

Moderating Role of Board Independence on the Relationship between Financial Risk and Profitability of listed Oil and Gas companies in Nigeria

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Abstract

This study examines the moderating effect of board independence on the relationship between financial risk and profitability of listed oil and gas companies in Nigeria. Employing a longitudinal research design, the study covers the period from 2010 to 2024, focusing on a population of nine listed oil and gas companies, all of which were included in the analysis using census sampling. The financial risk variables considered include credit risk, liquidity risk, foreign exchange risk, and interest rate risk, with return on equity (ROE) serving as the measure of profitability. Using Random Effects regression analysis, the findings reveal that board independence significantly moderates the effects of financial risks on profitability. Specifically, board independence strengthens the negative effect of credit risk, reverses the adverse impact of foreign exchange risk into a positive influence, and amplifies the positive effect of interest rate risk. Liquidity risk, while negatively associated with profitability, did not show a statistically significant moderating effect at the 5% level. Based on these findings, the study recommends that companies enhance board independence, strengthen risk management strategies, integrate governance into financial risk policies, and provide continuous training for independent directors to improve oversight and strategic decision-making. The results underscore the critical role of corporate governance in mitigating financial risks and enhancing firm profitability in the Nigerian oil and gas sector.

Keywords: Return on Equity, Credit Risk, Liquidity Risk, Foreign Exchange Risk, Interest Rate Risk, and Board Independence.

1. Introduction

The oil and gas industry has historically been a major driver of global economic growth, supporting key sectors such as transportation, manufacturing, and energy supply. Although its global relevance is gradually declining due to the ongoing energy transition, the industry remains critical for employment generation and national economic stability. At the same time, oil and gas operations are exposed to significant risks, including financial instability, operational disruptions, environmental challenges, and market volatility, which threaten sustainability and, in some cases, national security (Miranova

& Ibragimov, 2020). In Nigeria, the oil and gas sector represents the backbone of the economy, contributing substantially to government revenue, foreign exchange earnings, and employment. Despite its strategic importance and profitability, the sector faces persistent financial, operational, and regulatory challenges that threaten its long-term viability (Abubakar, 2020).

Profitability is fundamental to the survival and growth of oil and gas firms, as it enables reinvestment in exploration, infrastructure development, and technological innovation while ensuring adequate returns to investors. Profitable firms are better

positioned to withstand market volatility and adapt to structural changes such as the global shift toward renewable energy (Ahmadu, 2022). Financially stable companies are also more capable of complying with regulatory requirements and pursuing sustainability initiatives. To sustain profitability, Nigerian oil and gas firms must adopt effective Enterprise Risk Management (ERM) frameworks that provide a comprehensive approach to identifying and managing financial, operational, and regulatory risks (Ehiedu et al., 2022). Key financial risks affecting the sector include credit risk, liquidity constraints, operational inefficiencies, exchange rate volatility, and interest rate fluctuations, all of which significantly influence profitability, investment sustainability, and overall industry performance (Kariuki et al., 2022).

In recent years, Nigeria's oil and gas sector has become increasingly vulnerable to rising credit risk driven by high corporate leverage, exchange rate volatility, operational disruptions, and growing exposure within the banking system. The sector accounts for a substantial proportion of total bank credit, reflecting both its economic importance and the level of financial risk it poses to the financial system (Ahmadu et al., 2021). Excessive leverage and weak earnings among some firms have heightened default risk, as illustrated by companies such as Oando Plc, which reported significant borrowings alongside negative equity (Abubakar, 2020). The depreciation of the naira has further increased the burden of foreign-currency-denominated debt, while production challenges such as oil theft and pipeline vandalism have constrained cash flows. These pressures have contributed to rising non-performing loans in the banking sector, raising concerns about broader financial system stability (Eziocha & Malla, 2025). Weak internal controls and inadequate risk management practices further exacerbate

these challenges (Oluwaseun & Adegoke, 2024).

Liquidity management is another major concern for oil and gas companies in Nigeria, as adequate liquidity is essential for sustaining operations and meeting financial obligations (Almakura et al., 2024). Firms in the sector continue to face liquidity constraints due to delayed government payments, volatile revenues, and high operating costs. The removal of fuel subsidies in 2023 intensified cash flow pressures, forcing many companies to restructure their debt positions (CBN, 2023). In addition, the sector's dependence on foreign currency earnings alongside significant naira-denominated expenses exposes firms to currency mismatches. The sharp depreciation of the naira significantly increased import costs and working capital requirements, with downstream firms being particularly affected due to their predominantly naira-based revenues.

Foreign exchange risk remains a critical challenge for Nigerian oil and gas firms. Although crude oil exports are priced in U.S. dollars, the conversion of export proceeds into naira exposes companies to significant exchange rate volatility. Persistent depreciation of the naira has increased the cost of imported equipment and the servicing of dollar-denominated debt, eroding profit margins and weakening financial resilience (Wasiu, 2025). Consequently, exchange rate risk has become a major determinant of financial performance within the sector.

Furthermore, the capital-intensive nature of the oil and gas industry makes it highly sensitive to interest rate risk. Large-scale financing is required for exploration, production, and infrastructure development, exposing firms to fluctuations in borrowing costs (Augustine et al., 2020). The sharp rise in interest rates in Nigeria in 2023, implemented to curb inflation, significantly increased debt servicing costs and reduced firms' capacity to invest in expansion and

technological advancement (CBN, 2023). For highly leveraged firms, elevated interest rates pose serious threats to financial stability and long-term growth.

Corporate governance, particularly board independence, plays a crucial role in strengthening financial risk management and enhancing firm performance. Independent directors promote accountability, provide objective oversight, and help curb excessive risk-taking by management (Onatuyeh & Akpokerere, 2023). Empirical evidence suggests that firms with a higher proportion of independent directors tend to exhibit stronger internal controls, lower risk exposure, and improved risk-adjusted profitability (Aliu & Chukwudi, 2022; Alshirah et al., 2020).

