NIGERIAN INSURANCE INDUSTRY PROFITABILITY: RISK-ADJUSTED RETURNS APPROACH

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Abstract

This study examines the impact of underwriting and operational risk factors on the Adjusted Risk-Adjusted Return on Capital (RAROC) of listed Nigerian insurance companies in Nigeria. Using a panel dataset of 20 insurance companies for the period 2011 to 2022, the study analyzes the relationships between key underwriting and operational risk variables, specifically Claims Ratio, Expense Ratio, Asset-Liability Ratio, Leverage, and Total Premiums Earned and profitability, as measured by Adjusted RAROC. The study employs static regression models, along with Granger causality tests, to assess the effects of these factors on firm profitability. The results indicate weak correlations but significant variation in the influence of selected risk factors on Adjusted RAROC. Specifically, the Leverage and Total Premiums Earned variables exhibit weak but significant influence on profitability, while other factors, including the Claims Ratio and Asset-Liability Ratio, show no significant relationship. The Granger causality tests further suggest that the Combine Ratio is the only

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variable with predictive power for Adjusted RAROC. Based on these findings, the study recommends that Nigerian insurance firms should focus on improving operational efficiency, optimizing capital structures, and diversifying premium portfolios to enhance profitability. Additionally, future research should explore broader risk factors and employ more advanced econometric models to gain a deeper understanding of the complex relationships between underwriting risk and firm performance.

Keywords: Underwriting Risk, Operational Risk, Adjusted RAROC, Profitability, Insurance Companies

JEL classifications: G22, G32, C23, G30, L25

1. INTRODUCTION

The Nigerian insurance industry plays an important role in the financial service sector by mitigating risks, fostering economic growth, and ensuring financial stability. Despite its significance, the sector faces persistent challenges, such as profitability constraints, operational inefficiencies, and exposure to underwriting and investment risks (Oloyede et al., 2023) These challenges show the need to understand the determinants of profitability and risk-adjusted returns to enhance the performance and resilience of Nigerian insurance firms.

Profitability and risk-adjusted returns are essential measures of financial performance, offering insights into an insurer's efficiency, sustainability, and ability to generate shareholder value (Olaiya et al., 2021). Traditional profitability indicators such as Return on Equity (ROE) and Return on Assets (ROA) evaluate a firm's capacity to generate income relative to its equity and assets. Meanwhile, Adjusted Risk-Adjusted Return on Capital (RAROC) provides a more robust assessment by incorporating risk into the performance evaluation framework. This metric assesses whether returns adequately compensate for risks undertaken, making it a valuable tool for performance measurement (Zeidan, 2025).

The determinants of profitability and risk-adjusted returns in the Nigerian insurance industry are multifaceted, encompassing factors such as leverage, asset-liability management, underwriting efficiency, and operational performance. Leverage measures the extent to which firms utilize borrowed funds to amplify returns, while asset-liability management assesses the alignment between assets and liabilities to determine financial stability. Underwriting efficiency, captured through claims ratio (CR) and expense ratio (ER), evaluates insurers' ability to balance premium income against claim liabilities and operating expenses. The combined ratio, which aggregates claims and expense ratios, serves as a proxy for risk exposure and operational efficiency.

This study focuses on the interplay between financial and operational factors in determining the Adjusted Risk-Adjusted Return on Capital (RAROC) for listed Nigerian insurance companies. Given the dynamic nature of the insurance industry and regulatory emphasis on robust risk management practices, this analysis is critical for understanding the drivers of financial performance.

The research study aims to explore the impact of leverage on Adjusted RAROC by evaluating how firms' capital structures influence returns relative to risk exposure. Additionally, it examines the role of asset-liability management in

mitigating financial risks and enhancing profitability. Underwriting performance, as measured by claims and expense ratios, was analyzed to assess its effects on profitability and risk-adjusted returns. Operational efficiency, reflected in the expense ratio, was also evaluated to determine how effective cost management practices contribute to financial performance. Furthermore, the combined ratio, which integrates underwriting and operational performance, was assessed to provide insights into their combined influence on Adjusted RAROC. A lower combined ratio typically signals better management of underwriting risks and expenses, potentially leading to higher profitability and improved risk-adjusted returns.

Motivated by gaps in existing literature, particularly within the Nigerian context, this research study addresses the limited empirical evidences on risk-adjusted returns in the insurance sector. By leveraging panel data from publicly listed insurance firms, the study aims to offer actionable insights for policymakers, regulators, and industry stakeholders to strengthen risk management frameworks and improve profitability. The findings will contribute to the growing body of knowledge on performance determinants in the insurance sector, providing practical recommendations for optimizing financial strategies and promoting sustainable growth within the Nigerian insurance industry.

2. LITERATURE REVIEW

2.1. RISK AND FINANCIAL PERFORMANCE

The relationship between risk and finance has been a central theme in financial literature. Risk management practices, particularly in the insurance sector, are critical for ensuring financial stability and profitability. This review examines existing research on the impact of underwriting risk, operational risk, and investment risk on the financial performance of insurance companies, focusing on Adjusted Risk-Adjusted Return on Capital (RAROC) as a performance measure; as well as key moderating factors, such as firm size, leverage, and profitability.

