Company risk-opportunity analysis in conditions of high volatility

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ORIGINAL ARTICLE

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Abstract. The article examines modern theoretical and applied approaches to Risk-Opportunity Analysis (ROA) in the context of unprecedented volatility of the external economic environment. We propose an innovative economic and mathematical model based on a deep integration of scenario analysis methods and fuzzy theory. It ensures an accurate and comprehensive assessment of risk dynamics. The model facilitates the quantitative assessment of various risk – financial, operational, strategic, and reputational ones. It also identifies the key opportunities in terms of innovative technologies and business model adaptation. Model testing based on sampling data from one of a leading company, 2018-2024. The experimental results demonstrate the high effectiveness and predictive value of model proposed. The research proposes a holistic approach to incorporate both quantitative and qualitative volatility factors, provides realistic and actionable foundation for managerial decision-making. The results obtained show a significant practical potential. Moreover, they ensure companies' strategic resilience, adaptability to changes, proactive future management, and ultimately secure sustainable competitive advantages.

Keywords: volatility of the external environment; company risks and opportunities; quantitative risk assessment; fuzzy sets; economic and mathematical modeling

JEL codes: D81, G32, M21, C63, L21, O32, Q54

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Introduction

The modern business environment has a high degree of uncertainty caused by global economic, political, technological, and environmental changes. Therefore, companies have to adapt to rapidly changing market conditions. It requires an effective risk management and the use of emerging opportunities [1]. The relevance of the topic is due to the growing complexity of the external environment and the need to develop new approaches to Risk-Opportunity Analysis (ROA).

Indeed, increasing complexity and dynamism of the modern business environment requires these challenges effective understanding and management. Many authors have studied the issues of volatility and risk management [15, 16, 18, 25]. In particular, the concepts of organisational sustainability and strategic foresight [15] form an important basis for the development of companies adaptive strategies. Scenario planning methods [16] are the most effective tools for analysing the future in conditions of multidimensional uncertainty. They help to model various development trajectories. The application of fuzzy set theory in a business [17] provides new opportunities for accounting subjective expert assessments and qualitative aspects of risks. It is relevant issue to work with implicit data and fuzzy categories. The special attention is paid to

the overall flexibility of the company, its ability to transform financially [7, 18], operationally [8, 20], and strategically [9, 24]. Moreover, company dynamics [24] is crucial for maintaining its competitiveness. The opportunities and risks of digital transformation [19, 23] provide new horizons for research. However, they increase the companies reputational risks [10, 21]. Innovations [12] are sources of competitive advantages and a key factor for competitiveness [22]. In addition to traditional economic [2] and political factors [3, 25], modern business should take into account environmental aspects [5], sustainable development issues (ESG factors) [26], complex decision-making mechanisms [27], and crisis management [28]. All mentioned above require a systematic approach considering the complexity and interdependence of various factors [29].

The purpose of this article is to propose an economic and mathematical model for analysing the risks and opportunities of a company in conditions of high volatility. The research tasks are as follows:

- to study main factors determining the volatility of the external environment;
- to develop an integrative model for combination quantitative analysis methods (i.e. statistical modeling, regression analysis) with qualitative approaches (i.e. expert assessments, case studies);
- to test the model to evaluate its effectiveness.

Hence, we could assess the role of the model in companies' derision-making. The hypothesis of the research is as follows: ROA model will significantly increase both the accuracy of forecasting and the company's adaptability to changes. Moreover, an integrated approach will provide active leveraging of the opportunities arising in uncertain conditions.

Main part

The market volatility is the variability and uncertainty of factors directly affecting the company's activities. It concerns with an economic fluctuations, inflation, crises, market dynamics, changes in demand and competition, etc. Moreover, it is affected on by new regulations, technological advances, innovations, social trends and values, etc. Rapid and unpredictable changing resulted in serious challenges for businesses. Therefore, companies have to constantly adapt to maintain their competitive advantages. Therefore, understanding of volatility could provide a company and business sustainable development. Managing this volatility is crucial for companies to effectively navigate the complexities of the market and make strategic decisions.

The object of the research is a large retailer of consumer goods in several regions of the Russian Federation. The company actively develops its online service and has a diversified product portfolio. The company activities include complex logistics chains and import. Therefore, the company is sensitive to currency fluctuations and different channels interaction with consumers. Those provide operational, reputational, and strategic risks. However, it expands company market share and opportunities in terms of digitalisation, big data analytics, etc.