Against this backdrop, this study examines the effect of financial risk on the profitability of listed oil and gas firms in Nigeria, with board independence serving as a moderating variable.

2. Literature Review

2.1 Profitability

Profitability in the oil and gas industry represents a complex performance measure shaped by commodity price volatility, high capital intensity, regulatory pressures, and operational efficiency, rather than merely the excess of revenues over costs (Onodugo & Uzonwanne, 2024). Due to the sector's exposure to external shocks and substantial investment requirements, assessing profitability requires a broader and more nuanced approach than in most industries. Traditional financial ratios such as Return on Assets (ROA), Return on Equity (ROE), Net Profit Margin (NPM), and Earnings Per Share (EPS) remain relevant and widely used, particularly in empirical studies of Nigerian oil and gas firms. However, the industry's unique capital structure and regulatory environment significantly influence how these indicators reflect

financial performance (Onodugo & Uzonwanne, 2024).

What distinguishes profitability in oil and gas is its strong dependence on sector-specific factors, especially in the upstream segment, which is characterized by high risk and substantial capital expenditure. Exploration and production costs play a decisive role in determining profit outcomes, as unsuccessful exploration and high lifting costs can erode earnings even during periods of favourable oil prices (Fatimehin, 2022). In addition, global crude oil price volatility is a major driver of profitability, with fluctuations arising from geopolitical tensions, shifts in global demand, and production decisions by OPEC+ significantly affecting revenue streams. In the short term, oil price movements often exert a stronger influence on profitability than internal operational efficiency, particularly for export-oriented firms (Ojumu & Osho, 2026).

Beyond conventional accounting measures, oil and gas companies also rely on operational performance indicators such as Operating Netback, EBITDAX, and the Recycle Ratio to better capture core profitability. These metrics help isolate operational performance by excluding high, irregular costs such as exploration expenses and provide clearer insights into field-level and underlying profitability in a highly capital-intensive and volatile industry.

2.2 Return on Equity (ROE)

In studies of listed oil and gas companies in Nigeria, Return on Equity (ROE) is commonly defined as the ratio of net income after tax to average shareholders' equity, expressed as a percentage. It measures a firm's ability to generate returns for its owners based on the equity invested and is widely used to assess how efficiently management utilizes shareholders' funds in a highly volatile industry environment (Abubakar, 2020). Given the exposure of oil and gas firms to oil price fluctuations, exchange rate movements, and regulatory

uncertainty, ROE serves as a practical indicator of profitability under risk.

Conceptually, ROE links equity capital at risk to the returns generated, making it particularly relevant in the oil and gas sector, where shareholders' funds must absorb both operational risks, such as exploration and production uncertainty, and external shocks, including price and currency volatility (Diwe-Tochukwu & Okafor, 2024). A higher ROE, therefore, signals effective use of equity capital to generate profits despite these challenges.

Empirical evidence supports the relevance of ROE as a performance measure in the sector. For instance, Lawal et al. (2019) employed ROE alongside ROA to evaluate profitability in Nigerian oil and gas firms and found that human capital efficiency had a positive and significant effect on ROE. This finding reinforces the view that ROE reflects not only financial performance but also managerial and operational efficiency in a capital-intensive industry.

2.3 Credit Risk

In the oil and gas industry, credit risk refers to the likelihood that a firm will suffer financial losses because counterparties, such as customers, lenders, suppliers, or hedging partners, fail to meet their contractual obligations (Lu et al., 2022). This risk arises across upstream, midstream, and downstream operations when buyers default on payments, counterparties fail on derivative or hedging contracts, lenders withdraw or fail to renew credit facilities, or debt obligations cannot be refinanced. The industry's heavy capital requirements, long project development cycles, exposure to volatile commodity prices, and reliance on a limited number of counterparties significantly heighten credit risk exposure. Credit risk in oil and gas is commonly defined as the potential inability of a counterparty to fulfil contractual terms, particularly in trade and financial contracts (Leung, 2025). To mitigate this risk, firms typically engage only with creditworthy

counterparties and conduct continuous assessments of counterparty financial strength. However, credit risk is often amplified during industry downturns, as falling oil prices, shrinking margins, and structural shifts in energy demand increase the probability of defaults and credit downgrades, thereby intensifying overall credit risk within the sector.

2.4 Liquidity Risk

Liquidity risk management is critical to a firm's long-term sustainability, as liquidity risk arises when a company is unable to meet its short-term financial obligations as they fall due (Adegbe & Adesanmi, 2020). This risk is often caused by mismatches between a firm's asset and liability structures, where cash inflows do not align with required outflows, thereby creating funding pressures (Kiptoo et al., 2021). Liquidity risk is therefore defined as the possibility of incurring losses due to an inability to settle maturing obligations or to finance additional assets without facing high costs or significant losses (Mopho et al., 2022). When poorly managed, liquidity risk can impair a firm's capacity to meet obligations to third parties, generate internal financial distress, and ultimately weaken overall performance (Almakura et al., 2024).

Effective liquidity management requires careful planning, monitoring, and control to maintain stakeholder confidence and ensure operational continuity. Firms must strike an optimal balance by holding sufficient liquidity to meet obligations without maintaining excessive cash that could otherwise be invested in higher-yield opportunities (Appah et al., 2021). Inefficient liquidity management may result in severe liquidity shortages and, in extreme cases, lead to insolvency. Since firms finance operations through a mix of debt and equity, the ability to service both short- and long-term liabilities depends heavily on adequate liquidity levels (Awin, 2018). Liquidity, defined as the ease with which

assets can be converted into cash without significant loss of value, therefore plays a central role in sustaining financial stability while minimizing opportunity costs associated with holding idle funds (Fatimehin, 2022).

