Advances in Consumer Research
https://acr-journal.com/
Volume-3 | Issue-3 | March 2026
Original Researcher Article

Factors affecting financial risk management in coal industry enterprises: From the practical experience in Vietnam

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Received: 21/10/2025
Revised: 16/12/2025
Accepted: 27/01/2026
Published: 05/03/2026

ABSTRACT
In the context of an increasingly volatile energy market and business environment, financial risk management plays a crucial role in the stability and sustainable development of coal industry enterprises. However, the effectiveness of financial risk management in these enterprises is affected by various factors, including both internal and external environmental factors. This study aims to analyze the factors influencing financial risk management in coal industry enterprises from a Vietnamese perspective. The analysis results show that financial risk management in coal industry enterprises is significantly influenced by financial management capacity and internal control systems. In addition, capital structure, coal market volatility, access to capital, and the institutional environment also have a certain impact on the effectiveness of financial risk management, although the degree of influence varies. The findings suggest that improving the effectiveness of financial risk management requires a holistic approach, combining enhanced internal governance capacity within enterprises with a improved policy environment. This research contributes to the empirical evidence on financial risk management in the resource extraction industry and provides a scientific basis for proposing solutions to improve the effectiveness of financial risk management in coal mining enterprises
Keywords: Financial risk management; Coal industry enterprises; Financial management capacity; Financial leverage; Internal control; Vietnam..

INTRODUCTION:

In the context of a global economy increasingly impacted by financial shocks, energy price fluctuations, and a shift towards a sustainable growth model, financial risk management has become a central aspect of corporate governance. International studies confirm that financial risks, if not effectively identified and controlled, can severely impair solvency, operational efficiency, and long-term enterprise value (Modigliani and Miller, 1958; Stulz, 1996). Therefore, financial risk management is not only about preventing losses but is also considered a strategic tool to ensure the stability and sustainable development of businesses.

Among economic sectors, the natural resource extraction industry, especially the coal industry, is considered a high-risk financial sector due to its high capital intensity, long investment cycles, and strong dependence on commodity market fluctuations. Many studies show that coal prices tend to fluctuate sharply with economic cycles and are directly influenced by international energy, environmental, and trade policies, thereby increasing financial risk for businesses in the industry (Humphreys, 2013; Baffes et al., 2015). Furthermore, increasing extraction costs and the need for significant investment in technology, occupational safety, and environmental protection further increase financial pressure on coal industry businesses (International Energy Agency, 2021).

From the perspective of corporate finance theory, financial risk management is considered a systematic process encompassing the identification, measurement, and control of various risks that can affect a company's cash flow, solvency, and financial structure. Studies by Stulz and Froot indicate that the effectiveness of financial risk management depends not only on the use of risk prevention tools but also on the company's management capabilities, capital structure, and internal control system (Froot et al., 1993; Stulz, 2003). In the coal industry, where companies often use high financial leverage to finance long-term investment projects, financial risk management plays an even more crucial role in ensuring financial stability and minimizing the risk of insolvency.

Besides internal corporate factors, the institutional environment and government policies are considered important factors affecting the effectiveness of financial risk management in the coal industry. International studies indicate that changes in energy policy, environmental policy, and financial regulations can create systemic risks, increasing the level of uncertainty in the financial operations of coal mining companies (OECD, 2019; World Bank, 2020). In particular, as many countries accelerate energy transition and reduce dependence on fossil fuels, coal companies face new financial risks related to access to capital, financing costs, and long-term market prospects (Caldecott et al., 2017).

Empirical studies in many countries show that the effectiveness of financial risk management in the coal industry is simultaneously affected by multiple factors, including financial management capacity, capital structure, access to capital, the degree of coal price

volatility, and the quality of the internal control system (Aabo and Simkins, 2005; Tufano, 1996). However, most of these studies focus on large enterprises in developed economies, while empirical evidence in developing countries is relatively limited.

In Vietnam, the coal industry plays a crucial role in ensuring national energy security and supplying inputs to many key industries. However, coal companies are facing numerous financial challenges, including significant investment pressure, fluctuating input prices, increasingly stringent environmental and safety compliance requirements, and changes in energy policy. This situation necessitates a systematic study of the factors affecting financial risk management in coal companies, aiming to enhance their adaptability and financial stability in the new context.

Stemming from the aforementioned research gaps and practical requirements, this paper focuses on analyzing the factors influencing financial risk management in coal industry enterprises from a Vietnamese perspective. By inheriting theoretical arguments and international empirical evidence, the study aims to contribute to clarifying the mechanisms by which internal factors and the institutional environment impact financial risk management, and to provide a scientific basis for proposing solutions to improve the effectiveness of financial risk management in the coal industry.

2. THEORETICAL FOUNDATION

The concept and nature of financial risk management in businesses.

