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Original Research Article

Multivariate Analysis of Nepalese Non-life Insurers' Performance: Evidence from the CARAMEL Framework

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Abstract

Purpose: This study conducts a comprehensive multivariate evaluation of financial performance among selected Nepalese non-life insurers using the CARAMEL framework over the 2013/14–2021/22 period. It examines the influence of key financial dimensions on ROA and ROE, identifies patterns of strength and vulnerability, assesses the temporal stability of performance indicators, and develops a benchmarking tool tailored to Nepal's evolving insurance landscape.

Design/methodology/approach: A causal-comparative research design is employed, utilizing panel data from 19 pre-merger non-life insurance companies over nine fiscal years (2013/14–2021/22). in Nepal from 2014 to 2022. Secondary data were analyzed using multivariate panel regression models.

Findings: Results show that capital adequacy, asset quality, management efficiency, and liquidity significantly influence financial performance, while the effects of reinsurance and earnings remain inconclusive.

Conclusion: The study advances the understanding of financial performance evaluation in Nepal's non-life insurance sector by leveraging the CARAMEL framework and multivariate panel data analysis. The findings highlight the critical roles of capital adequacy, asset quality, and management efficiency in driving insurer performance, while the roles of reinsurance and earnings remain ambiguous, reflecting deeper institutional and operational constraints.

Implications: The study aspires to contribute meaningfully to the academic discourse and practical decision-making in the field of insurance management, empirically validate a multivariate framework that equips regulators, insurers, and policymakers in Nepal with actionable insights to enhance financial resilience, strategic decision-making, and sectoral governance.

Originality/Value: The study advances insurance performance analysis by linking multidimensional financial indicators within the CARAMEL framework to profitability outcomes, offering a holistic understanding of the drivers behind insurer resilience and growth.

JFL Classification: G22, G32, C33, L25

Introduction

The insurance sector has long been regarded as a cornerstone of economic infrastructure, serving not only as a risk transfer mechanism but also as a strategic financial intermediary that channels funds into long-term investment and supports macroeconomic stability (Madukwe, 2014; Monteiro & Nijumon, 2017). Globally, the role of non-life insurers as providers of coverage against property, liability, marine, health, and casualty risks has become increasingly critical amid growing climate uncertainty, evolving market risks, and the need for economic

resilience (Rosenberg, 2025). Unlike life insurance, which often involves contractual savings, non-life insurance offers direct risk mitigation by compensating for tangible losses, thus playing an indispensable role in sustaining business continuity and household welfare (Sachs, 2018).

Within this global landscape, Nepal's non-life insurance sector has witnessed steady yet complex growth. Following the liberalization of the financial system in the 1990s, the sector expanded in both scale and scope, driven by increased financial inclusion, regulatory reforms, and heightened awareness of risk management (Ghimire, 2023). Currently comprising a range of insurers offering diverse products, the non-life segment in Nepal contributes significantly to financial sector deepening. However, structural limitations persist: low market penetration, underdeveloped risk assessment mechanisms, high claim ratios, operational inefficiencies, and inconsistent regulatory compliance continue to constrain performance and sectoral credibility (Bhandari et al., 2021). In this context, evaluating the financial soundness of non-life insurers is not merely a regulatory necessity but a strategic imperative. Assessing financial performance in insurance is a complex task that demands a multidimensional framework capable of capturing both quantitative efficiency and qualitative resilience. The ability of an insurer to achieve higher yield from its assets and shareholders' equity is reflected in return on equity (ROE) and return on assets (ROA), which are commonly considered to be essential measures of financial health (Maggioni & Turchetti, 2024). Traditional profitability indicators such as ROA and ROE, while useful, provide an incomplete view of financial health unless integrated with broader measures such as capital adequacy, risk retention, asset quality, operational efficiency, and liquidity. In this regard, the CARAMEL framework, comprising Capital adequacy (CA), Asset quality (AQ), Reinsurance and Actuarial issues (RA), Management efficiency (ME), Earnings and profitability (EP), and Liquidity (LQ), has gained international traction as a holistic tool for assessing insurer performance across multiple dimensions (Das et al., 2003; IMF, 2006; World Bank, 2003).

Each element within the CARAMEL framework captures critical facets of an insurer's operational architecture. Capital adequacy ensures that insurers possess sufficient reserves to absorb potential losses and meet regulatory requirements, directly influencing both ROA and ROE by enhancing financial stability and investor confidence (Karki, 2017). Reinsurance and actuarial soundness relate to risk-sharing and pricing accuracy; management efficiency evaluates governance quality and cost control; earnings and profitability reflect core financial strength; and liquidity measures short-term resilience under financial stress (Salah et al., 2023). Together, these components enable a granular and integrated analysis of firm-level performance, making the framework theoretically and practically robust. Its theoretical foundation draws upon financial ratio analysis, capital structure theory (Modigliani & Miller, 1958), portfolio theory (Markowitz, 1952), and risk management literature (Hull, 2018), ensuring that it aligns with both global regulatory expectations and academic rigor (Brigham & Houston, 2012).