2.5 Foreign Exchange Rate Risk

The exchange rate represents the value of one country's currency in relation to another and is determined largely by the interaction of demand and supply in the foreign exchange market (Augustine & Olufemi, 2022; Margarita & Linar, 2020). It serves as a key link between domestic and international prices of goods and services, thereby playing a crucial role in international trade and economic activity. Exchange rates may either appreciate or depreciate, depending on whether fewer or more units of the domestic currency are required to obtain a unit of foreign currency (Abazu & Ofor, 2023). As a result, exchange rate movements can influence national economies and firm performance positively or negatively, depending on their direction and stability (Okika et al., 2018; Ahmadu et al., 2021; Gumbo et al., 2022). Exchange rate fluctuations give rise to exchange rate or foreign exchange risk, which refers to the financial uncertainty caused by unexpected changes in currency values (Isibor et al., 2024). This risk is particularly relevant for multinational firms, exporters, importers, and foreign investors whose cash flows, asset values, and operating income are sensitive to currency movements (Viska & Ety, 2022; Tan et al., 2019). Transaction exposure, a key form of foreign exchange exposure, arises when exchange rate changes affect existing foreign-currency-denominated transactions, resulting in gains or losses (Tan et al., 2019). Although exchange rate risk may be neutral in perfectly efficient markets where parity conditions hold, deviations from these conditions commonly expose firms to currency risk, making effective exchange rate risk management essential for

sustaining financial performance (Kariuki et al., 2022).

2.6 Interest Rate Risk

Interest rate refers to the cost of borrowing or the return on invested funds, usually expressed as an annual percentage of the principal. In Nigeria, it is a key monetary policy instrument regulated by the Central Bank of Nigeria (CBN) through the Monetary Policy Rate (MPR), which serves as the benchmark for lending and deposit rates across the economy (John, 2020; Ahmadu et al., 2021). The CBN uses interest rate adjustments to control inflation and stimulate economic growth, although excessively high interest rates can raise the cost of capital and constrain investment and development (Augustine et al., 2020; Kariuki et al., 2022).

Interest rates also influence investment decisions and financial market performance, as changes in policy rates affect borrowing costs, stock returns, and the valuation of financial assets (Shetty, 2019; Viska & Ety, 2022). Fluctuations in interest rates give rise to interest rate risk, which refers to the potential adverse impact of unexpected rate movements on a firm's earnings, capital, or overall financial position (Sarfo et al., 2022; Abazu & Ofor, 2023). This risk is particularly relevant for firms with significant debt or holdings of fixed-income securities, since rising interest rates typically reduce the market value of bonds and increase debt servicing costs (Adepoju, 2021).

Interest rate risk arises from several sources, including repricing risk due to mismatches in the timing of cash flows, basis risk from changes in relationships between different interest rates, yield curve risk from shifts across maturities, and option risk embedded in financial contracts (Adepoju, 2021). Managing interest rate risk requires effective monitoring of interest income and expenses, as well as the use of risk mitigation strategies such as portfolio diversification, duration management, and

hedging with interest rate derivatives (Olalere et al., 2019; Alalade et al., 2020). Overall, interest rate risk remains a critical factor influencing financial stability and investment performance, particularly in economies with volatile monetary conditions (Augustine et al., 2020).

2.7 Board Independence

Board independence refers to the composition of a company's board of directors, specifically the proportion of independent non-executive directors relative to the total number of board members (Onatuyeh & Akpokerere, 2023). Directors are considered independent if they have no financial, familial, or material ties to the firm that could compromise their objectivity (Aliu & Chukwudi, 2022). Drawing on agency theory, boards with a higher share of independent directors are more effective in overseeing management, protecting shareholders' interests, ensuring regulatory compliance, enhancing the quality of financial reporting, and ultimately improving overall firm performance (Alshirah et al., 2020).

2.8 Modern Portfolio Theory

Modern Portfolio Theory (MPT), developed by Harry Markowitz (1952), offers a framework for optimizing the trade-off between risk and return through diversification. While originally applied to investment portfolios, MPT principles are increasingly relevant in corporate financial risk management, particularly in the oil and gas sector, which faces multiple interrelated financial risks.

In managing credit risk, MPT highlights the importance of balancing returns with risk exposure. High financial leverage increases the volatility of returns and the likelihood of default, so oil and gas firms must manage debt levels carefully, maintaining a balanced capital structure of debt and equity to optimize risk-adjusted returns. For liquidity risk, MPT encourages holding a mix of liquid and illiquid assets to preserve flexibility. Oil and gas companies apply this

principle by managing working capital efficiently and maintaining cash reserves, enabling them to meet short-term obligations and navigate periods of low oil prices without compromising profitability. Regarding foreign exchange risk, the global operations of oil and gas firms expose them to multiple currencies. MPT supports hedging strategies, such as forward contracts and currency swaps, to reduce volatility in cash flows and earnings, ensuring more stable profitability. In terms of interest rate risk, capital-intensive projects in oil and gas are sensitive to borrowing costs. Applying MPT, firms use interest rate derivatives to hedge against fluctuations, stabilizing financing costs and protecting project returns.

In general, MPT provides a theoretical basis for managing multiple financial risks simultaneously. By emphasizing diversification, hedging, and risk-return optimization, it helps oil and gas companies develop comprehensive financial risk management strategies that safeguard and enhance profitability.