Financial risk management is considered a crucial part of corporate financial management, reflecting the ability to identify, control, and mitigate risks that could cause financial losses and affect the stability of the business. In the modern approach, financial risk management aims not only to limit short-term fluctuations in cash flow or profits, but also to ensure solvency, maintain financial balance, and support the maximization of business value in the long term (Sultz, 1996).

For resource extraction businesses, financial risk management is particularly important due to the long investment cycles, large capital requirements, and high dependence on commodity market fluctuations. When financial risks are not effectively managed, businesses may face financial imbalances, reduced access to capital, and an increased risk of insolvency.

Corporate finance theory and financial risk management

According to corporate finance theory, financial risk arises primarily from the capital structure, investment policies, and financing policies of a business. The use of financial leverage helps businesses expand their operations and exploit investment opportunities, but at the same time increases the level of financial risk under conditions of unstable cash flow (Modigliani and Miller, 1958).

Later studies suggest that financial risk management plays a role in regulating the relationship between expected returns and acceptable risk levels, helping businesses minimize the negative impact of market shocks and maintain financial stability (Sultz, 2003). This approach is particularly suitable for highly volatile industries such as the coal industry.

Theories of business risk management and financial risk

Enterprise risk management theory approaches risk holistically, arguing that various types of risks within a business are closely interrelated and need to be managed in a coordinated rather than isolated manner. Within this framework, financial risk does not exist independently but is influenced by market risk, operational risk, and institutional risk.

Empirical studies show that businesses that apply enterprise risk management are generally able to identify risks earlier, coordinate better between departments, and make more effective financial decisions, thereby minimizing financial volatility and improving their ability to adapt to external shocks (Gordon et al., 2009).

Specific financial risks in coal industry businesses

The coal industry is considered one of the industries with a high level of financial risk due to its strong dependence on coal price fluctuations, increasing mining costs, and the need for significant investment in technology, safety, and environmental protection. Coal price fluctuations directly impact the revenue, profits, and cash flow of businesses, thereby increasing liquidity risk and financial imbalance risk (International Energy Agency, 2021).

Furthermore, coal companies often have to raise large amounts of capital for long-term investment projects, leading to a high degree of financial leverage. In unfavorable market conditions or policy changes, this financial structure can amplify financial risks and weaken the company's resilience.

The role of financial management competence in risk control.

The financial management capabilities of the leadership team and finance department are considered a key factor in determining the effectiveness of financial risk management. Businesses with professional financial management systems and clear risk analysis and monitoring processes are generally better able to predict financial fluctuations and take timely preventive measures (Aabo and Simkins, 2005).

In the coal industry, where investment and financing decisions are large-scale and have long-term impacts, limitations in financial management capacity can lead to short-term decisions, increasing risk and negatively affecting the financial stability of the business.

Institutional and policy environment in financial risk management

From an institutional approach, the legal and policy environment of the State directly influences the financial behavior and risk levels of businesses. In the coal industry, policies related to energy, environment, taxation, and credit can create systemic risks that are beyond the control of individual businesses (OECD, 2019).

Policy stability and transparency help businesses reduce uncertainty and improve financial risk management, while sudden or inconsistent policy changes can increase risks and hinder long-term investment. In the context of Vietnam adjusting its energy policy towards sustainable development, institutional factors have become an indispensable element in the financial risk management analysis of coal industry enterprises.

3. RESEARCH METHODOLOGY

Research approach

This study employs a quantitative approach to analyze the factors influencing financial risk management in coal industry enterprises. This approach allows for the quantification of the impact of internal and external environmental factors on the effectiveness of financial risk management, thereby testing the theoretical arguments developed in the theoretical framework.

Research data was collected through direct surveys of coal industry enterprises in Vietnam. The survey respondents were business leaders and financial managers who have direct and comprehensive knowledge of the financial situation and risk management practices of the enterprises.

Research model

Based on theories of corporate finance, corporate risk management, and previous empirical studies, this research proposes an analytical model in which financial risk management is considered the dependent variable. This variable reflects the effectiveness of a business in identifying, controlling, and responding to financial risks.

The independent variables in the model include: financial management capacity; capital structure and level of financial leverage; market volatility and coal prices; access to capital and financial markets; internal control systems and corporate risk management; and the institutional and policy environment. The selection of these variables stems from their prevalence in international studies and their relevance to the specific operations of coal industry enterprises.

Research hypothesis system

Based on the proposed research model, the following research hypotheses are formulated:

Hypothesis H1: Financial management capabilities have a positive impact on the effectiveness of financial risk management in coal industry enterprises.

Hypothesis H2: Capital structure and the level of financial leverage have a negative impact on the effectiveness of financial risk management in coal industry enterprises.

Hypothesis H3: Market volatility and coal price fluctuations have a negative impact on the effectiveness of financial risk management in coal industry enterprises.