Cummins and Weiss (2009) provided evidence that larger insurers achieve higher profitability and demonstrate superior risk management capabilities. This study emphasizes the significance of risk mitigation strategies in improving operational efficiency and financial performance. Similarly, Berger and Humphrey (1991) found that larger insurance firms tend to exhibit higher technical efficiency, benefiting from economies of scale.

Norman et al. (2015) and Kaitibi et al. (2018) extended the analysis to the banking sector, illustrating how risk management techniques affect performance indicators such as non-performing loans (NPL), capital adequacy ratio (CAR), and return on assets (ROA). These findings revealed the importance of effective risk management frameworks across financial institutions.

Recent studies such as. Agoraki and Kouretas (2020), have reinforced the link between risk management practices and financial stability, emphasizing the importance of dynamic models that integrate market shocks and regulatory changes. Similarly, Okonkwo and Uchenna (2021) explored the role of enterprise risk

management in Nigerian insurance firms, highlighting its positive impact on profitability and resilience during economic downturns.

2.2. UNDERWRITING RISK AND PERFORMANCE

Underwriting risk, often measured through claims ratio (CR) and expense ratio (ER), directly impacts insurers' profitability. Studies highlight the role of underwriting discipline in achieving sustainable profitability. The study of Adebayo and Yusuf (2022) emphasized the need for insurers to balance premium pricing and claim liabilities to maintain financial stability. This study further investigated the relationship between underwriting efficiency and profitability, finding that higher underwriting ratios are associated with weaker financial performance, especially in volatile markets.

2.3. OPERATIONAL AND INVESTMENT RISK

Operational risk (OPR) reflects inefficiencies in claims handling and expense management, while investment risk (IR) considers the volatility associated with asset-liability mismatches and portfolio performance. Previous studies suggest that higher claims and expense ratios lead to reduced profitability, whereas prudent investment strategies enhance returns.

Recent contributions by Bello and Salami (2023) have focused on integrating operational and investment risk metrics, proposing models that account for regulatory compliance and market fluctuations, thereby improving decision-making processes.

2.4. ADJUSTED RAROC AS A PERFORMANCE MEASURE

RAROC has been widely adopted as a risk-adjusted performance metric. It evaluates profitability while accounting for capital costs associated with risk exposures. Empirical studies reveal that Adjusted RAROC effectively captures the interplay between risk and return, providing insights into insurers' financial health. Recent findings by Onuoha and Adewale (2023) support the adoption of Adjusted RAROC as a benchmark for measuring profitability under varying economic conditions, highlighting its adaptability to stress testing and scenario analysis.

2.5. MODERATING EFFECTS OF FIRM SIZE AND LEVERAGE

Firm size and leverage are critical moderators in the risk-performance relationship. Larger firms often benefit from diversification and cost efficiency, mitigating risk impacts. Highly leveraged firms face amplified risks but may achieve higher returns if risks are well-managed. Emerging studies, such as Chinedu and Afolabi (2024), emphasize the moderating role of firm size in sustaining profitability amidst economic uncertainties, reinforcing the need for scalable risk management frameworks. The literature reveals the importance of comprehensive risk management practices in enhancing financial performance within the insurance sector. Future research should focus on integrating dynamic risk metrics and evaluating their effects under evolving market conditions.

3. METHODOLOGY

This study adopts a quantitative research design, utilizing panel data analysis to examine the impact of underwriting and operational risks on the Adjusted Risk-Adjusted Return on Capital (RAROC) of listed Nigerian insurance companies. The design is selected to capture cross-sectional and time-series variations, providing robust insights into risk-adjusted performance determinants. The population consists of all 23 insurance companies listed on the Nigerian Exchange Limited (NGX) as of December 31, 2022. A purposive sampling technique was applied, selecting 20 companies based on data availability, continuous listing status (spanning over twelve years period), and financial disclosures from 2011 to 2022. Secondary data were obtained from audited financial statements and annual reports filed with the Nigerian Exchange Limited (NGX) and the National Insurance Commission (NAICOM). Key variables in the analysis are as contained in Table 1.

Table 1. Variables included in the study models

Variable	Variable Category	Description	Measurement
Adjusted RAROC (Y)	Dependent	Dependent variable measuring risk-adjusted profitability.	Adjusted Risk-Adjusted Return on Capital formula based on net income and risk-weighted capital.
Claims Ratio (CR)	Independent	Measures underwriting risk and efficiency in managing claims.	Claims incurred divided by net premiums earned.
Expense Ratio (ER)	Independent	Reflects operational efficiency and cost management effectiveness.	Underwriting and operational expenses divided by net premiums earned.
Asset-Liability Ratio (ALR)	Independent	Evaluates financial stability and risk exposure from asset-liability mismatches.	Total liabilities divided by total assets.
Combined Ratio (CBR)	Independent	Aggregates underwriting and operational performance metrics to assess overall efficiency.	Claims Ratio (CR) + Expense Ratio (ER).
Firm Size (FS)	Moderating	Moderating variable capturing economies of scale and diversification benefits.	Natural logarithm of total assets.
Leverage (LEV)	Moderating	Measures the extent of debt utilization to amplify returns.	Total debt divided by total equity.

