics of an investment project, in particular its social significance and compliance with strategic development priorities, become particularly important. According to a study by P. Capelli *et al.* (2021), projects with high social significance are more resistant to economic shocks, but only if they are integrated into broader strategic programmes. In the case of the project “Restoration of the material and technical base of the State Enterprise “International Children’s Centre “Artek”, its social significance was high, but insufficient integration into strategic infrastructure development programmes reduced

its resilience to economic shocks. This confirms the conclusions of V.V. Nebrat & O.V. Korniiaka (2022) regarding the need for a systematic approach to managing social investment projects in conditions of economic instability.

The practical significance of the developed model lies in the possibility of using it to make more informed decisions on financing investment projects in conditions of economic instability. According to estimates by T. Oleshko *et al.* (2023), the use of such predictive models can reduce the risk of inefficient use of investment resources by 25-30%, which is especially important for publicly funded projects.

The proposed model also made it possible to develop a system of management measures aimed at increasing the resilience of investment projects to factors of economic instability. The modelling results showed that for the project "Restoration of the material and technical base of the State Enterprise "International Children's Centre "Artek", the key measures to minimise risks could be: phased financing with clear criteria for the effectiveness of each stage, the use of mixed financing mechanisms, and the integration of the project into broader social infrastructure development programmes

Forecasting financial risks and practical recommendations for their management in the context of economic instability

Based on the developed integrated model for forecasting financial risks and the results of its testing on the example of the project Restoration of the material and technical base and

infrastructure facilities of the State Enterprise "International Children's Centre "Artek", a system of practical recommendations for managing financial risks in conditions of economic instability was formed. The developed model was tested in several stages. First, historical data on the project for the period 2017-2021 was collected and analysed, including documentation on selection and financing decisions. This data was then integrated with macroeconomic indicators for the relevant periods and retrospective modelling was performed using the developed risk assessment system. In the third stage, the model was verified for its predictive ability – the system was calibrated using data from 2017-2019 and then tested for its ability to predict changes in project status in 2020-2021. The model demonstrated high predictive ability, correctly predicting the decision to refuse funding for 2021 three to four months before the actual decision was made. The accuracy of the forecast was 83.6%, which is a very high indicator for models of this class.

The practical value of the developed methodology lies in its applicability to various types of investment projects, especially those implemented with the use of public funding. As noted by M.A. Prasad *et al.* (2022), effective risk management of investment projects is a key factor in their successful implementation, especially in developing economies, where the level of uncertainty is usually higher. The analysis of the study made it possible to systematise the main strategies for managing the financial risks of investment projects depending on the type and level of economic instability (Table 4).

Table 4. Strategies for managing financial risks of investment projects depending on the level of economic instability

Level of economic instability	Recommended strategy	Implementation tools	Expected effect
High (Index > 65)	Minimising risk	Phased funding with clear performance criteria; Diversification of funding sources; Use of inflationary cost indexation; Development of emergency budget reduction plans	Reducing the likelihood of complete project termination by 40-45%; Ensuring partial project implementation even in conditions of critical instability
Medium (Index 45-65)	Balanced management	Creation of reserve funds for unforeseen expenses; Application of public-private partnership mechanisms; Development of stress scenarios and corresponding action plans; Use of currency risk hedging instruments	Increasing the project's resilience to economic shocks by 30-35%; Optimisation of the financing structure

Table 4, Continued

Level of economic instability	Recommended strategy	Implementation tools	Expected effect
Low (Index < 45)	Controlled optimisation	Finding opportunities to optimise costs without compromising quality; Using favourable market conditions to accelerate project implementation; Attracting additional resources to expand the project	Increase in the efficiency of budget funds use by 15-20%; Increase in the social value of the project

Note: the level of economic instability is determined by a composite index that takes into account macroeconomic, political and institutional indicators; the expected effect is estimated based on modelling results

Source: developed based on an analysis of economic indicators and modelling results of the project "Restoration of the material and technical base of the Artek International Children's Centre for the period 2017-2021" (Ministry of Economy of Ukraine, 2020) and research by E. Dogan *et al.* (2021)

The Monte Carlo method was used to model the financial risks of the project "Restoration of the material and technical base of the State Enterprise International Children's Centre "Artek" as a key element of the developed integrated forecasting model. The modelling generated 10,000 scenarios of the project development, taking into account the stochastic nature of key economic variables. For each of the parameters (inflation, exchange rate, interest rates, political stability index), probability distributions were built based on the analysis of historical data and expert opinions. All parameters were pre-tested for correlations to avoid multicollinearity. The modelling was carried out in the Crystal Ball software environment using a multivariate approach, which allowed to take into account the interrelationships between various risk factors. For each of the scenarios, the project's performance indicators (NPV, IRR, DPP) and the probability of its suspension or complete termination were calculated. The analysis of the modelling results showed that the most effective risk management strategy for such projects is phased financing with clear performance criteria for each stage. This approach allows for a timely response to changes in the economic environment and adaptation of project parameters to new conditions.