Hypothesis H4: Access to capital and financial markets has a positive impact on the effectiveness of financial risk management in coal industry enterprises.

Hypothesis H5: Internal control systems and enterprise risk management have a positive impact on the effectiveness of financial risk management in coal industry enterprises.

Hypothesis H6: A stable and transparent institutional and policy environment has a positive impact on the effectiveness of financial risk management in coal industry enterprises.

Data analysis methods

The study sample comprises 42 enterprises operating in the coal mining, processing, and trading sectors, distributed across major mining regions in the North, Central, and South of Vietnam. The regional sampling approach reflects the differences in mining conditions, scale, and operating environments of coal enterprises in Vietnam, while also ensuring the feasibility and reliability of the data.

The collected data were processed using descriptive statistical techniques to reflect the characteristics of the research sample and the variables. Next, the reliability of the scales was tested before conducting multivariate regression analysis to assess the extent and direction of the impact of factors on financial risk management. The results of the analysis were used to test the research hypotheses and formed the basis for the results and discussion.

4. RESEARCH RESULTS AND DISCUSSION

Characteristics of the research sample

The study sample comprises 42 enterprises operating in the coal mining, processing, and trading sector in Vietnam, distributed across major coal-mining regions in the North, Central, and South. The enterprises in the sample show significant differences in workforce size and operating time, reflecting the fundamental characteristics of the coal industry: high capital intensity and long investment cycles. The survey respondents were primarily business leaders and financial managers, thus ensuring the reliability of information related to financial risk management.

Table 1. Descriptive statistics of the research variables

Research variables	Average value	Standard deviation	Minimum value	The greatest value
Financial risk management	3.54	0.61	2.25	4.75
Financial management skills	3.69	0.58	2.50	4.80
Financial leverage	3.48	0.64	2.30	4.65
Market volatility	3.71	0.62	2.85	5.00
Access to capital	3.31	0.60	2.20	4.55

Internal control	3.76	0.57	2.60	4.85
Institutions and policies	3.29	0.63	2.15	4.60

Descriptive statistics show that the average level of financial risk management among coal industry enterprises is quite good, but there are still certain disparities between enterprises. Financial management capacity and internal control systems have higher average values than other factors, reflecting the prominent role of management in the context of the coal industry facing many financial risks. Conversely, access to capital and the institutional environment have lower average values, indicating that these remain significant limitations in the financial risk management practices of enterprises.

Reliability of the scale

Before analyzing the relationships between variables, the scales are validated to ensure the reliability and internal consistency of the survey data.

Table 2. Results of reliability testing of the scale

Scale	Number of observed variables	Cronbach's alpha coefficient
Financial risk management	4	0.88
Financial management skills	3	0.85
Financial leverage	3	0.82
Market volatility	3	0.84
Access to capital	3	0.83
Internal control	3	0.87
Institutions and policies	3	0.81

The Cronbach alpha coefficients all exceeded the acceptable threshold in social science research, indicating that the scales have good reliability and are suitable for use in subsequent quantitative analysis. This confirms that the observed variables relatively accurately reflect the research concepts related to financial risk management in coal industry enterprises.

Results of regression analysis and research model testing.

Based on validated data, the study conducted a multiple regression analysis to assess the impact of various factors on financial risk management in coal industry enterprises.

Independent variable	Regression coefficient	Test value	Significance level
Financial management skills	0.318	3.92	Significant
Financial leverage	-0.241	-2.87	Significant
Market volatility	-0.206	-2.54	Significant
Access to capital	0.174	2.31	Significant
Internal control	0.295	3.66	Significant
Institutions and policies	0.162	2.08	Significant
Business size	0.083	1.21	Trivial
Area of operation	0.071	1.09	Trivial

Table 3. Regression model estimation results

The regression results show that the research model relatively well explains the variation in financial risk management in coal industry enterprises. Financial management capacity and internal control systems are the two factors with the strongest and most statistically significant impact, demonstrating the central role of management in controlling financial risk. Financial leverage and market volatility have an inverse impact, reflecting the fact that a high degree of dependence on borrowed capital and coal price fluctuations increase financial risk and limit the enterprise's ability to control risk. Access to capital and the institutional environment have a positive but to a lesser extent, indicating the supporting role of these factors in improving the effectiveness of financial risk management.

Testing the research hypothesis system.

Hypothesis H1 suggests that financial management capabilities have a positive impact on the effectiveness of financial risk management in coal industry enterprises. The estimation results show that the regression coefficient of the financial management capability variable is positive and statistically significant. This demonstrates that enterprises with highly skilled financial management teams, well-structured financial analysis systems, and good risk management experience tend to be more effective in identifying and controlling financial risks. This result confirms the central role of human factors and management capabilities in the context of the coal industry, which has high capital intensity and significant financial risk.