Despite its analytical power and international adoption, the application of the CARAMEL framework in the Nepalese context, particularly in the non-life insurance segment, remains markedly underdeveloped. The limited scholarly focus on this segment has left a significant void in empirical evidence that could guide industry benchmarking and inform policymaking. Most extant research has either concentrated on life insurance firms or evaluated financial performance using narrow, unidimensional metrics, often without accounting for temporal variability or multivariate interactions among performance determinants (Bhandari et al., 2021; Ghimire & Kumar, 2014). Moreover, studies have rarely incorporated contextual factors such as actuarial capacity, governance efficiency, or market volatility, factors that are increasingly critical in the evolving regulatory environment of Nepal. The gap is further compounded by the absence of frameworks that blend both quantitative ratios and qualitative assessments to reflect the operational realities of Nepalese non-life insurers. Compounding these analytical voids is the evidence suggesting that internal organizational stressors, such as rising job demands and managerial inefficiencies, may indirectly influence financial outcomes, yet remain insufficiently examined in empirical models (Bhattarai et al., 2024; Devkota et al., 2023). The absence of structured frameworks tailored to Nepal's unique market dynamics impedes the ability of stakeholders to accurately assess financial performance, identify vulnerabilities, and implement targeted interventions (Karki, 2018). As a result, there is a pressing need for empirical studies that adapt and validate the CARAMEL framework within the Nepalese non-life insurance context.

In response to this critical research gap, the present study undertakes a comprehensive multivariate evaluation of financial performance among selected Nepalese non-life insurers using the CARAMEL framework. Specifically, this study seeks to investigate how each dimension of the CARAMEL framework influences financial performance, measured by ROA and ROE, over a nine-year period from 2013/14 to 2021/22. It aims to examine the relative financial standing of these firms by identifying patterns of strength and vulnerability; to assess the temporal stability and directional influence of key performance indicators; and to offer an empirically validated performance benchmarking tool that is adaptable to Nepal's dynamic insurance environment. Through this, the study aspires to contribute meaningfully to the academic discourse and practical decision-making in the field of insurance management, empirically validate a multivariate framework that equips regulators, insurers, and policymakers in Nepal with actionable insights to enhance financial resilience, strategic decision-making, and sectoral governance.

Literature Review

CARAMEL Framework

The evolution of performance assessment frameworks in the financial sector has highlighted a significant shift from single-metric evaluations, ROA, and ROE, to more multidimensional and sector-specific models. In this trajectory, the CARAMEL framework emerged as a pivotal innovation in insurance performance diagnostics. Recognizing the limitations of bank-centric tools like the CAMEL model, the World Bank and International Monetary Fund (IMF) jointly developed the CARAMEL framework in the early 2000s to assess the financial soundness of insurance companies, particularly non-life insurers, in a more integrated and context-sensitive manner (Das et al., 2003; IMF, 2006).

Comprising six performance dimensions, the framework captures insurer stability and risk exposures. Unlike its banking counterpart, the CARAMEL framework accounts for sector-specific nuances such as underwriting volatility, reinsurance dependency, actuarial precision, and payout liquidity, making it uniquely tailored to the operational realities of insurance firms (Salah et al., 2023; Eling & Pankoke, 2014).

Theoretically, each pillar of the CARAMEL framework is anchored in established financial and economic models. Capital Adequacy is informed by capital structure theory (Modigliani & Miller, 1958), which emphasizes optimal equity-debt ratios to absorb shocks and satisfy solvency mandates. Asset quality aligns with Modern Portfolio Theory (Markowitz, 1952), advocating risk-weighted asset allocation and diversification to minimize volatility. The Reinsurance and Actuarial Issues dimension reflects principles of risk transfer, hedging, and pricing theory drawn from risk management literature (Hull, 2018). Management Efficiency is underpinned by agency theory and governance literature, suggesting that operational outcomes are shaped by the alignment of incentives and decision-making structures (Sinnaiah et al., 2023). Earnings and Profitability extend from corporate finance traditions with emerging societal concerns such as green innovation, green finance, and long-term sustainability (Brigham & Houston, 2012; Khadka et al., 2024), while Liquidity incorporates elements from cash flow theory and financial intermediation literature, particularly the bank-run models of Diamond and Rajan (2001), which posit that liquidity shortfalls can precipitate institutional failures even in solvent firms.

The ASEAN region's insurance market is marked by robust growth, supported by increasing insurance penetration, insurance density, and premium volume, which together play a significant role in the region's overall economic development (Safitri, 2019). Additionally, 17 emerging countries from Europe and Asia have also witnessed significant expansion in insurance markets, driven by various economic, demographic, and institutional factors (Dragos, 2014). However, the South Asian regional industry faces challenges including low insurance literacy, limited product innovation, and operational inefficiencies. Empirical studies in South Asia have applied the CARAMEL framework to analyze insurer performance, revealing that capital adequacy and asset quality remain critical determinants of profitability and solvency (Kumar & Singh, 2019; Ghimire & Karki, 2022). Management efficiency and liquidity management have also been highlighted as key success factors in navigating competitive pressures and regulatory compliance. Nonetheless, the heterogeneity of regulatory environments and market maturity levels across the region necessitates country-specific analyses to tailor policy and strategic interventions effectively.