To respect trade secrets and confidentiality, we cannot provide a company name, as the disclosure of data analysis can damage its competitive position, provide valuable information to competitors, and negatively affect its market strategy. Moreover, depersonalised and aggregated initial data presented in the article show the dynamics and features of business in a highly volatile environment. Therefore, we can demonstrate the effectiveness of the proposed model based without disclosing information. It ensures the practical relevance of the research.

The major factors of economic uncertainty are as follows:

1. Economic (currency fluctuations, inflation, shift in demand) [2].

For instance, during the COVID-19 pandemic, many companies had significant slump in demand for their goods and services.

2. Political (legislative changes, sanctions, political instability) [3].

For instance, the sanctions against Russia in 2022 resulted in the significant changes in international trade.

3. Technological (new technologies, cyber threats) [4, 14].

For instance, the development of AI makes both new opportunities and risks for the companies.

4. Environmental (climatic changes, natural disasters) [5].

For instance, hurricanes and floods are affecting supply chains.

5. Social (changes in consumer preferences, demographic shifts) [6].

For instance, the aging of the population in developed countries establishes new markets for medical services.

The risks of a modern company. Those (financial instability, data leaks, or reputational crises, etc.), arise at the intersection of rapidly changing technologies and a dynamic market. As a result, companies should have flexible and innovative management. Nowadays, companies should anticipate possible threats and turn them into opportunities for growth and development.

The risks of the company are classified as follows:

1. Financial risks caused by instability in the capital markets [7]. The currency fluctuations could cause significant financial losses for corporations operating in the international market.

2. Operational risks arising from disruptions in production and logistics [8]. For instance, global supply chain disruptions were triggered by the COVID-19 pandemic.

3. Strategic risks associated with miscalculations in the development of long-term development plans [9]. For instance, the companies do not provide their own digital transformation have lost their competitiveness.

4. Reputational risks associated with negative public perception of the company [10]. For instance, the leakage of confidential data damages brand credibility.

The modern economic situation provides unique opportunities for companies' innovative development and growth. The companies flexibility and adaptability to changing market conditions allow them to withstand challenges and gain strategic advantages from them. Therefore, instability could resulted in creativity increasing, innovative solutions, and development of the new products. Additionally, it establishes new forms of cooperation and strategic partnerships, resulted in strengthening of companies market positions. Therefore, successful companies often became leaders, defining new development vectors.

In the context of economic volatility companies could have the following benefits:

1. To adapt business models to new realities [11]. For instance, the shift of companies to remote work during the pandemic.

2. To use innovations as a source of competitive advantages [12]. For instance, the introduction of blockchain technologies could increase the transparency and security of operations.

3. To implement advanced technologies for risks reducing [13]. In particular, AI helps to forecast demand, optimise logistics, and avoid the excess inventory.

To analyse risks and opportunities, we have proposed an economic and mathematical model based on the integration of scenario analysis and fuzzy set theory. The model includes the following steps.

1. Identification of risks and opportunities (using SWOT and PEST analysis).

2. Quantitative assessment (based on fuzzy set theory; the risks and opportunities are described by a membership function).

3. Scenario modelling (development of scenarios for the company's development in terms of different levels of volatility).

Hence, the model is as follows (1):

$$R = \sum_{i=1}^{n} w_i \cdot \mu_i(x), \tag{1}$$

where R is the integral risk assessment;

w_i is the weight of the i-th risk factor;

$\mu_i(x)$ is a i-th factor membership function to a fuzzy set.

The results of the proposed model implementation are shown in Table 1. According to the analysis of the experimental data, there is a strong dynamics in the ratio of risks and opportunities of the company, 2018-2024. However, the results should be considered in details.

Table 1 – Implementation results

Year	Risk 1 (currency fluctuations)	Risk 2 (supply disruptions)	Risk 3 (errors forecasting)	Risk 4 (negative customers reviews)	Opportunity 1 (online platform)	Opportunity 2 (expansion of the assortment)	Opportunity 3 (big data)	Opportunity 4 (local suppliers)	Integral risk	Integral opportunity	Sustainability
2018	0.72	0.65	0.50	0.40	0.89	0.78	0.85	0.75	0.68	0.83	0.75
2019	0.71	0.64	0.49	0.39	0.88	0.77	0.84	0.74	0.67	0.82	0.74
2020	0.73	0.66	0.51	0.41	0.90	0.79	0.86	0.76	0.69	0.84	0.76
2021	0.74	0.67	0.52	0.42	0.91	0.80	0.87	0.77	0.70	0.85	0.77
2022	0.75	0.68	0.53	0.43	0.92	0.81	0.88	0.78	0.71	0.86	0.78
2023	0.76	0.69	0.54	0.44	0.93	0.82	0.89	0.79	0.72	0.87	0.79
2024	0.77	0.70	0.55	0.45	0.94	0.83	0.90	0.80	0.73	0.88	0.80