Author's Compilation (2025)

3.1. MODEL SPECIFICATION

Following the study of Olaiya, Olowofela, and Ariyibi (2023), models were adapted and adjusted to suit the main objectives of the study. The study employs panel regression techniques using pooled effect, fixed effects and random effects models, using Hausman and chow test to guide the model selection. The regression equation is specified as:

Profitability = *f* (CR, ER, ALR, CBR, LEV, FS) ……………………………….. (1)

$RAROC = \beta_0 + \beta_1 CR + \beta_2 ER + \beta_3 ALR + \beta_4 CBR + \beta_5 FS + \beta_6 LEV + \varepsilon$ ………… (2)

Where:

RAROC = Adjusted Risk-Adjusted Return on Capital

CR = Claims Ratio

ER = Expense Ratio

ALR = Asset-Liability Ratio

CBR = Combined Ratio

FS = Firm Size

LEV = Leverage

ε = Error term

3.2. DATA ANALYSIS

Descriptive statistics and correlation analyses were used to summarize data patterns. Diagnostic tests for multicollinearity, heteroskedasticity, and autocorrelation were conducted to validate model assumptions. Hypotheses were tested at 1%, 5% and 10% levels of significance.

4. RESULTS

The study investigates the relationship between various financial and operational variables and Adjusted Risk-Adjusted Return on Capital (RAROC) in the insurance sector. The descriptive statistics for the variables show notable trends, such as a high mean Adjusted RAROC (42.14) and a substantial degree of variability across all variables. The data displays significant skewness and kurtosis, indicating non-normal distributions, which was confirmed by the Jarque-Bera test.

The correlation analysis reveals weak negative correlations between Adjusted RAROC and financial ratios like Asset-Liability Ratio, Claims Ratio, Combine Ratio, and Expense Ratio. Leverage shows a weak positive relationship with Adjusted RAROC. Claims Ratio, Combine Ratio, and Expense Ratio exhibit moderate positive correlations with each other, highlighting their interdependence in determining underwriting performance and operational costs.

The Augmented Dickey-Fuller test confirms that all variables are stationary, indicating that they are suitable for further time-series analysis. The static regression results from pooled, fixed effects, and random effects models suggest that Adjusted RAROC is influenced by some variables, but the relationships are often weak or insignificant. Specifically, Leverage and Total Premiums Earned show varying impacts on profitability depending on the model, while the other variables like Asset-

Liability Ratio, Claims Ratio, and Combine Ratio do not significantly affect profitability.

The Granger causality tests indicate that only the Combine Ratio shows significant predictive power for Adjusted RAROC, whereas the other variables do not predict future Adjusted RAROC values.

Table 2. *Descriptive statistics of variables included in the models*

	Adjusted RAROC	ALR	CR	CBR	ER	LEV	TPE
Mean	42.14346	2.683603	34.33132	59.65068	27.46707	272.9165	8.09E+09
Median	29.53988	1.985314	28.38935	40.96789	21.45291	91.69070	5.05E+09
Maximum	724.0683	25.72117	189.7748	867.2818	201.4048	14764.50	8.53E+10
Minimum	0.043653	0.188864	0.019059	-3.973828	0.000000	-281.7766	4.92E+08
Std. Dev.	53.71917	2.980401	24.97723	88.76940	24.22628	1058.056	1.01E+10
Skewness	8.781777	4.417035	2.346216	5.299974	3.146442	11.35365	3.851820
Kurtosis	109.5884	26.86177	11.80156	39.62976	17.48727	150.2891	22.82337
Jarque-Bera	116695.7	6474.248	994.8632	14540.98	2494.813	222097.0	4523.121
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	10114.43	644.0647	8239.518	14316.16	6592.097	65499.97	1.94E+12
Sum Sq. Dev.	689694.1	2122.986	149103.0	1883322.	140272.1	2.68E+08	2.46E+22
Observations	240	240	240	240	240	240	240

Table 2 presents the descriptive statistics for the variables analyzed in this study, which include Adjusted Risk-Adjusted Return on Capital (RAROC), Asset-Liability Ratio, Claims Ratio, Combine Ratio, Expense Ratio, Leverage, and Total Premiums Earned. These variables were examined over a sample of 240 observations spanning from 2011 to 2022.

The mean values for the variables indicate the average performance over the period. Notably, the Adjusted RAROC has a mean of 42.14, suggesting that the average risk-adjusted return on capital for the insurance companies in the sample is relatively high. The mean Asset-Liability Ratio is 2.68, implying a moderate level of financial leverage, while the mean Claims Ratio is 34.33, pointing to a considerable proportion of claims relative to premiums earned. The mean Combine Ratio of 59.65 further reflects a high level of combined underwriting and expense costs. The Expense Ratio has a mean value of 27.47, suggesting an average operational cost relative to premiums earned, and the Leverage ratio is 272.92, indicating the use of substantial debt in the firms' capital structures. The mean Total Premiums Earned is 8.09E+09, which highlights the substantial premium income in the sector.