Empirical Review

Over the past two decades, the CARAMEL framework has become a preferred evaluative model in insurance sector performance analysis, especially in assessing non-life insurers where risk exposure, claims volatility, and operational agility critically influence financial sustainability. Comprising six performance dimensions, the framework has found broad empirical acceptance across both developed and emerging markets. The global literature increasingly demonstrates that the interplay of these dimensions offers a more comprehensive and predictive assessment of insurer viability than traditional single-metric models like ROA and ROE. Recent empirical studies demonstrate the effectiveness of comprehensive assessment frameworks in evaluating insurance company performance, with comparative analysis using the CARAMEL model across four major life insurance companies showing significant differences in financial soundness indicators, where multi-parameter assessments provide superior insight into insurer performance compared to single-metric evaluations (Patel & Patel, 2021).

Yet, its application remains uneven across jurisdictions, with notable limitations in emerging economies where data integrity, actuarial infrastructure, and regulatory oversight vary considerably.

Empirical studies from developed markets consistently affirm the robustness of the CARAMEL framework. In a comparative study of insurers across the United States and Western Europe, Cummins and Weiss (2014) revealed that capital adequacy and asset diversification are positively associated with long-term solvency and stable profitability. Eling and Pankoke (2014) similarly observed that reinsurance quality and actuarial soundness mitigated the adverse effects of catastrophe exposure, especially in property and casualty segments. In Japan, Xiao and Qiu (2021) found a significant correlation between reinsurance ratios and underwriting profitability, emphasizing the strategic importance of risk transfer arrangements in non-life portfolios. These studies collectively indicate that firms with robust capital adequacy, prudent asset quality policies, and effective reinsurance and Actuarial mechanisms not only withstand external shocks better but also outperform peers in efficiency and earnings metrics. Furthermore, the adoption of integrated solvency frameworks like Solvency II in Europe has enabled insurers to incorporate forward-looking capital modeling and risk-weighted assessments, enhancing the practical utility of the CARAMEL structure.

In contrast, studies from emerging economies offer more mixed findings due to regulatory asymmetries and market immaturity. In India, Barua et al. (2018) reported that ME and Liquidity are the most statistically significant predictors of non-life insurer performance, while capital adequacy plays a relatively subdued role due to capital infusion constraints and underdeveloped capital markets. Sasidharan et al. (2023), focusing on Bangladesh, identified asset quality and inadequate actuarial governance as critical impediments to insurer solvency, thereby emphasizing the need for regulatory strengthening in reinsurance and Actuarial dimensions. Similarly, Kumar and Singh (2019) applied the CARAMEL framework in analyzing insurer performance using evidence from South Asia, demonstrating the framework's regional applicability in emerging markets. These regional applications highlight the need for contextual calibration of the framework rather than universal replication, especially in economies grappling with low insurance penetration, shallow risk pools, and limited reinsurance depth.

In the Nepalese context, empirical applications of the CARAMEL framework are relatively recent but growing. Mahat et al. (2023) examined the influence of capital adequacy and asset quality on profitability metrics among non-life insurers and found both to be statistically significant, particularly in the post-COVID-19 environment characterized by higher claims frequency and volatile investment returns. Upadhyaya et al. (2023), employing 14 years of panel data across 13 insurers, revealed that retention ratio, gross written premium, and combined ratio significantly affect ROA, confirming the relevance of management efficiency and earnings and profitability in explaining firm-level performance variations. However, these studies tend to treat CARAMEL components in isolation, often neglecting the multidimensional interactions that may yield richer policy and managerial insights. Empirical evidence suggests that asset quality and capital adequacy substantially impact profitability metrics such as ROA and ROE, while management efficiency and liquidity also play important roles (Kwashie et al., 2022; Mahat et al., 2023). However, the impact of reinsurance and actuarial practices remains underexplored, reflecting data limitations and the evolving dynamics of risk management in the Nepalese context.

Conceptual Framework

The conceptual framework of this study (Figure 1) conceptualizes the six pillars of the CARAMEL framework as key independent variables influencing the financial performance of non-life insurance firms. Financial performance is operationalized through two widely accepted metrics: ROA and ROE, serving as the dependent variables in the model.

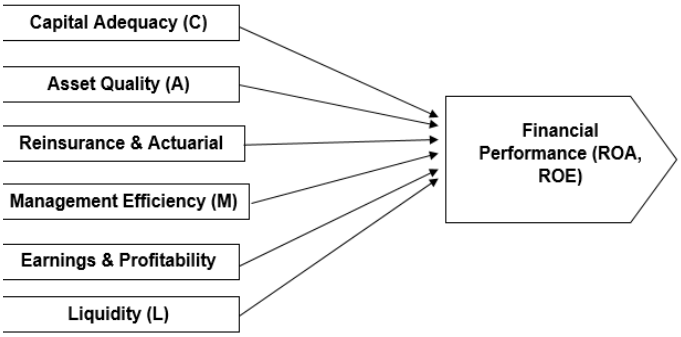

Figure 1. Conceptual Framework

Specification of Variables and Hypothesis

Capital adequacy

Capital adequacy reflects an insurer's financial strength to absorb losses and maintain solvency under stress. It is a crucial measure of an insurer's capacity to withstand losses, meet regulatory requirements, and keep solvency under adverse conditions (Das et al., 2003). Higher capital adequacy enhances financial resilience and investor confidence, directly impacting profitability and stability (World Bank, 2005). It is especially critical in emerging markets like Nepal, where economic shocks, natural disasters, and regulatory uncertainty are prevalent. Strong capital buffers enhance operational stability, underwriting capacity, and investor confidence.