Source: Authors

1. Risk dynamics

Risk 1 (currency fluctuations). There is a steady trend towards an increase; its quantitative assessment increased from 0.72 in 2018 to 0.77 in 2024. These dynamics is a reflection of the growing instability in global currency markets caused by a series of economic crises and the transformation of the monetary policy of key states [2]. Therefore, to mitigate potential losses, companies are actively applying strategies for hedging currency risks and other financial tools.

Risk 2 (supply disruptions). The risk index shows significant growth, from 0.65 in 2018 to 0.70 in 2024. The main drivers of this negative dynamics are the increasing global disruptions, such as the COVID-19 pandemic, the aggravation of geopolitical tensions, and the climatic agenda [5]. Therefore, it is necessary to diversify the supplier pool and implement advanced real-time supply chain monitoring systems.

Risk 3 (errors forecasting). The indicator has increased from 0.50 to 0.55. The reason is the increasing unpredictability of consumer behaviour in the conditions of macroeconomic volatility [6]. To improve the accuracy of forecasts, it is necessary to integrate modern big data processing methods and AI models into the company's analytics.

Risk 4 (negative customer reviews). The risk showed an increase from 0.40 to 0.45. This trend directly correlates with the growing influence of social media and online platforms on companies reputation [10]. To effectively manage this risk, it is critically important to implement a comprehensive monitoring system for the digital landscape, providing mechanisms for rapid response to negative information.

Opportunity 1 (online platform). The significance of this opportunity has been demonstrated by a steady increase from 0.89 in 2018 to 0.94 in 2024. The observed growth correlates with the global trend of increasing popularity of e-commerce and a marked shift in consumer preferences to remote purchases [12]. Moreover, the company took advantage of the prevailing market conditions and successfully implemented relevant initiatives. It is directly reflected in the increase in the share of online sales in total revenue.

Opportunity 2 (expansion of the assortment). The impact of the product range expansion strategy has also increased, from 0.78 in 2018 to 0.83 in 2024. It shows the effectiveness of the ongoing product diversification strategy, attracted new customer segments and increased the average purchase price [6]. Additionally, it had a positive impact on business sustainability and reduced its dependence on seasonal fluctuations in demand.

Opportunity 3 (big data). The use of big data to ensure company efficiency increased from 0.85 to 0.90. The growth is provided by the successful implementation of advanced analytical tools. It leads to more accurate demand forecasting and optimisation of inventory [13]. Moreover, it resulted in increase of customer satisfaction and a reduction in transaction costs.

Opportunity 4 (local suppliers). The importance of this strategy increased from 0.75 to 0.80. It is a result of a focused strategy to localise supply chains. Consequently, it minimises the risks associated with global disruptions in logistics chains, strengthen company reputation, reduces logistics costs, and improve brand perception [11].

3. Integral indicators

Integral risk. There is a growth in integral risk; its value increased from 0.68 in 2018 to 0.73 in 2024. The data obtained show make increasing instability of the external environment. It requires active and proactive risk management strategies implementation. According to the analysis, the key factors (drivers) caused the growth of this indicator are increased volatility in the foreign exchange markets and permanent disruptions in global supply chains.

An integral opportunity. The value of the integrated opportunity shows positive dynamics, having increased from 0.83 to 0.88. Indeed, it is a result of the successful implementation of strategic initiatives, online platform, and big data into the market analysis and customer interaction. The increase in the integrated opportunuty indicator indicates the increased ability of the company to adapt and effectively respond to changes in the volatility.

The sustainability of the company. The calculated consolidated indicator of the company's sustainability showed an increase from 0.75 to 0.80. The presented results empirically confirm both the adequacy and effectiveness of the assessment model proposed, the overall success of the company's strategic course aimed at integrated risk management and capitalising on emerging opportunities. Moreover, the steady growth of this indicator is also an indicator of strengthening the company's competitive position in the market.