The standard deviations reflect considerable variation across the observations. Adjusted RAROC has a high standard deviation of 53.72, signifying a high level of volatility in profitability among the companies. The Asset-Liability Ratio has a standard deviation of 2.98, indicating moderate variation in firms' leverage levels. The Claims Ratio shows a standard deviation of 24.98, suggesting significant variability in claims relative to premiums. The Combine Ratio, with a standard deviation of 88.77, indicates substantial variation in underwriting performance. The Expense Ratio (24.23) and Leverage (1058.06) also exhibit notable variation, underscoring the diversity in operational efficiency and financial structures. The Total Premiums Earned has a standard deviation of 1.01E+10, highlighting considerable variation in the premium income across companies.

Skewness values show the asymmetry of the distributions. The Adjusted RAROC exhibits a high positive skew of 8.78, indicating that most of the observations are clustered towards lower values, with a few extreme outliers on the higher side. Similarly, the Asset-Liability Ratio and other variables like Claims Ratio, Combine Ratio, Expense Ratio, and Leverage also show positive skewness, with the Leverage variable being particularly skewed with a value of 11.35, suggesting a few companies with extreme leverage.

The kurtosis values indicate the peakedness of the distribution. The Adjusted RAROC has an extraordinarily high kurtosis of 109.59, reflecting a distribution with very heavy tails and extreme outliers. Other variables like Asset-Liability Ratio (26.86), Claims Ratio (11.80), Combine Ratio (39.63), and Leverage (150.29) also exhibit high kurtosis, indicating the presence of outliers and extreme values in the data.

The Jarque-Bera test, which assesses the normality of the data, shows significant values (p-value = 0.000), confirming that the distributions of all variables deviate significantly from normality. This is consistent with the high skewness and kurtosis observed, further suggesting that the data is non-normally distributed and may require transformations or non-parametric methods for further analysis.

Table 3. *Results of correlation analysis of key variables*

	Adjusted RAROC	ALR	CR	CBR	ER	LEV	TPE
Adjusted RAROC	1.000000	-0.055056	-0.077608	-0.051616	-0.043887	0.163774	0.056769
ALR	-0.055056	1.000000	-0.158297	-0.044781	-0.072533	-0.099965	-0.091656
CR	-0.077608	-0.158297	1.000000	0.428967	0.428872	0.011471	0.057399
CBR	-0.051616	-0.044781	0.428967	1.000000	0.308351	-0.024129	-0.032062
ER	-0.043887	-0.072533	0.428872	0.308351	1.000000	-0.032373	-0.152581
LEV	0.163774	-0.099965	0.011471	-0.024129	-0.032373	1.000000	0.028728
TPE	0.056769	-0.091656	0.057399	-0.032062	-0.152581	0.028728	1.000000

The correlation matrix presented in Table 3 provides insights into the relationships among the dependent and independent variables in this study, including

Adjusted Risk-Adjusted Return on Capital (RAROC), Asset-Liability Ratio, Claims Ratio, Combine Ratio, Expense Ratio, Leverage, and Total Premiums Earned. Adjusted RAROC exhibits weak negative correlation with several variables: Asset-Liability Ratio (r = -0.055), Claims Ratio (r = -0.078), Combine Ratio (r = -0.052), and Expense Ratio (r = -0.044). These negative correlations indicate that as the company's leverage claims, underwriting performance, and expenses increase, the risk-adjusted return on capital slightly decreases. However, these relationships are weak, suggesting that other factors may also contribute to RAROC performance.

Adjusted RAROC is positively correlated with Leverage (r = 0.164), indicating that higher leverage is weakly associated with improved risk-adjusted returns. This suggests that firms using more debt could potentially enhance returns on capital, though the strength of this relationship is not significant enough to imply a strong causal connection. Additionally, Adjusted RAROC shows a weak positive correlation with Total Premiums Earned (r = 0.057), implying a minimal relationship between premium generation and risk-adjusted returns in this context.

The Asset-Liability Ratio demonstrates weak correlations with other variables. Specifically, it shows a weak negative correlation with Claims Ratio (r = -0.158), and Expense Ratio (r = -0.073), indicating that higher leverage could be linked to slightly lower claims and expenses. However, these correlations are weak, and the relationship between asset-liability balance and claims or expenses requires further examination.

Claims Ratio has a moderate positive correlation with Combine Ratio (r = 0.429) and Expense Ratio (r = 0.429), indicating that higher claims payouts are associated with worse underwriting performance and higher operational costs. This suggests that firms with higher claims often incur more expenses, which could reflect inefficiencies in managing claims or administrative costs related to claims processing.

The Combine Ratio exhibits a moderate positive correlation with the Expense Ratio (r = 0.308), implying that higher underwriting expenses tend to coincide with higher operational costs in the insurance industry. Additionally, Combine Ratio shows weak negative correlations with Leverage (r = -0.024) and Total Premiums Earned (r = -0.032), suggesting minimal influence of leverage or premium income on the overall underwriting and expense performance.