Empirical studies consistently highlight the positive link between capital adequacy and financial performance. Cummins and Weiss (2014) and Eling and Pankoke (2014) found that well-capitalized insurers report higher ROA and ROE due to improved risk management and resilience. In South Asia, researchers have confirmed that capital adequacy significantly contributes to insurer profitability, especially during economic disruptions like COVID-19 (Kumar & Singh, 2019; Karki & Aryal, 2019). Similarly, Shrestha et al. (2022) observed a strong association between solvency margins and ROE among Nepalese firms.

H1: Capital adequacy has a significant and positive impact on the financial performance (ROA and ROE) of Nepalese non-life insurers.

Asset Quality

Asset quality reflects the degree of credit risk and the overall soundness of an insurer's investment and loan portfolios. High asset quality implies lower default risk, more stable investment income, and improved risk mitigation, thereby contributing to superior financial performance (Brigham & Houston, 2012). Conversely, poor asset quality can lead to earnings volatility, increased provisions, and weakened solvency positions (Salah et al., 2023).

H2: Asset quality has a significant and positive impact on the financial performance (ROA and ROE) of Nepalese non-life insurers.

Reinsurance and Actuarial Issues

Reinsurance and actuarial issues pertain to risk-sharing arrangements and the reliability of reserve estimations. Sound reinsurance structures help mitigate underwriting risks and stabilize claims ratios, while actuarial robustness ensures adequate provisioning (Hull, 2018; Xiao & Qiu, 2021). Inadequate reinsurance or actuarial misjudgments can lead to solvency issues (Das et al., 2003). Empirical results from Japan (Xiao & Qiu, 2021) show a positive link between reinsurance ratios and underwriting profitability. However, studies in South Asia, including by Sasidharan et al. (2023), highlight the underdevelopment of actuarial capacities and ineffective risk transfer mechanisms as major weaknesses.

H3: Reinsurance and actuarial soundness significantly and positively impact the financial performance (ROA and ROE) of Nepalese non-life insurers.

Management Efficiency

Management efficiency evaluates the insurer's ability to manage operational costs, allocate resources, and uphold governance standards. Drawing from agency and resource-based theories (Sinnaiah et al., 2023), efficient management translates into lower expense ratios and higher profitability. Kumar and Singh (2019) in India and Shrestha et al. (2022) and Upadhyaya et al. (2023) in Nepal demonstrate that efficient firms show stronger financial performance, as measured by return metrics and combined ratios. Efficient management enhances profitability, operational efficiency, and sustainability (Kumar & Singh, 2019; Shrestha et al., 2022).

H4: Management efficiency significantly and positively impacts the financial performance (ROA and ROE) of Nepalese non-life insurers.

Earnings and Profitability

It reflects an insurer's ability to generate sustainable income from underwriting and investment activities. Strong earnings enhance solvency, operational stability, and reinvestment capacity (Eling & Pankoke, 2014). In Nepal, Upadhyaya et al. (2023) found that indicators like the combined ratio and retention ratio significantly influence profitability, particularly under rising market competition and product concentration.

H5: Earnings and profitability are positively associated with the financial performance (ROA and ROE) of Nepalese non-life insurers.

Liquidity

It indicates an insurer's ability to meet short-term obligations and unexpected claims without disrupting operations. Measured through ratios like liquid assets to liabilities, it ensures financial flexibility and trustworthiness (Diamond & Rajan, 2001). Liquidity shortfalls, on the other hand, can lead to claim delays, reputational damage, and regulatory penalties (Hull, 2018).

H6: Liquidity management has a positive impact on the financial performance (ROA and ROE) of Nepalese non-life insurers.

Methods

This study employs a causal-comparative research design to investigate the relationship between the CARAMEL framework components and the financial performance (ROA and ROE) of Nepalese non-life insurance companies. The causal-comparative approach is appropriate for evaluating historical financial performance where variables cannot be manipulated but existing differences can be systematically compared (Ohemeng, 2022). The target population consists of all 19 pre-merger non-life insurers operating in Nepal. Due to mergers and consolidation trends, data availability varied; however, the study includes a purposively selected sample of 10 firms based on criteria such as paid-up capital and data consistency, which align with the standards for purposive sampling and analytical generalizability (Andrade, 2020). These firms, Shikhar Insurance, Himalayan Everest General, Neco Insurance, IME General, Nepal Insurance Company, Sagarmatha Insurance, NLG Insurance, Lumbini General, Prabhu Insurance, and Siddhartha Insurance, represent the financially robust subset of the sector. The dataset spans nine fiscal years (2013/14 to 2021/22), allowing for longitudinal performance analysis.

The study is based on secondary data, collected from:

- Audited annual financial statements of the selected insurers,
- Publications and filings from the Insurance Board of Nepal,
- Industry benchmarking reports and policy documents.