2.9 Risk Management Theory

This theoretical perspective views corporate risk management not as the elimination of all risk, but as the strategic optimization of risk to enhance firm value. By stabilizing cash flows and reducing the likelihood of financial distress, firms can mitigate earnings volatility and maintain financial flexibility (Stulz, 1996). Effective risk management lowers expected costs from bankruptcy, agency conflicts, and underinvestment, thereby supporting long-term value creation (Froot et al., 1993). This aligns with Modern Portfolio Theory (MPT), which emphasizes optimal diversification and efficient risk allocation to increase expected returns for a given level of risk (Markowitz, 1952; Tufano, 1996). In this framework, risk management is a value-enhancing tool that balances uncertainty and return to maximize shareholder wealth.

In the Nigerian oil and gas sector, empirical evidence supports this perspective. Ahmadu et al. (2021) found that higher exposure to market risks, such as foreign exchange, interest rate, and commodity price fluctuations, negatively affects financial performance. Similarly, strong internal controls have been shown to improve financial risk management practices, suggesting a positive impact on firm performance (Etim et al., 2020). Governance also matters: the independence of risk-management committees in listed Nigerian oil and gas firms is significantly associated with higher firm value, highlighting the importance of effective oversight in creating value.

Applying this perspective indicates that Nigerian oil and gas firms that strategically manage, rather than eliminate, risk can stabilize cash flows, reduce financial distress, and enhance profitability. By addressing currency, interest rate, and commodity-price exposures, these firms can reduce earnings variability, maintain investor confidence, and lower the cost of capital, thereby aligning with the MPT-inspired approach of optimizing returns relative to risk.

2.10 Empirical Review

Miranova and Ibragimov (2020) examined the impact of financial risk management on global oil companies during the COVID-19 pandemic. They found that disruptions in trade, logistics, and production chains led to reduced corporate income, rising unemployment, and widespread financial instability. The study identified currency, credit, interest rate, price, and liquidity risks as major determinants of corporate solvency. The authors emphasized that robust financial risk management systems are essential for enhancing solvency, sustainability, and competitiveness during periods of uncertainty. However, the study is largely conceptual and lacks empirical validation, and its discussion of

stabilization measures remains generalized with limited practical guidance.

Shaheen et al. (2024) investigated the influence of macroeconomic and bank-specific factors on credit risk in Islamic banks in Pakistan using panel data from four full-fledged Islamic banks between 2007 and 2021. The study found that loan loss provisions significantly increase credit risk, while bank size and capital adequacy ratio significantly reduce it, highlighting their mitigating role. Other variables, such as GDP, inflation, interest rate growth, return on assets, and asset quality, were found to be insignificant. The study concluded that effective management of internal factors, such as loan monitoring, capital adequacy, and bank size, is crucial for controlling credit risk. Nonetheless, the small sample size and reliance on OLS regression limit generalizability and analytical depth, and the interaction of Islamic finance principles with conventional risk determinants was not deeply explored.

Peykani et al. (2025) explored the interrelationship between liquidity risk, credit risk, and solvency risk in 21 Iranian banks listed on the Iranian Capital Market from 2011 to 2023 using a Panel Vector Error Correction Model (VECM) and panel impulse response analysis. They found that higher liquidity levels improve bank solvency, whereas increased credit risk reduces solvency but does not significantly affect liquidity. These findings underscore the importance of managing both liquidity and credit risks to maintain solvency in emerging markets. While the study employs a sophisticated econometric approach, it does not fully explore causality, structural, or regulatory factors, and its focus on Iranian banks limits external validity.

Adegbe and Adesanmi (2020) investigated the role of liquidity management in promoting corporate sustainability among ten oil and gas companies listed on the Nigerian Stock Exchange (NSE). Using an ex-post facto research design and data from

audited financial statements, the study found that effective liquidity management significantly enhances corporate sustainability, positively influencing economic value added. The findings suggest that firms with strong liquidity practices generate higher economic returns, highlighting the strategic importance of liquidity management in the oil and gas sector. While the study benefits from credible data and robust statistical analysis, its small sample size and unspecified time frame limit the generalizability and temporal insights of the results.

Muhammad et al. (2021) examined the impact of credit risk on financial performance in 69 non-financial firms listed on the Pakistan Stock Exchange (KSE-100) between 2012 and 2017. Using the Altman Z-score model to measure credit risk and controlling for leverage, liquidity, and firm size, the study found that liquidity had no significant effect on financial performance, as measured by ROA and ROE. The research offers a valuable perspective on credit risk in non-financial firms and benefits from a relatively large sample. However, the six-year period may not fully capture long-term trends, and the reliance on LSDV regression may limit the study's ability to account for dynamic relationships or endogeneity, affecting the robustness of its conclusions.

Amir et al. (2020) assessed the effects of financial risks, credit, operational, and liquidity risk, on the financial performance of ten commercial banks in Pakistan from 2007 to 2015, with the Capital Adequacy Ratio (CAR) as a mediating variable. Using ROA as the performance measure, the study found that liquidity risk negatively impacts financial performance, while CAR positively influences performance and mitigates the adverse effects of financial risks. The nine-year dataset allowed for capturing long-term trends, and differentiating between financial risk types provided a detailed understanding of their

individual effects. Nevertheless, the study's limited sample size and unclear measurement of key variables restrict the generalizability of findings and may introduce ambiguity in interpreting results. González et al. (2020) analysed the effect of Enterprise Risk Management (ERM) on risk and performance in Spanish-listed companies using annual and corporate governance reports from 2012 to 2015. The study found that hedging against exchange rate risk enhances profitability and reduces overall risk. However, it did not examine other major risks covered by ERM, lacked methodological clarity, and may not reflect long-term ERM effects. Expanding the analysis to include operational and interest rate risks, clarifying research methods, and providing practical recommendations would improve its relevance for corporate governance and risk management practitioners.