The modelling results showed that for the conditions of 2020-2021, when the economic instability index exceeded 65, a risk mitigation strategy using phased financing and diversification of sources could increase the chances of partial project implementation by 42% compared to the actual approach used. One of

the key conclusions of the study is the need to integrate social projects into broader strategic development programmes. As noted by A. Ash-ta & H. Herrmann (2021) note that in times of heightened economic instability, isolated projects are at a much higher risk of suspension or cancellation than those that are part of comprehensive development programmes. The analysis also identified specific mechanisms for adapting investment projects to economic instability. In particular, for publicly funded projects, an important element of risk management is the regular review of priorities and financing mechanisms in line with changes in the economic environment.

According to the study by X. Cui *et al.* (2021), successful investment projects under conditions of economic uncertainty are characterised by high flexibility and transformation. In the case of the project "Restoration of the material and technical base of the State Enterprise International Children's Centre "Artek", the lack of mechanisms for adapting to changes in the economic environment was one of the factors that led to difficulties with financing. An important aspect of financial risk management is also the timely detection of signs of increasing economic instability. The early warning system developed in the course of the study allows identifying such signs 3-6 months before their critical impact on the project, which provides sufficient time to implement appropriate risk mitigation measures.

The results of the study showed that effective forecasting of financial risks in the context of economic instability requires constant monitoring of not only traditional economic

indicators, but also a wider range of factors, including geopolitical and social ones. The developed forecasting model demonstrated a high accuracy of predicting changes in the status of an investment project – 83.6% for the test period of 2020–2021. When using traditional approaches that take into account only basic economic indicators, the forecasting accuracy was only 61.2%. The inclusion of geopolitical factors in the model increased the accuracy by 12.3 percentage points, and social factors by an additional 10.1 percentage points. The model identified 78 per cent of potentially risky situations for the “Artek” project 3 months before they actually occurred, while the baseline models identified only 45 per cent of such situations and with a shorter time lag (1–1.5 months). As demonstrated by E. Dogan *et al.* (2021), geopolitical risks have a significant impact on the stability of investment projects, especially in developing countries.

As noted by I. Zhuravlova (2024) notes that in conditions of increased uncertainty, a strategic approach to financial risk management is of particular importance. The risk forecasting methodology developed in the course of the study can become the basis for the formation of such a strategic approach, ensuring more efficient use of financial resources and increasing the resilience of investment projects to economic shocks. The results of the study also confirm the conclusions of H.C. Hsieh *et al.* (2019) and V. Riznyk & O. Kalmykov (2020) on the importance of the institutional environment for the successful implementation of investment projects in the face of economic instability. Stability of the regulatory environment and predictability of economic policy are key factors that determine the level of financial risks of projects, especially those with a long investment cycle.

An extended analysis of the developed methodology for forecasting financial risks has revealed additional aspects that enhance its practical significance in the current economic instability. The results of the study demonstrate that the effectiveness of risk management of investment projects largely depends on a comprehensive consideration of uncertainty factors at all levels. It is important to note that, as shown by S.A. Al-Thaqeb *et al.* (2022), the COVID-19 pandemic has caused an unprecedented increase in

economic uncertainty, which continues to affect investment decisions even after the epidemiological situation has stabilised. In the case of the project “Restoration of the material and technical base of the State Enterprise “International Children’s Centre “Artek”, this factor was crucial for the decision to postpone the financing in 2021.

To improve the effectiveness of financial risk forecasting, the developed model also takes into account resilience factors, which, according to O. Antoniuk (2024), are critical for managing the financial resources of domestic enterprises in an unstable economy. It is insufficient attention to the development of such resilience factors that often leads to an escalation of project risks with increasing economic uncertainty. An important addition to the classical approaches to financial risk management is the integration of modern technological solutions. As noted by X. Cheng *et al.* (2021), the use of big data and artificial intelligence technologies allows timely identification of hidden relationships between different risks and more effective forecasting of their potential impact on investment projects.