Data were cleaned and standardized using Microsoft Excel to compute CARAMEL-aligned financial ratios. These were subsequently analyzed using GRETL software, which enabled structured panel data modeling, descriptive statistics, and inferential testing (Baltagi, 2021).

Descriptive analysis (mean, standard deviation, min, max) was conducted to summarize variable distributions. Bivariate correlation analysis identified linear relationships among the independent variables and between predictors and outcomes. The core regression model, based on the study's conceptual framework, is specified as:

$$ROA\ (ROE) = f\ (C, A, RA, M, E, \&\ L) \quad \text{---------- (1)}$$

$$ROA_{it} = \beta_0 + \beta_1 C_{it} + \beta_2 A_{it} + \beta_3 RA_{it} + \beta_4 M_{it} + \beta_5 E_{it} + \beta_6 L_{it} + \varepsilon_{it} \quad \text{..... (1a)}$$

$$ROE_{it} = \beta_0 + \beta_1 C_{it} + \beta_2 A_{it} + \beta_3 RA_{it} + \beta_4 M_{it} + \beta_5 E_{it} + \beta_6 L_{it} + \varepsilon_{it} \quad \text{..... (1b)}$$

Equations (1a) and (1b) show the relationship of CARAMEL factors on financial performance and represent the error term.

Given the panel structure of the data, which includes both cross-sectional and time-series dimensions, the study employs three econometric estimation techniques to ensure robust analysis: (1) Pooled OLS, which assumes homogeneity across firms and time and serves as the baseline model; (2) the Fixed Effects Model (FEM), which controls for unobserved, time-invariant heterogeneity using firm-specific intercepts, implemented as One-Way FEM (firm-level effects) and Two-Way FEM (accounting for both firm and time effects); and (3) the Random Effects Model (REM), which assumes individual effects are random and uncorrelated with regressors, enabling broader generalization across the population.

The general form of the panel regression model employed is:

$$Yit = \alpha + \beta' Xit + \mu i + \epsilon it \quad \text{---------- (2)}$$

Where:

Yit : dependent variables (ROA or ROE),

Xit: vector of independent variables (CARAMEL factors),

μi captures the unobserved individual effect,

ϵit is the idiosyncratic error term.

Model specification and robustness were rigorously validated through a series of diagnostic tests: the Hausman Test guided the selection between Fixed and Random Effects models (Hausman, 1978), while the Breusch-Pagan LM Test assessed the appropriateness of REM over pooled OLS. Multicollinearity was evaluated using the Variance Inflation Factor (VIF), with thresholds guided by Wooldridge (2002), and model consistency was further tested for serial correlation and heteroskedasticity via the Breusch-Godfrey/Wooldridge and Breusch-Pagan tests, respectively. To enhance construct validity and internal consistency, data were cross-verified across multiple credible sources, and ratio definitions and transformation procedures were uniformly applied, ensuring empirical rigor and estimation reliability (Wooldridge, 2002).

Results and Analysis

The descriptive analysis of the study variables is presented in Table 1. The explained variables (ROA & ROE) are examined alongside the CARAMEL framework's explanatory variables (in short: C, A, RA, M, E, & L).

Table 1: Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
C	90	14.85	53.36	27.2987	8.15894
A	90	31.11	80.21	53.5648	11.15428
RA	90	18.70	90.11	45.0670	12.54389
M	90	0.62	5.17	1.4374	0.61014
E	90	16.14	57.80	29.7462	9.72306
L	90	0.49	3.26	1.6911	0.61410
ROE	90	-4.45	27.48	14.9378	5.98010
ROA	90	-2.15	12.71	7.6782	2.62956

The distribution of ROA and ROE reflects notable differences in financial performance across firms. ROA demonstrates moderate dispersion (M = 7.68, SD = 2.63), while ROE exhibits greater variability (M = 14.94, SD = 5.98), suggesting a wider divergence in equity-driven returns. Among the explanatory variables, Capital Adequacy and Asset Quality display substantial heterogeneity, indicating divergent risk and solvency profiles across firms. In contrast, Liquidity remains relatively uniform, implying a consistent short-term financial position within the sector.

Correlation Analysis

The correlation matrix reveals associations between the explanatory variables and the two performance indicators, ROA and ROE. ROE exhibits strong negative correlations with Capital Adequacy (r = –0.561), Asset Quality (r = –0.492), and Earnings (r = –0.552),

indicating that increases in these risk-related metrics may correspond to diminished returns on equity. ROA is also negatively correlated with Management Efficiency (r = –0.364) and Earnings (r = –0.417), suggesting inefficiencies and subdued earnings performance may constrain asset-based profitability. Notably, ROE and ROA are strongly positively correlated (r = 0.889), confirming their close alignment as measures of firm performance. These relationships signal potential multicollinearity concerns and highlights the importance of rigorous diagnostic testing before regression analysis.