Julius (2020) studied foreign exchange risk management and its influence on the profitability of deposit money banks in Lagos, Nigeria, using a descriptive survey approach. Data from questionnaires, interviews, and observations showed that 78.7% of respondents strongly agreed that exchange rate risk affects firm value. While the study offers insights into perceptions of exchange rate risk, its heavy reliance on subjective responses without quantitative validation or direct profitability measures limits its practical utility. Incorporating statistical analysis and explicit links to financial performance would strengthen its applicability for the banking sector.

Abdussalam et al. (2022) examined financial risk management in Lebanon's construction industry, identifying currency fluctuations, inflation, and solvency challenges as the most critical financial risks. Using a questionnaire survey targeting industry experts, the study highlighted the significance of financial risk in volatile economic contexts. However, it lacked detailed information on

questionnaire design, sample size, and respondent selection, which reduces reproducibility. In addition, it did not analyse underlying causes, mitigation strategies, or interactions among different risk types. Improving methodological transparency and expanding the analytical scope would enhance the study's relevance and practical value for industry stakeholders.

Viska and Ety (2022) investigated the effects of interest rate, exchange rate, profitability, and liquidity on stock prices in Indonesia's Food and Beverage Sub-Sector Manufacturing Companies between 2017 and 2020. Using multiple linear regression with SPSS and purposive sampling, the study found that interest rates had no significant impact on stock prices. However, the analysis did not provide detailed insights into the influence of the other factors studied. While the focused industry approach and statistical methodology add value, the study lacked transparency regarding sampling criteria, model assumptions, and the effects of key variables, limiting its overall robustness. Broader discussion and methodological clarity would strengthen its contribution.

John (2020) examined the impact of financial risk management on bank profitability in Nigeria, focusing on Access Bank Plc. Using a survey design, data from 56 management staff were analysed with simple linear regression in SPSS. The study found a significant positive relationship between interest rate risk and Return on Assets (ROA) and recommended proactive risk management. Despite its practical insights, the study's narrow focus on a single bank, limited sample size, and basic analytical approach reduce its generalizability. Expanding the scope and employing more sophisticated analytical methods would enhance the study's relevance.

Imran and Sulehri (2023) explored the effect of financial risk on profitability in

Pakistan's manufacturing and services sectors using panel data and the Levin, Lin, and Chu (LLC) unit root test for stationarity. Their findings indicate that times interest earned positively influences profitability, as measured by ROA. While the sector comparison provides useful insights, the study lacks justification for focusing solely on times interest earned, ignores other financial risk factors, and does not account for sector-specific dynamics. Incorporating a broader set of financial risks and actionable recommendations would improve its practical relevance.

Eke et al. (2019) explored the impact of board independence and size on the performance of Nigerian listed firms using secondary data from 35 companies over ten years (2009–2018). The study employed pooled Ordinary Least Squares (OLS) and Generalized Least Squares regression techniques. The findings indicated that board independence did not have a significant effect on financial performance, suggesting that the influence of independent boards may vary depending on industry or organizational context.

Ikponmwosa and Izedomi (2020) focused specifically on Nigerian oil and gas companies, analysing data from seven firms between 2013 and 2018 obtained from the National Bureau of Statistics and annual financial reports. Using multiple regression analysis, the study found that board independence had a significant positive effect on Return on Assets (ROA), indicating that greater independence contributes to improved financial performance in the oil and gas sector.

Owolabi et al. (2021) examined the relationship between board diversity, independence, and profitability across ten Nigerian listed firms. Employing panel regression methods, including fixed effects, pooled OLS, and random effects, the study revealed that board independence positively influenced financial performance. This reinforces the idea that independent boards

play a crucial role in enhancing corporate profitability and promoting effective governance in Nigerian listed companies.

3. Methodology

3.1 Population and Sample Size

The population of this study consists of all oil and gas companies listed on the Nigerian Exchange Group, which totals nine (9) companies. Given the small size of the population and the objective to include all relevant entities, the study employed a census sampling technique. This means that all nine listed oil and gas companies were included in the analysis rather than selecting a subset, ensuring that the study captures the full spectrum of financial risk and profitability dynamics within the sector over the period from 2010 to 2024. Using census sampling enhances the accuracy and generalizability of the findings for the entire population of listed oil and gas companies in Nigeria.

3.2 Method of Data Collection and Analysis

This study employed secondary data sourced from audited financial statements of the nine oil and gas companies listed on the Nigerian Exchange Group (NGX), as well as publications from government agencies, particularly the Central Bank of Nigeria (CBN). Data on independent variables, including foreign exchange risk and interest rate risk, were obtained from the CBN Statistical Bulletin, while information on credit risk, liquidity risk, operational risk, and the dependent variable, Return on Equity (ROE), was extracted from company financial statements and

annual reports. The study applied multiple linear regression analysis to dynamic panel data, integrating company-level financial data with macroeconomic indicators from the CBN and market data from the NGX. This methodology allows for a comprehensive examination of how financial risks and macroeconomic factors impact the profitability of listed oil and gas firms over time, offering robust insights into the relationships among the variables.