Expense Ratio is negatively correlated with Total Premiums Earned (r = -0.153), indicating that higher premiums earned are associated with lower operational expenses relative to the premiums earned, potentially reflecting economies of scale in premium generation. Moreover, Expense Ratio shows minimal correlation with Leverage (r = -0.032), suggesting that leverage does not have a significant impact on operational efficiency or costs.

Finally, Leverage is weakly correlated with Total Premiums Earned (r = 0.029), suggesting that leverage has a minimal relationship with premium income.

In summary, the correlation analysis reveals that the relationship between Adjusted RAROC and key variables, such as Claims Ratio, Combine Ratio, and Expense Ratio, is weakly negative, while Leverage shows a weak positive

correlation with Adjusted RAROC. Claims Ratio and Expense Ratio exhibit moderate positive correlations, highlighting their importance in determining underwriting performance and operational costs. Overall, the correlation analysis suggests that while some relationships exist, they are weak and warrant further investigation through more sophisticated statistical techniques, such as regression modeling, to explore causal links and refine strategies for improving financial performance and risk management in insurance firms.

Table 4. *Results of the Unit Root Test*

Variable	ADF t-Statistic	Prob.	1% Critical Value	5% Critical Value	10% Critical Value	Stationarity
Adjusted RAROC	-6.205014	0.0000	-3.457747	-2.873492	-2.573215	Stationary
ALR	-7.929094	0.0000	-3.457630	-2.873440	-2.573187	Stationary
CR	-10.76306	0.0000	-3.457630	-2.873440	-2.573187	Stationary
CBR	-5.157192	0.0000	-3.457747	-2.873492	-2.573215	Stationary
ER	-9.036817	0.0000	-3.457630	-2.873440	-2.573187	Stationary
LEV	-7.056917	0.0000	-3.457747	-2.873492	-2.573215	Stationary
TPE (Firm Size)	-5.898065	0.0000	-3.457630	-2.873440	-2.573187	Stationary

Table 4 presents the results of the Augmented Dickey-Fuller (ADF) unit root test, which was conducted to assess the stationarity of the variables: Adjusted RAROC, Asset-Liability Ratio, Claims Ratio, Combine Ratio, Expense Ratio, Leverage, and Total Premiums Earned. The ADF test was applied at the level form, incorporating a constant term in the model. The results reveal that all variables are stationary at the level form (I (0)), as the ADF test statistics exceed the 1%, 5%, and 10% critical values, and the p-values are all less than 0.01 ($p < 0.01$). This leads to the rejection of the null hypothesis of a unit root for all variables, confirming that the data does not exhibit any unit roots, and is suitable for further time-series analysis without the need for differencing.

The profitability indicator, Adjusted RAROC ($t = -6.2050$), is stationary, demonstrating stability over time, which makes it appropriate for further analysis without requiring transformation. Similarly, the Asset-Liability Ratio ($t = -7.9291$) and Leverage ($t = -7.0569$) are stationary, indicating that these financial stability metrics do not display any trend or drift over time, making them reliable for modeling financial health. The Claims Ratio ($t = -10.7631$) and Expense Ratio ($t = -9.0368$) also show strong stationarity, suggesting consistent trends and reliability in assessing risk factors. Additionally, the Combine Ratio ($t = -5.1572$) and Total Premiums Earned ($t = -5.8981$) are stationary, highlighting their potential as stable predictors of profitability and operational performance.

Given that all variables are stationary at their levels, there is no need for additional transformations or differences. These findings confirm that the data meets the necessary conditions for time-series modeling and econometric techniques, such as Ordinary Least Squares (OLS), Fixed Effects, Random Effects, and Panel Data Estimations. The stationarity of the variables also supports the application of co-integration tests and dynamic regression models to explore long-term relationships and short-term dynamics without the risk of spurious regressions. Overall, the results from the ADF unit root test confirm that all variables are integrated at order zero, I (0), and are immediately suitable for regression and time-series analyses. These outcomes provide a robust foundation for further econometric investigations into the relationships between profitability, risk measures, and performance indicators in the insurance sector.

Table 5. *Static regression analysis for Adjusted RAROC*

Variable	Pooled Coefficient (Prob.)	Fixed Coefficient (Prob.)	Random Coefficient (Prob.)
C	46.47730 (0.0000)	21.91230 (0.0000)	-37.23877 (0.0499)
ALR	-0.869676 (0.4630)	0.182701 (0.3020)	0.217165 (0.3304)
CR	-0.188955 (0.2562)	0.085485 (0.0887)	-0.056035 (0.0472)
CBR	-0.007797 (0.8582)	-0.000972 (0.9591)	-0.056035 (0.0472)
ER	0.016781 (0.9179)	-0.059527 (0.3779)	-0.077235 (0.0101)
LEV	0.008040 (0.0150)	0.005991 (0.0539)	-0.003660 (0.0000)
TPE (Firm Size)	2.84E-10 (0.4170)	5.74E-10 (0.0000)	1.852746 (0.0264)
Adjusted R-squared	0.014031	0.106418	0.195389
F-statistic	1.566868	5.743803	12.60758
Prob(F-statistic)	0.157648	0.000014	0.0000
Durbin-Watson stat	1.993382	1.209066	1.640672
Cross-Section Dependence Tests			
Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	266.6088	190	0.0002
Pesaran scaled LM	3.929947		0.0001
Pesaran CD	0.530314		0.5959
Heteroskedasticity Test			
Test	Value	d.f.	Probability
Likelihood ratio	380.7224	20	0.0000
Hausman Test Results			
Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.	
24.6479	5	0.0002	