Table 2: Pearson Correlation Coefficients among Variables

	C	A	RA	M	E	L	ROE	ROA
C	1							
A	.836**	1						
	0.000							
RA	-0.140	-.237*	1					
	0.187	0.025						
M	.405**	.264*	.473**	1				
	0.000	0.012	0.000					
E	.543**	.522**	-.550**	.335**	1			
	0.000	0.000	0.000	0.001				
L	.493**	.686**	-.459**	-0.160	.450**	1		
	0.000	0.000	0.000	0.133	0.000			
ROE	-.561**	-.492**	0.145	-.374**	-.552**	-.445**	1	
	0.000	0.000	0.173	0.000	0.000	0.000		
ROA	-.294**	-0.126	0.073	-.364**	-.417**	-0.179	.889**	1
	0.005	0.236	0.496	0.000	0.000	0.091	0.000	

Panel Data Regression Analysis

Panel data estimation was performed using three competing models: Pooled OLS, FEM, and REM. Model selection was guided by the Hausman Test and the Breusch-Pagan Lagrange Multiplier Test to ensure robustness and consistency of estimates. The balanced panel comprises 10 cross-sectional units observed over 9 time periods, with financial performance, measured through ROA and ROE, serving as the dependent variable.

Pooled OLS Regression: The Pooled OLS regression results for ROA and ROE are presented in Table 3. For the ROA model, an R^2 of 35.6% indicates moderate explanatory power, with Capital Adequacy, Asset Quality, Management Efficiency, and Liquidity emerging as significant predictors. The Durbin-Watson statistic of 1.51 points to potential positive autocorrelation.

Table 3: Pooled OLS Regression Results for ROA and ROE

	ROA			ROE		
	Unstandardized Coefficients	T	Sig.	Unstandardized Coefficients	T	Sig.
	β			β		
(Constant)	7.897	3.082	0.003	30.226	5.761	<0.001
C	-0.135	-2.409	0.018	-0.253	-2.198	0.031
A	0.182	3.863	<0.001	0.144	1.499	0.138
RA	0.027	0.664	0.511	-0.022	-0.263	0.793
M	-2.052	-2.528	0.014	-2.567	-1.544	0.127
E	-0.043	-0.828	0.410	-0.160	-1.495	0.139
L	-1.910	-3.019	0.003	-3.948	-3.047	0.003
	R-sq. = 0.356 SEE = 2.187 Durbin Watson= 1.510			R-sq. = 0.477 SEE = 4.478 Durbin Watson=1.426		

In the ROE model, an R^2 of 47.7% reflects a relatively stronger explanatory capacity. Capital Adequacy and Liquidity emerge as significant predictors, both exhibiting negative coefficients, indicating their inverse relationship with return on equity.

FEM: Table 4 presents the FEM results for ROA and ROE based on a one-way effects specification. For the ROA model, the F-statistic is significant, and the R^2 value of 41% indicates improved model fit compared to Pooled OLS. Among the predictors, only Management Efficiency and Liquidity show a statistically significant influence on ROA.

Table 4: One-Way Fixed Effects Model Results for ROA and ROE

Variables	ROA				ROE			
	Coef.	Std. Err.	t-ratio	p-value	Coef.	Std. Err.	t-ratio	p-value
const	7.828	2.960	2.645	0.0100	28.2550	6.056	4.666	<0.001
C	-0.144	0.098	-1.470	0.1458	-0.2219	0.199	-1.111	0.2703
A	0.142	0.075	1.881	0.0639	0.0188	0.154	0.122	0.9032
RA	0.036	0.059	0.614	0.5411	0.0543	0.120	0.451	0.6535
M	-2.325	0.911	-2.552	0.0128	-3.383	1.864	-1.815	0.0736
E	0.008	0.067	0.125	0.9007	-0.005	0.137	-0.033	0.9736
L	-1.8982	0.747	-2.542	0.0131	-3.669	1.528	-2.402	0.0188
du_2	0.966	1.526	0.634	0.5283	0.141	3.121	0.045	0.9640
du_3	0.993	1.565	0.635	0.5277	0.975	3.202	0.305	0.7616
du_4	1.922	1.494	1.286	0.2023	1.961	3.057	0.642	0.5231
du_5	0.110	1.440	0.077	0.9391	-0.322	2.946	-0.109	0.9132
du_6	1.082	1.388	0.780	0.4382	1.510	2.840	0.532	0.5965
du_7	1.164	1.363	0.854	0.3958	1.669	2.789	0.599	0.5513
du_8	1.766	1.372	1.286	0.2024	1.652	2.809	0.588	0.5583
du_9	-0.566	1.646	-0.344	0.7319	-3.893	3.367	-1.156	0.2513
du_10	1.177	1.626	0.724	0.4716	1.231	3.327	0.370	0.7124
	Mean dependent var 7.678319				Mean dependent var 14.93718			
	S.D. dependent var 2.629942				S.D. dependent var 5.979770			
	Sum squared resid 365.7586				Sum squared resid 1531.119			
	S.E. of regression 2.223215				S.E. of regression 4.548713			
	R-squared 0.405828				R-squared 0.518884			
	Adjusted R-squared 0.285388				Adjusted R-squared 0.421360			
	F(15, 74) 3.369539				F(15, 74) 5.320603			
	P-value(F) 0.000250				P-value(F) $4.51e^{-07}$			
	Durbin-Watson 1.561056				Durbin-Watson 1.455108			