3.3 Model Specification

To assess the effect of corporate financial risk management on the profitability of Nigerian listed oil and gas companies, the study employed regression analysis. The relationship is expressed through the following regression models:

$$ROE_{it} = \beta_0 + \beta_1 CRR_{it} + \beta_2 LIR_{it} + \beta_3 FER_{it} + \beta_4 IIR_{it} + \epsilon_{it} \tag{1}$$

$$ROE_{it} = \beta_0 + \beta_1 BI_{it} + \epsilon_{it} \tag{2}$$

$$ROE_{it} = \beta_0 + \beta_1 CRR_{it} + \beta_2 LIR_{it} + \beta_3 FER_{it} + \beta_4 IIR_{it} + \beta_5 CRR \times BI_{it} + \beta_6 LIR \times BI_{it} + \beta_7 FER \times BI_{it} + \beta_8 IIR \times BI_{it} + \epsilon_{it} \tag{3}$$

- ROE = Return on Equity
- CRR = Credit Risk
- LIR = Liquidity Risk
- FER = Foreign Exchange Risk
- IRR = Interest Rate Risk
- BI = Board Independence
- β_0 = Regression coefficient
- ϵ = error term

Table 1: Measurements of Variables

Variable	Nature	Measurement	Source
Return on Equity	Dependent	Profit after tax / Total equity	(Sirajo et al., 2024)
Credit risk	Independent	Total debts / Total equity	(Kariuki et al., 2022)
Liquidity risk	Independent	Current assets / Current liabilities	(Almakura et al., 2024)
Foreign exchange risk	Independent	Assets – Liabilities / Total Assets	(Ahmadu et al., 2021)
Interest rate risk	Independent	Assets – Liabilities / Total Capital	(Sarfo et al., 2022)
Board Independence	Moderator	Independent non-executive directors / All directors	(Owolabi et al., 2021)

Source: Researcher’s Compilation (2024)

4. Results and Discussion

4.1 Descriptive Statistics

Descriptive statistics are methods used to organize and clearly present data by

summarizing its main features. They use measures such as the mean, median, mode, and range, often shown in tables or charts, to reveal patterns without making conclusions beyond the dataset.

Table 2: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Minimum	Maximum
ROE	135	0.0028	0.1445	-0.7349	0.9011
CRR	135	0.7900	0.2348	0.1623	1.6531
LIR	135	0.9591	1.1191	-1.9546	9.9368
FER	135	0.2437	0.2076	0.0000	1.3807
IRR	135	-0.3164	1.8871	-16.0667	3.1333
BIN	135	0.0241	0.4295	0.0000	0.1270

Table 2 presents the descriptive statistics for the variables used to examine the moderating effect of financial risk on the profitability of listed oil and gas companies in Nigeria. The data consists of 135 observations covering the period from 2010 to 2024.

Return on Equity (ROE): The mean ROE is 0.0028 with a standard deviation of 0.1445, indicating that, on average, the profitability of the listed oil and gas companies is low, with considerable variation among firms. The minimum and maximum ROE values of -0.7349 and 0.9011, respectively, suggest that some firms experienced negative returns, reflecting periods of financial losses, while others achieved high returns.

Credit Risk (CRR): CRR has a mean of 0.7900 and a standard deviation of 0.2348, indicating moderate levels of credit risk

across the companies. The minimum of 0.1623 and the maximum of 1.6531 show that there is variation in how companies manage or are exposed to credit risk.

Liquidity Risk (LIR): LIR has a mean of 0.9591 and a standard deviation of 1.1191, suggesting that liquidity risk varies widely across the firms. The range from -1.9546 to 9.9368 indicates that some companies experienced negative liquidity pressures, while others faced high liquidity challenges during the period.

Foreign Exchange Risk (FER): FER has a mean of 0.2437 and a standard deviation of 0.2076, showing relatively low average exposure to foreign exchange risk, but with enough variation (ranging from 0.0000 to 1.3807) to capture the effects of exchange rate fluctuations on profitability.

Interest Rate Risk (IRR): IRR exhibits a mean of -0.3164 and a standard deviation of 1.8871, indicating that interest rate fluctuations have, on average, a slightly negative effect, but with substantial variability. The extreme values, from -16.0667 to 3.1333, suggest periods of significant interest rate changes impacting certain firms.

Board Independence (BIN): BIN, included as a moderating variable, has a mean of 0.0241 and a standard deviation of 0.4295, with a minimum of 0.0000 and a maximum of 0.1270. This shows that board independence is generally low among the sampled firms, which may influence how financial risk affects profitability.

The descriptive statistics indicate considerable variability in both financial

Table 3: Heteroskedasticity Test for Model 1

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Chi² = 2.27
Prob > Chi² = 0.1321

The Breusch-Pagan / Cook-Weisberg test was conducted to examine whether the variance of the errors in the regression model is constant, a condition known as homoskedasticity. The test yielded a Chi-square statistic of 2.27 with a corresponding p-value of 0.1321. In this context, the null hypothesis assumes that the error variance is constant, while the alternative hypothesis suggests the presence of heteroskedasticity. Since the p-value exceeds the conventional significance level of 0.05, there is

Table 4: Variance Inflation Factor (VIF) Test for Multicollinearity for Model 1

Variable	VIF	1/VIF
FER	1.12	0.890649
IRR	1.07	0.938459
BIN	1.05	0.953260
LIR	1.02	0.978253
CRR	1.02	0.984073
Mean	1.06	

The Variance Inflation Factor (VIF) test for Model 1 shows that all independent variables have VIF values close to 1,

risk and profitability among listed oil and gas companies in Nigeria. The wide ranges and standard deviations suggest that firms differ significantly in their exposure to credit, liquidity, foreign exchange, and interest rate risks. Board independence is generally low, implying that corporate governance structures may influence how financial risks impact firm profitability. These variations are important as they set the context for analysing the moderating effect of financial risk on profitability.

4.2 Pre-Estimation Analyses for Model 1

Before conducting regression analysis, it is important to examine the data for possible econometric problems such as heteroskedasticity and multicollinearity, as these issues can undermine the accuracy and reliability of the estimated coefficients.

insufficient evidence to reject the null hypothesis. This indicates that the model does not exhibit significant heteroskedasticity, and the assumption of constant variance is reasonably satisfied. Consequently, the reliability of the regression estimates, including standard errors and confidence intervals, remains intact, supporting the validity of subsequent statistical inference.

ranging from 1.02 to 1.12, with a mean of 1.06. This indicates very low multicollinearity, suggesting that the

predictors are not highly correlated and each contributes unique information to the model. Consequently, the regression estimates are stable, and statistical inferences can be considered reliable.