Table 5 presents the results of the static regression analysis for Adjusted RAROC, utilizing pooled, fixed effects, and random effects models. The analysis examines the relationship between Adjusted RAROC and key explanatory variables, including Asset-Liability Ratio, Claims Ratio, Combine Ratio, Expense Ratio, Leverage, and Total Premiums Earned.

In the Pooled model, the constant term is highly significant with a positive coefficient (46.47730, p = 0.0000), indicating that the baseline profitability is significantly positive when other factors are not considered. The Fixed model also shows a significant constant (21.91230, p = 0.0000), but with a lower value compared to the pooled model, suggesting that controlling for firm-specific effects reduces the profitability estimate. In the Random model, the constant term is negative (-37.23877, p = 0.0499), suggesting that after accounting for random firm effects, the baseline profitability becomes significantly negative.

The Pooled model shows an insignificant negative coefficient for the Asset-Liability Ratio (-0.869676, p = 0.4630), indicating no significant relationship between the asset-liability ratio and profitability. The Fixed model (0.182701, p = 0.3020) and Random model (0.217165, p = 0.3304) also show positive but statistically insignificant relationships, suggesting that the asset-liability ratio does not have a significant effect on profitability when considering individual firm effects.

The Pooled model shows a negative and insignificant relationship between the Claims Ratio (-0.188955, p = 0.2562), indicating that it does not significantly affect profitability in the aggregated model. In the Fixed model, the coefficient is positive (0.085485, p = 0.0887), which is marginally significant, suggesting that claims ratio may have a weak positive impact on profitability when firm-specific effects are considered. The Random model shows a negative and statistically significant relationship (-0.056035, p = 0.0472), implying that higher claims ratios may negatively affect profitability when random firm effects are accounted for.

The Combine Ratio is insignificant across all models: the Pooled model (-0.007797, p = 0.8582), Fixed model (-0.000972, p = 0.9591), and Random model (-0.056035, p = 0.0472) all indicate no meaningful effect on profitability. This suggests that the combine ratio does not significantly impact profitability in any of the models. In the Pooled model, the coefficient is positive (0.016781, p = 0.9179), but insignificant, indicating that the expense ratio does not significantly affect profitability when firms are pooled together. The Fixed model shows a negative coefficient (-0.059527, p = 0.3779), but again, it is insignificant, suggesting that expense ratio does not have a meaningful effect on profitability when controlling firm-specific effects. In the Random model, the coefficient is negative and statistically significant (-0.077235, p = 0.0101), indicating that higher expense ratios are associated with lower profitability when considering random firm effects.

The Pooled model reveals a significant positive relationship between Leverage and profitability (0.008040, p = 0.0150), suggesting that higher leverage leads to higher profitability in the aggregate model. In the Fixed model, the relationship weakens but remains marginally significant (0.005991, p = 0.0539),

implying that leverage still affects profitability but to a lesser extent when considering firm-specific effects. The Random model shows a significant negative relationship (-0.003660, p = 0.0000), suggesting that leverage has a negative impact on profitability when accounting for random firm effects. The Pooled model shows an insignificant relationship with a very small coefficient (2.84E-10, p = 0.4170). In the Fixed model, the coefficient is significantly positive (5.74E-10, p = 0.0000), indicating that total premiums earned contribute positively to profitability when firm-specific effects are considered. The Random model also shows a positive and significant relationship (1.852746, p = 0.0264), reinforcing the idea that higher premiums earned are associated with increased profitability.

The Pooled model has a low adjusted R-squared of 0.014031, suggesting poor explanatory power. The Fixed model (0.106418) and Random model (0.195389) show better explanatory power, indicating that the models accounting for firm-specific effects provide a better fit. The Pooled model has a low F-statistic (1.566868, p = 0.1576), suggesting poor model fit. However, the Fixed model (F-statistic = 5.743803, p = 0.000014) and Random model (F-statistic = 12.60758, p < 0.0001) show statistically significant values, indicating better model fit. The Pooled model shows no significant autocorrelation (1.993382), while the Fixed model (1.209066) and Random model (1.640672) indicate potential autocorrelation, particularly in the Fixed model.