Table 5: Two-way Fixed Effects Model Results for ROA and ROE

Variables	ROA				ROE			
	Variables	Coef.	Std. Err.	t-ratio	Variables	Coef.	Std. Err.	t-ratio
const	5.910	3.867	1.528	0.1312	23.338	8.180	2.853	0.0058
C	-0.147	0.109	-1.345	0.1833	-0.239	0.230	-1.036	0.3038
A	0.139	0.094	1.487	0.1418	0.041	0.198	0.207	0.8364
RA	0.045	0.060	0.758	0.4513	0.077	0.126	0.613	0.5419
M	-2.437	1.001	-2.433	0.0177	-3.733	2.118	-1.762	0.0827
E	0.051	0.071	0.713	0.4786	0.084	0.150	0.561	0.5765
L	-2.093	0.901	-2.324	0.0232	-3.314	1.905	-1.740	0.0866
du_2	1.147	1.573	0.729	0.4686	0.938	3.327	0.282	0.7788
du_3	1.202	1.594	0.754	0.4537	1.231	3.372	0.365	0.7162
du_4	2.259	1.530	1.476	0.1448	2.270	3.238	0.701	0.4858
du_5	0.360	1.522	0.236	0.8143	0.693	3.220	0.215	0.8303
du_6	1.197	1.398	0.856	0.3951	1.854	2.958	0.627	0.5330
du_7	1.289	1.422	0.906	0.3682	2.398	3.008	0.797	0.4283
du_8	1.682	1.472	1.142	0.2575	1.817	3.114	0.584	0.5615
du_9	-0.826	1.774	-0.466	0.6431	-3.771	3.753	-1.005	0.3186
du_10	1.525	1.620	0.941	0.3500	1.750	3.428	0.511	0.6113
dt_2	0.776	1.022	0.760	0.4502	0.165	2.162	0.076	0.9395
dt_3	0.862	1.090	0.791	0.4319	0.650	2.305	0.282	0.7787
dt_4	1.363	1.113	1.225	0.2249	1.596	2.354	0.678	0.5001
dt_5	2.026	1.204	1.683	0.0970	1.638	2.546	0.643	0.5224
dt_6	1.024	1.320	0.776	0.4403	-0.516	2.791	-0.185	0.8538
dt_7	1.652	1.588	1.040	0.3020	0.577	3.359	0.172	0.8642
dt_8	-0.138	1.649	-0.083	0.9337	-2.123	3.488	-0.610	0.5437
dt_9	-0.145	1.743	-0.083	0.9337	-2.184	3.686	-0.593	0.5555
	Mean dependent var 7.678319				Mean dependent var 14.93718			
	S.D. dependent var 2.629942				S.D. dependent var 5.979770			
	Sum squared resid 319.9347				Sum squared resid 1431.622			
	S.E. of regression 2.201703				S.E. of regression 4.657386			
	R-squared 0.480269				R-squared 0.550148			
	Adjusted R-squared 0.299150				Adjusted R-squared 0.393382			
	F (23, 66) 2.651682				F (23, 66) 3.509347			
	P-value(F) 0.001070				P-value(F) 0.000034			
	Durbin-Watson 1.551574				Durbin-Watson 1.400297			

The two-way Fixed Effects model improves explanatory power for both ROA (R^2 = 48%) and ROE (R^2 = 55%). However, the unit and time effects are not individually significant in either model, indicating limited contribution from cross-sectional and temporal variations.

REM: Table 6 presents the REM results for ROA and ROE. For ROA, Capital Adequacy, Asset Quality, Management Efficiency, and Liquidity are statistically significant, indicating their collective influence on profitability. However, a theta value of zero suggests that the REM effectively collapses into the Pooled OLS model, implying no meaningful variance across individual effects.

Table 6: REM Results for ROA and ROE

Variables	ROA				ROE				VIF
	Coef.	Std. Err.	t-ratio	p-value	Coef.	Std. Err.	t-ratio	p-value	
const	7.897	2.562	3.082	0.0028	30.226	5.247	5.761	<0.0001	-
C	-0.135	0.056	-2.409	0.0182	-0.253	0.115	-2.198	0.0307	3.915
A	0.182	0.047	3.863	0.0002	0.144	0.096	1.499	0.1376	5.124
RA	0.027	0.041	0.664	0.5087	-0.021	0.083	-0.263	0.7934	4.810
M	-2.052	0.812	-2.528	0.0134	-2.567	1.663	-1.544	0.1265	4.568
E	-0.043	0.052	-0.828	0.4100	-0.160	0.107	-1.495	0.1387	4.820
L	-1.910	0.633	-3.019	0.0034	-3.948	1.296	-3.047	0.0031	2.804
	Mean dependent var 7.678319 S.D. dependent var 2.629942 Sum squared resid 396.8561 S.E. of regression 2.173586 'Within' variance = 4.94268 'Between' variance = 0.226511 Theta used for quasi-demeaning = 0				Mean dependent var 14.93718 S.D. dependent var 5.979770 Sum squared resid 1664.621 S.E. of regression 4.451620 'Within' variance = 20.6908 'Between' variance = 1.2436 Theta used for quasi-demeaning = 0				

For ROE, Liquidity is the only statistically significant predictor, with the model closely mirroring the Pooled OLS specification as indicated by a theta value of zero.