Hypothesis H2 suggests that capital structure and the level of financial leverage have a negative impact on the effectiveness of financial risk management in coal industry enterprises. The analysis results show that the regression coefficient of the financial leverage variable is negative and statistically significant, reflecting the fact that a high degree of reliance on borrowed capital increases payment pressure and the risk of financial

imbalance. In the coal industry, where investment projects often have long payback periods, the use of high financial leverage can impair the ability to respond to market fluctuations.

Hypothesis H3 suggests that market volatility and coal prices negatively impact financial risk management performance. The regression results show that market volatility has a negative and statistically significant coefficient, indicating that strong fluctuations in coal prices increase the uncertainty of cash flow and profits, thus making it difficult for businesses to plan financially and control risks. This finding clearly reflects the specific characteristics of the coal industry, where revenue and financial performance are closely dependent on market price movements.

Hypothesis H4 refers to the positive impact of access to capital and financial markets on the effectiveness of financial risk management. The analysis results show that the access to capital variable has a positive coefficient and is statistically significant, indicating that businesses with access to stable, affordable, and diversified capital sources generally have better conditions for risk diversification and maintaining financial stability. In the context of the coal industry, which faces significant risks and investment pressures, access to capital plays a crucial supporting role in financial risk management.

Hypothesis H5 suggests that internal control systems and corporate risk management have a positive impact on the effectiveness of financial risk management. The regression results show that the coefficient for the internal control variable is positive and highly statistically significant, indicating that companies with robust financial control processes, clear risk monitoring mechanisms, and effective early warning systems generally manage financial risks better. This result underscores the role of systemic risk management in mitigating the negative impacts of financial shocks.

Hypothesis H6 suggests that a stable and transparent institutional and policy environment has a positive impact on the effectiveness of financial risk management in coal industry enterprises. The analysis shows that the institutional environment variable has a positive and statistically significant coefficient, although its impact is lower than that of internal enterprise factors. This indicates that policy stability and a clear legal framework help enterprises reduce uncertainty and support financial risk management, but the ultimate effectiveness still depends primarily on the internal management capabilities of the enterprise.

5. CONCLUSION AND POLICY IMPLICATIONS

This study analyzed the factors influencing financial risk management in coal industry enterprises based on Vietnamese practice, combining theoretical arguments and quantitative empirical evidence. The research results show that financial risk management in coal industry enterprises is simultaneously affected by both internal enterprise factors and external environmental factors, with internal factors playing a decisive role.

Specifically, financial management capacity and internal control systems were identified as the two factors with the strongest impact on the effectiveness of financial risk management. This indicates that in the context of the coal industry, which has high capital intensity, long investment cycles, and high levels of risk, the capacity of the management team and the quality of the governance system play a central role in controlling and mitigating financial risks. In addition, access to capital and a stable institutional environment also have a positive impact, but to a lesser extent than the internal factors.

Conversely, a capital structure with a high degree of financial leverage and market volatility, especially coal price fluctuations, negatively impacts financial risk management. This result accurately reflects the specifics of the coal industry, where heavy reliance on borrowed capital and strong commodity market volatility can increase liquidity risk and limit a company's financial responsiveness. Overall, the study suggests that financial risk management in coal companies needs a holistic approach, harmoniously combining internal management capabilities with external environmental conditions.

Based on the research findings, several important policy implications can be drawn to improve the effectiveness of financial risk management in coal industry enterprises.

First and foremost, it is crucial to focus on improving the financial management capabilities of leaders and financial managers in coal industry enterprises. In-depth training programs on financial management, risk analysis, and long-term financial planning should be implemented systematically, enabling businesses to be more proactive in identifying and controlling financial risks.

Secondly, coal industry enterprises need to gradually improve their internal control and risk management systems in a systematic and integrated manner. Establishing clear financial monitoring processes, early risk warning mechanisms, and specific responsibilities will help enterprises enhance their ability to respond to financial and market shocks.

Thirdly, financial policies should aim to support coal industry enterprises in accessing stable, long-term capital sources at reasonable costs, while encouraging enterprises to reduce their reliance on excessive financial leverage. This will not only help reduce liquidity risk but also create conditions for enterprises to implement long-term investment projects more sustainably.

Fourth, in the context of a highly volatile coal market, regulatory bodies need to enhance the stability and transparency of policies related to energy, environment, and finance. Policy consistency will contribute to reducing uncertainty, supporting businesses in improving financial risk management and developing long-term growth strategies.

In conclusion, the study shows that improving financial risk management in the coal industry cannot rely on a single solution, but requires coordinated efforts between businesses and the government. A harmonious combination of enhancing internal governance capacity and improving the policy environment will be a crucial foundation for coal businesses in Vietnam to strengthen their financial resilience and achieve sustainable development in a volatile economic environment

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