4.3 Multivariate Regression Results and Analyses of Main Effects

Multivariate regression is a statistical method used to analyse how multiple independent variables influence a single

dependent variable, with particular emphasis on identifying the main effects of each predictor while controlling for others. Estimation plays a key role in this process by providing numerical coefficients that describe the strength and direction of these relationships, allowing researchers to make inferences from sample data to a broader population.

Table 5: Regression results of Main Effects (Model 1)

Fixed Effects Regression Results				Random Effects Regression Results			
ROE	Coef.	t	P>/t/	ROE	Coef.	t	P>/t/
CRR	-0.0669	-0.98	0.329	CRR	-0.0791	-1.70	0.090
LIR	-0.0166	-1.61	0.110	LIR	-0.0206	-2.14	0.032
FER	-0.1483	-2.46	0.015	FER	-0.1334	-2.44	0.015
IRR	0.0209	3.40	0.001	IRR	0.0210	3.61	0.000
BIN	-1.0517	-3.63	0.000	BIN	-1.0306	-4.04	0.000
R-squared	0.2995			R-squared	0.3016		
Prob > F	0.0000			Prob > F	0.0000		
Obs.	135			Obs.	135		
Hausman Test		Prob > Chi ²	=		0.8222		

The random effects regression results in Table 5 examine the impact of financial risk on the profitability of listed oil and gas companies in Nigeria, with Board Independence (BIN) included as a moderating factor. Profitability is measured using Return on Equity (ROE), while financial risk is represented by Credit Risk (CRR), Liquidity Risk (LIR), Foreign Exchange Risk (FER), and Interest Rate Risk (IRR).

The results indicate that Credit Risk (CRR) negatively affects profitability (coef. = -0.0791) but is only marginally significant at the 10% level, suggesting a weak relationship. Liquidity Risk (LIR) shows a statistically significant negative effect (coef. = -0.0206, p = 0.032), implying that firms with higher liquidity risk tend to experience lower ROE. Similarly, Foreign Exchange Risk (FER) negatively influences profitability (coef. = -0.1334, p = 0.015), highlighting the adverse effect of currency fluctuations on firm performance. In contrast, Interest Rate Risk (IRR) exhibits a

positive and highly significant effect (coef. = 0.0210, p < 0.001), suggesting that firms may benefit from interest rate exposure, possibly through effective hedging or investment strategies.

The moderating variable, Board Independence (BIN), also has a strong negative and significant effect on ROE (coef. = -1.0306, p < 0.001), indicating that greater board independence may constrain managerial discretion, thereby reducing short-term profitability. This underscores the complex role of corporate governance in balancing oversight with performance outcomes.

Generally, the model is statistically significant (Prob > F = 0.0000) and explains approximately 30% of the variation in profitability (R² = 0.3016). These findings suggest that financial risk factors, especially foreign exchange and liquidity risks, have detrimental effects on the profitability of Nigerian oil and gas firms, while interest rate risk may offer opportunities for gains. The moderating role of board independence

further emphasizes the importance of corporate governance structures in shaping firm performance.

In conclusion, the random effects analysis demonstrates that effective financial risk management and governance practices are crucial in influencing the profitability of listed oil and gas companies in Nigeria, with

Table 6: Heteroskedasticity Test for Model 2

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Chi ²	=	2.73
Prob > Chi ²	=	0.0986

Table 3 presents the result of the Breusch–Pagan / Cook–Weisberg test conducted to examine the presence of heteroskedasticity in Model 2. The test evaluates whether the variance of the error terms in the regression model is constant (homoscedastic) or varies across observations (heteroscedastic).

The test result shows a Chi-square (χ^2) value of 2.73 with a corresponding probability value (Prob > Chi²) of 0.0986. The null hypothesis of the Breusch–Pagan / Cook–Weisberg test states that the variance of the residuals is constant (homoskedasticity), while the alternative hypothesis indicates the presence of heteroskedasticity.

Since the probability value (0.0986) is greater than the conventional 5%

Table 7: Variance Inflation Factor (VIF) Test for Multicollinearity for Model 2

Variable	VIF	1/VIF
FER_BIN	2.68	0.373381
LIR_BIN	2.54	0.393340
IRR	1.94	0.515441
IRR_BIN	1.92	0.520080
FER	1.14	0.878594
CRR	1.10	0.905997
CRR_BIN	1.07	0.937659
CRR	1.02	0.984073
Mean	1.06	

Table 4 presents the results of the Variance Inflation Factor (VIF) test conducted to assess the presence of multicollinearity among the explanatory variables included in Model 2. Multicollinearity occurs when independent variables in a regression model

both risks and board oversight playing significant and sometimes opposing roles.

4.4 Pre-Estimation Analyses for Model 2

Pre-estimation analyses for Model 2 assess data quality and assumptions before regression, ensuring the model is well-specified and produces reliable, valid results.

significance level (0.05), the null hypothesis cannot be rejected. This implies that there is no statistically significant evidence of heteroskedasticity in Model 2. In other words, the residuals appear to have constant variance across observations.

Therefore, the regression model satisfies the homoskedasticity assumption, suggesting that the estimated coefficients are efficient and the standard errors are reliable for statistical inference. However, because the p-value is relatively close to the 10% significance level, the evidence against heteroskedasticity is moderate, and researchers may still consider using robust standard errors as a precautionary measure.

are highly correlated with each other, which can inflate the variance of coefficient estimates and reduce the reliability of statistical inferences.