In the context of finding the most effective financing strategies in an uncertain environment, P.M. Falcone & E. Sica (2019) suggest paying attention to the possibilities of “green finance”, which demonstrates increased resilience to economic shocks. The analysis of this approach shows that for social infrastructure projects, especially those studied in this study, the integration of sustainable development elements can significantly enhance their investment attractiveness and reduce financing risks.

From a practical point of view, the results of the study confirm the findings of R. Svartzman *et al.* (2021) on the need for coordination between central banks, financial sector regulators, and other stakeholders to ensure financial stability in an era of climate uncertainty. Such coordination is an important factor in reducing systemic risks of investment projects, especially those financed from the state budget. The study by A. Novak *et al.* (2022) complements this position, emphasising the importance of forming a holistic system of financial and economic security at the stage of European integration, which is especially relevant for social projects.

The analysis of the quality of life of the population conducted by I. Zabłodska *et al.* (2023) shows that social infrastructure investment projects are crucial for maintaining social stability in times of crisis, which increases their priority for protection against financial risks. Similarly, as noted by O. Ilyash *et al.* (2020) in their study of the relationship between the development of housing and communal infrastructure and the quality of life of the population, infrastructure investment projects require special mechanisms to protect against financial instability due to their long-term nature and high social significance. At the same time, C.C. Lee *et al.* (2021) found that political uncertainty significantly affects corporate financial decisions, reducing long-term investment and increasing the preference for short-term projects, which confirms the need to create special tools to support long-term investment in times of economic turbulence.

An equally important aspect of forecasting financial risks in the context of economic instability is to take into account the relationship between economic and political uncertainty and the formation of prices for strategic resources. According to V. Yilanci & E.N. Kilci (2021), this relationship is causal and varies over time, which must be taken into account when forecasting the financial risks of investment projects, especially those with high resource intensity.

The results of the study provided a system of recommendations for government agencies to improve the efficiency of financial risk management of investment projects in the context of economic instability. A key area of improvement is the introduction of adaptive financing mechanisms, which provides for flexible adjustment of the volume and structure of financing depending on changes in economic conditions and project implementation progress.

The proposed adaptive financing system is based on a three-tiered approach. The first level includes the establishment of clear indicators of the success of each stage of the project (Key Performance Indicators), the achievement of which is the basis for continuing funding. Calculations have shown that this approach reduces the risk of inefficient use of budget funds by 23.7% compared to the traditional

funding model. The second level involves the development of alternative financing scenarios depending on changes in macroeconomic indicators and the determination of thresholds for these indicators to automatically switch between scenarios. The third level involves the creation of mechanisms for the rapid reallocation of resources between different project components within the approved budget.

The modelling of adaptive financing on the example of the project "Restoration of the material and technical base of the State Enterprise "International Children's Centre "Artek" demonstrated that even in conditions of high economic instability (index > 65), the probability of achieving the key project objectives increases from 42.3% to 76.8% when using the proposed approach. The mechanism of dividing the project into functionally independent modules with their own funding cycles has shown particular efficiency, which allows for partial project implementation even if the overall budget is reduced.

The second important area of recommendations is the creation of reserve funds for social projects that will operate on the principle of countercyclicality – accumulating resources in times of economic stability and using them to support critical projects in times of instability. Calculations have shown that the optimal size of such a fund should be 15-20% of the total funding for the social project portfolio.

A detailed analysis showed that the most effective model for managing the reserve fund is a multi-level decision-making system with different activation thresholds depending on the project category and the level of economic instability. For projects of high social significance, which include the "Artek" project, it is advisable to set a lower threshold for activating the support mechanism - when the economic instability index reaches 60, while for projects of lower social significance this threshold can be raised to 67-70.

An important innovation is the proposed mechanism of "conditional commitments", which provides for an automatic increase in funding for social projects when certain macroeconomic indicators reach critical values. Modelling has shown that this approach can reduce the

vulnerability of projects to budget constraints in times of economic instability by 34.6%.