Breusch-Pagan LM Test (p = 0.0002) and Pesaran Scaled LM Test (p = 0.0001) indicate the presence of cross-sectional dependence, which may affect the robustness of the model. Heteroskedasticity Test (Likelihood ratio) shows strong evidence of heteroskedasticity (p < 0.0001), suggesting the need for robust standard errors to address varying error variances. The Hausman test results (Chi-sq = 24.6479, p = 0.0002) indicate that the Fixed Effects model is preferred over the Random Effects model, as it provides more consistent estimates when individual firm effects are significant.

Table 6. Static regression analysis and Granger causality tests.

Variable	Pooled	Fixed	Random	Granger Causality Test
C	-0.023361 (0.9812)	1.292684 (0.0043)	1.268537 (0.0451)	
ALR	0.910710 (0.5177)	-0.869676 (0.4630)	-0.617475 (0.6075)	ALR does not Granger Cause Adjusted RAROC: F-stat=0.66707 (0.5144)
CR	-0.126807 (0.4925)	-0.188955 (0.2562)	-0.171774 (0.3023)	**CR does not Granger Cause Adjusted RAROC:** F-stat=2.23083 (0.1102)

CBR	-0.041083 (0.4205)	-0.007797 (0.8582)	-0.012888 (0.7705)	**CBR does not Granger Cause Adjusted RAROC**: F-stat=6.77667 (0.0014)
ER	-0.098964 (0.6033)	0.016781 (0.9179)	-0.005917 (0.9713)	**ER does not Granger Cause Adjusted RAROC**: F-stat=4.55927 (0.0116)
LEV	0.005377 (0.1446)	0.008040 (0.0150)	0.007651 (0.0213)	**LEV does not Granger Cause Adjusted RAROC**: F-stat=4.18025 (0.0167)
TPE	-1.20E-10 (0.8033)	2.84E-10 (0.4170)	2.39E-10 (0.5061)	**TPE does not Granger Cause Adjusted RAROC:** F-stat=2.77705 (0.0647)
Adjusted R-squared	0.150593	0.051363	0.009208	
Durbin Watson	2.244451	1.993382	2.036815	
F-statistics	1.517621 (0.0608)	1.566868 (0.1576)	1.370195 (0.2274)	
Prob (F-statistics)	0.060818	0.157648	0.227431	
Hausman Test	-	-	0.1388	

Table 6 presents the results of the static regression analysis for Adjusted RAROC, using pooled, fixed effects, and random effects models, along with the results of the Granger causality tests. The analysis evaluates the relationship between Adjusted RAROC and key explanatory variables, including Asset-Liability Ratio, Claims Ratio, Combine Ratio, Expense Ratio, Leverage, and Total Premiums Earned, and explores the potential for Granger causality among these variables.

In the Pooled model, the constant term is insignificant (coefficient = -0.023361, p = 0.9812), indicating that the baseline level of Adjusted RAROC is not significantly different from zero when accounting for all other variables in the model. The Fixed model shows a significant positive constant (1.292684, p = 0.0043), suggesting a positive baseline profitability after controlling for firm-specific effects. The Random model also shows a positive constant (1.268537, p = 0.0451), though

it is less significant than the fixed effects model, but still indicating a positive baseline profitability after accounting for random firm effects.

The Pooled model shows a positive but insignificant relationship (coefficient = 0.910710, p = 0.5177) between the Asset-Liability Ratio and Adjusted RAROC, indicating no significant effect in the pooled data. The Fixed model shows a negative and insignificant coefficient (-0.869676, p = 0.4630), suggesting no significant impact when accounting for individual firm effects. Similarly, the Random model reveals an insignificant negative coefficient (-0.617475, p = 0.6075), indicating that the Asset-Liability Ratio does not significantly influence Adjusted RAROC. The Granger causality test shows that Asset-Liability Ratio does not Granger cause Adjusted RAROC (F-stat = 0.66707, p = 0.5144), confirming that changes in the asset-liability ratio do not predict future values of Adjusted RAROC.

In the Pooled model, the coefficient for the Claims Ratio is negative and insignificant (-0.126807, p = 0.4925), suggesting no significant relationship with Adjusted RAROC. The Fixed model also shows an insignificant negative coefficient (-0.188955, p = 0.2562), further indicating that the Claims Ratio does not significantly impact Adjusted RAROC when firm-specific effects are considered. Similarly, the Random model shows a negative but insignificant relationship (-0.171774, p = 0.3023). The Granger causality test reveals that Claims Ratio does not Granger cause Adjusted RAROC (F-stat = 2.23083, p = 0.1102), implying that the Claims Ratio is not a predictive factor for future values of Adjusted RAROC.

The Pooled model reveals an insignificant negative relationship for the Combine Ratio (-0.041083, p = 0.4205), indicating no significant effect on Adjusted RAROC in the pooled data. The Fixed model also shows an insignificant relationship (-0.007797, p = 0.8582), suggesting that the Combine Ratio does not significantly influence Adjusted RAROC when controlling for firm-specific effects. The Random model also reports an insignificant negative coefficient (-0.012888, p = 0.7705). The Granger causality test indicates that Combine Ratio does Granger cause Adjusted RAROC (F-stat = 6.77667, p = 0.0014), suggesting a significant predictive relationship in the context of Adjusted RAROC.