The VIF values reported for the variables in Model 2 range from 1.02 to 2.68, while the

corresponding tolerance values (1/VIF) range from 0.373 to 0.984. The highest VIF value is observed for FER_BIN (2.68), followed by LIR_BIN (2.54), IRR (1.94), and IRR_BIN (1.92). Other variables such as FER (1.14), CRR (1.10), CRR_BIN (1.07), and CRR (1.02) have even lower VIF values.

Generally, a VIF value greater than 10 (and in some cases 5) is considered indicative of serious multicollinearity problems. Since all the VIF values in this model are well below these thresholds, the results suggest that

there is no significant multicollinearity among the independent variables. Additionally, the tolerance values (1/VIF) are all well above the critical level of 0.10, further confirming the absence of multicollinearity.

The mean VIF of 1.06 also indicates that the explanatory variables collectively exhibit a very low level of correlation. Therefore, the regression estimates for Model 2 are not adversely affected by multicollinearity, and the coefficients can be considered stable and reliable for interpretation and inference.

Table 8: Regression results of Moderating Effects (Model 2)

Fixed Effects Regression Results				Random Effects Regression Results			
ROE	Coef.	t	P>/t/	ROE	Coef.	t	P>/t/
CRR_BI	-0.9862	-1.70	0.092	CRR_BIN	-1.1707	-2.22	0.026
LIR_BI	-1.1547	-2.14	0.034	LIR_BIN	-0.9687	-1.88	0.060
FER_BI	5.8897	2.51	0.013	FER_BIN	4.4631	2.11	0.035
IRR_BI	3.1934	5.00	0.000	IRR_BIN	3.2352	5.36	0.000
R-squared	0.3905			R-squared	0.4014		
Prob > F	0.0000			Prob > F	0.0000		
Obs.	135			Obs.	135		
Hausman Test		Prob > Chi ²	=		0.8382		

The Random Effects regression results in Table 8 examine the moderating effect of Board Independence (BIN) on the relationship between financial risk and the profitability of listed oil and gas companies in Nigeria. The Hausman test probability value of 0.8382 confirms that the Random Effects model is appropriate, consistent with the main effects model. The inclusion of board independence as a moderator improves the explanatory power of the model, with an R-squared of 0.4014 compared to 0.3016 in the main effects model, indicating that the interaction between board independence and financial risk explains additional variation in profitability.

The interaction between Credit Risk and Board Independence (CRR_BIN) is negative and statistically significant at the 5% level (coefficient = -1.1707, t = -2.22, p = 0.026). Compared to the main effects model, where credit risk alone was only

marginally significant (-0.0791, p = 0.090), this result shows that board independence amplifies the adverse effect of credit risk on profitability. This suggests that firms with a higher proportion of independent directors experience stronger negative effects from credit risk, likely due to stricter monitoring and cautious financial policies that limit aggressive profit-seeking strategies.

The moderating effect of Foreign Exchange Risk (FER_BIN) is positive and statistically significant at the 5% level (coefficient = 4.4631, t = 2.11, p = 0.035). In contrast, foreign exchange risk in the main effects model had a negative effect on profitability (-0.1334, p = 0.015). This reversal indicates that board independence enables firms to manage foreign exchange risk more effectively, likely through strategic oversight, hedging, and decision-making, turning a potential threat into a driver of profitability.

Interest Rate Risk moderated by board independence (IRR_BIN) shows a strong positive and highly significant effect at the 5% level (coefficient = 3.2352, $t = 5.36$, $p = 0.000$), reinforcing the positive effect observed in the main effects model (coefficient = 0.0210, $p = 0.000$). This suggests that independent boards enhance the ability of firms to capitalize on interest rate fluctuations through effective debt management or interest-sensitive investment strategies.

Generally, when considering only effects significant at the 5% level, credit risk, foreign exchange risk, and interest rate risk are significantly moderated by board independence, whereas liquidity risk (LIR_BIN) is not significant at this threshold ($p = 0.060$). Compared with the main effects model, the moderating analysis shows that board independence strengthens the negative effect of credit risk, reverses the negative effect of foreign exchange risk, and amplifies the positive effect of interest rate risk on profitability. These findings highlight the critical role of board independence in shaping how financial risks affect the profitability of listed oil and gas companies in Nigeria.

5. Conclusion

Conclusion and Recommendations

Based on the findings of the moderating effects, it can be concluded that board independence plays a significant role in shaping the impact of financial risks on the profitability of listed oil and gas companies in Nigeria. Specifically, board independence strengthens the negative effect of credit risk, reverses the adverse effect of foreign exchange risk into a positive influence, and amplifies the positive effect of interest rate risk on profitability. These results indicate that independent boards enhance risk management and strategic oversight, enabling firms to mitigate certain financial risks while leveraging others to improve

returns. Overall, effective corporate governance through board independence significantly influences how financial risk factors translate into firm profitability.

Recommendations

Based on the findings of the moderating effects, several recommendations are proposed for the listed oil and gas companies in Nigeria. Firms should strengthen board independence, as independent directors play a crucial role in influencing how financial risks affect profitability. Enhanced board oversight can help reduce the negative impact of credit risk and improve responses to interest rate and foreign exchange risks. Companies should also improve their risk management strategies by leveraging the expertise of independent directors to address credit exposure and currency fluctuations through effective monitoring and hedging practices. In addition, boards should focus on making strategic financial decisions, particularly in managing interest rate and foreign exchange opportunities through careful debt structuring and investment planning to enhance profitability. Continuous training and capacity-building programs should be provided for independent directors to deepen their knowledge of financial risk assessment, corporate governance, and strategic decision-making. Finally, firms should integrate strong governance structures, especially board independence, into their overall risk management frameworks to ensure a proactive approach to financial risks and improve overall performance.

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