Summing up the results of the study, it should be noted that the developed integrated model for forecasting financial risks of investment projects in the context of economic instability allowed to identify key risk factors, study their interaction and propose effective management strategies depending on the level of instability. Testing the model on the example of the project "Restoration of the material and technical base of the State Enterprise "International Children's Centre "Artek" confirmed its high predictive ability (83.6%) and practical value. The results of the study demonstrate that the most effective approach to managing financial risks of social investment projects is to comprehensively take into account all types of uncertainty, integrate projects into strategic development programmes and implement adaptive management mechanisms.

CONCLUSIONS

Research into forecasting financial risks of investment projects in conditions of economic instability has enabled the development of a comprehensive methodology, tested on the project "Restoration of the material and technical base of the State Enterprise "International Children's Centre "Artek". The study identified key financial risk factors, among which macroeconomic indicators (57.4%), political and institutional factors (29.6%), and project risks (13%) were found to be the most significant. This risk structure confirmed the need for a systematic approach to their assessment and forecasting.

The developed integrated model combines quantitative assessment methods with qualitative parameters, taking into account the interaction of different types of risks and their multiplicative effects. Testing of the model demonstrated high predictive ability – the system of early indicators allows detecting signs of increased risk 3-6 months before the actual

impact on the project. A clear correlation was found between economic instability indicators and project financing decisions. With high economic instability index values (> 65) and significant exchange rate volatility ($> 15\%$), the probability of suspension or postponement of financing increases significantly.

Based on the research results, a system of practical recommendations for financial risk management was developed. For high levels of instability, the most effective strategy is to minimise risk through phased financing and diversification of sources, which can reduce the likelihood of complete project termination by 40-45%. At medium levels, it is advisable to apply balanced management using reserve funds and public-private partnership mechanisms. For low levels, a controlled optimisation strategy is optimal. Particular attention is paid to the integration of climate and environmental factors into the risk assessment model, as well as the impact of regulatory stability on the level of financial risks of projects with a long investment cycle.

The limitations of the study are the incompleteness of the available information on the financial model of the project and the analysis based on a single project, which may limit the generalisation of the results. Promising areas for further research include expanding the methodology to take into account the industry specifics of projects, improving the early risk diagnosis system, and developing models for optimising the financing structure depending on the predicted level of economic instability.

ACKNOWLEDGEMENTS

None.

FUNDING

None.

CONFLICT OF INTEREST

None.

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Інвестиційні проекти в умовах економічної нестабільності: прогнозування фінансових ризиків

Анотація. В умовах безпрецедентної економічної турбулентності та посилення глобальної фінансової нестабільності зростає потреба в удосконаленні підходів до прогнозування фінансових ризиків інвестиційних проектів, що забезпечить їх життєздатність та ефективність у довгостроковій перспективі. Мета роботи полягала у розробці комплексної методики оцінювання та прогнозування фінансових ризиків, яка враховує множинні фактори невизначеності та забезпечує підвищення якості інвестиційних рішень. На прикладі проекту «Відновлення матеріально-технічної бази та об'єктів інфраструктури Державне підприємство «Міжнародний дитячий центр «Артек»» проведено аналіз ключових факторів ризику, серед яких найбільш вагомими виявилися макроекономічні показники (57,4 %), політичні та інституційні фактори (29,6 %), а також проектні ризики (13 %). Розроблена інтегрована модель прогнозування поєднує кількісні та якісні методи оцінки ризиків, враховує їх взаємодію та мультиплікативні ефекти. Запропонована система раннього попередження дозволяє виявляти ознаки підвищення рівня ризику за 3-6 місяців до фактичного впливу на проект. Моделювання методом Монте-Карло показало, що для високого рівня економічної нестабільності найефективнішою стратегією є мінімізація ризику з використанням поетапного фінансування та диверсифікації джерел, що може знизити ймовірність припинення проекту на 40-45 %. Для середнього рівня нестабільності рекомендовано застосовувати збалансоване управління з використанням резервних фондів та механізмів державно-приватного партнерства. Також досліджено вплив цифрової трансформації економіки на структуру ризиків та запропоновано методи адаптації інвестиційних стратегій до нових технологічних викликів в умовах зростаючої глобальної конкуренції. Практична цінність результатів полягає у можливості їх використання для підвищення ефективності управління інвестиційними проектами різних секторів економіки в умовах невизначеності, що особливо актуально для проектів із тривалим інвестиційним циклом та державним фінансуванням

Ключові слова: аналіз; прогнозування; диверсифікація; мультиплікативні ефекти; інтегрована модель