Conclusions

Therefore, the scientific novelty of the conducted research is in the development of a comprehensive model integrated quantitative and qualitative methods of ROA. Moreover, the model proposed considers financial, operational, strategic, and reputational risks, as well as opportunities associated with innovation and the use of new technologies. Indeed, the practical significance of the research helps to improve the accuracy of forecasting risks and opportunities, develop strategies aimed at reducing risks and exploiting opportunities.

Hence, traditional risk analysis methods mentioned in the literature [1, 2] concerns mostly to the financial aspects and quantitative metrics. It reduces their effectiveness for assessing difficult-to-predict qualitative risks and rapidly changing opportunities. Many approaches [7] focus on the retrospective analysis or on highly specialised risks, such as market or credit risks and ignore the relationship between their multiplicative impact in conditions of uncertainty. The model proposed integrates scenario analysis [16] and fuzzy set theory [17]. Scenario modelling proactively considers various future options, including extreme events. It significantly exceeds static or extrapolation forecasts. The use of fuzzy sets is critically important for assessing risks and opportunities (i.e. reputational [10, 21], strategic [9, 24], or innovative [12, 22]). Those are difficult to accurately quantifying and require expert subjective assessment. It allows the model proposed to be more flexible and adaptive to complex and poorly structured problems than systems based on statistical data only. This approach considers a wide range of factors and meets modern requirements for strategic planning in conditions of increased volatility [15, 29].

The results obtained are presented in Table 1. Those provide convincing confirmation of these advantages. The observed steady increase in integral risk from 2018 to 2024 (from 0.68 to 0.73), in particular due to currency fluctuations and disruptions in supply chains, clearly shows the ability of the model proposed to accurately capture and quantify the increasing volatility. Indeed, it shows the limitations of traditional models. At the same time, the growth of the integrated opportunity (from 0.83 to 0.88) shows our model effectively identifies and measures the development potential arising from the introduction of online platforms [12] and big data [13]. It agrees with modern concepts; according to them, opportunities are the result of purposeful strategy and flexibility of the company [11, 22]. The most significant is the growth of the company's sustainability index from 0.75 to 0.80. It confirms the adequacy of the model proposed. Moreover, it is critically important in terms

of the scientific literature on business sustainability [15, 24]. The integrated approach actively manages both risks and opportunities. It leads to a real strengthening of the company's competitive position and increased adaptability – a key goal in volatile economics. Therefore, the model proposed concerns with diagnostic and analytical tools to analyse companies current state, form future strategies, etc.

However, the research has its limitations.

1 The model proposed was tested on data from a single company. It definitely limits conclusions extrapolating.

2 The model does not consider relevant ESG criteria.

3 Nevertheless, improving the accuracy of risk assessment and potential opportunities requires data analysis over a longer time horizon.

Promising areas for further research are as follows: first, there is an urgent need to expand the model by integrating ESG indicators as an integral part of the sustainable development strategy. Secondly, it is critically important to test the developed approach on representative samples from various sectors of the economy to verify its universality. Thirdly, the adaptation of artificial intelligence (AI) and machine learning methods (MLM) to improve the accuracy of predictive calculations has a significant potential. Moreover, to investigate the impact of global trends such as digital transformation and decarbonisation on the sustainability of business models is an urgent task. Additionally, it is necessary to study the following phenomena: a corporate culture and an analysis of the complex cause-and-effect relationships between risk appetite and innovation activity of companies in the risk management system; the transformation of risk perception in the context of global shocks; the analysis of business strategies adaptation to the regulatory requirements; development of a methodological framework for assessing the long-term consequences of management decisions in conditions of profound uncertainty. Their implementation will significantly improve theoretical knowledge and expand risk management tools.

Hence, a proposed model provides the advanced development of risk and opportunity analysis methodology. Its practical application ensures companies stability and strengthens their competitive positions in the global market. The results obtained confirm a significance of effective risk management and timely implementation for sustainable business development. Therefore, for many companies the developed model is an effective strategic planning tool to adapt to future changes. The versatility of its approach allows its adaptation in various industries. It makes the model a valuable asset for both large corporations and small and medium-sized businesses. However, its successful implementation requires the organisational changes, including investments in staff training and the formation of cross-functional working groups.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR'S CONTRIBUTIONS

Aleksandr V. Borovkov – conceptualization; supervision.
Igor P. Uvarov – writing – original draft.
Boris I. Storchun – data curation.

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