The Pooled model shows a negative but insignificant coefficient for the Expense Ratio (-0.098964, p = 0.6033), suggesting no significant relationship with Adjusted RAROC in the pooled data. The Fixed model also shows an insignificant positive coefficient (0.016781, p = 0.9179), indicating no meaningful effect on Adjusted RAROC after controlling for individual firm effects. The Random model shows an insignificant negative coefficient (-0.005917, p = 0.9713), further confirming the lack of impact of Expense Ratio on Adjusted RAROC. The Granger causality test shows that Expense Ratio does not Granger cause Adjusted RAROC (F-stat = 4.55927, p = 0.0116), indicating a potential relationship, but not a strong predictive one.

The Pooled model shows a positive and insignificant relationship between Leverage and Adjusted RAROC (0.005377, p = 0.1446), suggesting that leverage does not significantly influence profitability in the pooled data. The Fixed model shows a positive and significant coefficient (0.008040, p = 0.0150), indicating that

leverage positively impacts Adjusted RAROC when firm-specific effects are accounted for. The Random model also shows a positive and significant relationship (0.007651, p = 0.0213), suggesting that leverage has a significant positive effect on Adjusted RAROC in the context of random firm effects. The Granger causality test reveals that Leverage does not Granger cause Adjusted RAROC (F-stat = 4.18025, p = 0.0167), indicating that leverage is not a predictor of future changes in Adjusted RAROC.

The Pooled model shows an insignificant relationship with a very small coefficient (-1.20E-10, p = 0.8033), indicating no significant effect on Adjusted RAROC. The Fixed model shows a small positive and insignificant relationship (2.84E-10, p = 0.4170), suggesting a minimal effect on profitability after controlling for firm-specific effects. The Random model shows a similar insignificant positive relationship (2.39E-10, p = 0.5061). The Granger causality test shows that Total Premiums Earned does not Granger cause Adjusted RAROC (F-stat = 2.77705, p = 0.0647), indicating that premiums earned do not predict future changes in Adjusted RAROC.

Adjusted R-squared: The Pooled model explains 15.06% of the variation in Adjusted RAROC, while the Fixed model explains only 5.14%, and the Random model explains just 0.92%. These results suggest that the Pooled model provides the best explanatory power among the three models.

Durbin-Watson Statistic for Pooled model (2.244451) suggests the absence of autocorrelation. The Fixed model (1.993382) and Random model (2.036815) both produced values close to 2.00, indicating no significant autocorrelation in the data.

F-statistics and Prob (F-statistics): The Pooled model (F-stat = 1.517621, p = 0.0608), Fixed model (F-stat = 1.566868, p = 0.1576), and Random model (F-stat = 1.370195, p = 0.2274) all exhibit low F-statistics, indicating that the models do not significantly explain the variation in Adjusted RAROC.

The Hausman test results (p = 0.1388) suggest no strong evidence against the Random Effects model, implying that the random effects model is not significantly different from the fixed effects model.

5. CONCLUSION

This study provides insights into the impact of underwriting and operational risk factors on the Adjusted Risk-Adjusted Return on Capital (RAROC) of listed Nigerian insurance companies. The analysis reveals weak correlations between Adjusted RAROC and key financial and operational variables, suggesting that while these factors may influence profitability, their effects are not consistently strong to constitute significant effects. The findings from the static regression models indicate that some variables, such as Leverage and Total Premiums Earned, show varying impacts on profitability depending on the model, but most variables, including Asset-Liability Ratio, Claims Ratio, and Combine Ratio, do not significantly affect profitability. The Granger causality tests further confirm that only the Combine Ratio has predictive power for Adjusted RAROC, with other variables failing to provide significant forecasting tendencies.

Given the relatively weak relationships identified, it was concluded that the link between underwriting and operational risks on the one side, and profitability on the other, is more complex than initially anticipated. This complexity calls for a deeper exploration into other potential factors that may be influencing the profitability and risk management strategies of Nigerian insurance companies.

RECOMMENDATIONS

The study suggests that improving underwriting practices and operational efficiency could enhance profitability, particularly by focusing on variables such as the Combine Ratio. Insurance firms should prioritize refining their claims handling, underwriting processes, and expense management strategies to reduce operational costs and improve profitability. Since Leverage and Total Premiums Earned show some influence on Adjusted RAROC, insurance companies should explore strategies to optimize capital structures and premium pricing. Insurance companies in Nigeria might benefit from diversifying their premium portfolios to increase premium income without significantly increasing operational risks. Given the weak relationships discovered between Adjusted RAROC and selected variables, future studies should include a broader set of financial and non-financial indicators to better capture the complexities of risk management and profitability among Nigerian Insurance companies. Factors such as market dynamics, regulatory changes, and external economic conditions may be considered in establishing more economically robust relationships. Insurance companies should continuously monitor their key ratios, particularly the Combine Ratio, to predict and adjust strategies in real-time. Incorporating more frequent reviews of these ratios in risk management processes can allow for proactive adjustments and better long-term profitability.

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