Diagnostic Tests

To identify the most appropriate regression model, a series of diagnostic tests were conducted. Multicollinearity was evaluated using the Variance Inflation Factor (VIF), with all variables exhibiting VIF values below the critical threshold of 10 (Table 6), indicating no significant multicollinearity issues.

The Hausman specification test was applied to distinguish between the FEM and the REM. Results favored the REM for both ROA ($\chi^2 = 6.046$, $p = 0.418$) and ROE ($\chi^2 = 5.748$, $p = 0.452$), implying that individual effects are uncorrelated with the regressors.

Subsequently, the Breusch-Pagan Lagrangian Multiplier (LM) test assessed whether the REM offered efficiency gains over the Pooled OLS model. The test yielded no significant differences for ROA ($\chi^2 = 1.442$, $p = 0.229$) and ROE ($\chi^2 = 1.522$, $p = 0.229$), supporting the selection of the more parsimonious Pooled OLS specification

Hypothesis Testing Summary

The results of hypothesis testing for the key CARAMEL variables in relation to financial performance indicators, ROA and ROE, of Nepalese non-life insurers are presented in Table 7.

Table 7: Summary of Hypothesis Tests'

Hypothesis	Statements	P-value	Remarks
H1a	There is a significant relationship between Capital Adequacy and ROA of the insurance companies.	0.018	Accepted
H1b	There is a significant relationship between Capital Adequacy and the ROE of the insurance companies.	0.031	Accepted
H2a	There is a significant relationship between asset quality and the ROA of the insurance companies.	<0.001	Accepted
H2b	There is a significant relationship between asset quality and the ROE of the insurance companies.	0.138	Rejected
H3a	There is a significant relationship between Reinsurance and ROA of the insurance companies.	0.511	Rejected
H3b	There is a significant relationship between Reinsurance and ROE of the insurance companies.	0.793	Rejected
H4a	There is a significant relationship between Management Efficiency and the ROA of the insurance companies.	0.014	Accepted
H4b	There is a significant relationship between Management Efficiency and ROE of the insurance companies.	0.127	Rejected
H5a	There is a significant relationship between the Earnings and ROA of the insurance companies.	0.410	Rejected
H5b	There is a significant relationship between the Earnings and ROE of the insurance companies.	0.139	Rejected
H6a	There is a significant relationship between the Liquidity and ROA of the insurance companies.	0.003	Accepted
H6b	There is a significant relationship between the Liquidity and ROE of the insurance companies.	0.003	Accepted

As detailed in Table 7, Capital Adequacy exerted a significant positive impact on both ROA ($p = 0.018$) and ROE ($p = 0.031$). Asset Quality significantly affected ROA ($p < 0.001$) but did not demonstrate a statistically meaningful effect on ROE ($p = 0.138$). Management Efficiency was a significant determinant of ROA ($p = 0.014$), whereas its influence on ROE was not significant. Liquidity showed a strong positive effect on both ROA and ROE ($p = 0.003$). In contrast, Reinsurance and Earnings did not exhibit statistically significant

relationships with either performance indicator, highlighting areas for further research. Collectively, these findings provide valuable strategic guidance for strengthening financial performance and risk management practices within the sector.

Discussions

This study critically examined the financial performance of Nepalese non-life insurers through the lens of the CARAMEL framework, assessing how capital adequacy, asset quality, management efficiency, reinsurance, earnings, and liquidity influence profitability, measured by ROA and ROE. The findings offer critical insights into the complex dynamics shaping insurer performance in an emerging market context characterized by regulatory evolution and sectoral challenges. Capital Adequacy emerged with a statistically significant but negative relationship to both ROA and ROE under the REM. While the extant literature establishes that robust capital buffers are foundational to insurer solvency and systemic resilience (Karki & Aryal, 2019; Tutar et al., 2024; Shabani, 2019), the negative coefficient here highlights a critical boundary condition: beyond a regulatory minimum, incremental capital may impose diminishing returns. This implies that while maintaining regulatory capital is necessary, an overly conservative stance may suppress profitability by limiting investment in higher-yielding assets.

Asset Quality's positive and significant influence on ROA confirms its pivotal role in operational efficiency, reflecting prudent underwriting and effective risk management that minimize non-performing assets (Kadioglu et al., 2017; Chattopadhyay, 2024). However, its lack of significance on ROE suggests that while sound assets enhance internal performance metrics, their impact on shareholder returns is mediated by leverage structures and cost of capital (Modigliani & Miller, 1958). This bifurcation resonates with the trade-off theory of capital structure, where asset quality improves firm value primarily through reduced default risk rather than direct equity yield improvements. It also indicates that Nepalese insurers might experience constraints in leveraging asset quality gains into equity returns, potentially due to market inefficiencies or suboptimal financial intermediation.

Reinsurance/Actuarial Ratio's insignificance in influencing both ROA and ROE contradicts established findings emphasizing reinsurance as a risk mitigation and earnings stabilization tool (Grofčíková et al., 2022). This anomaly could reflect contextual specificities: Nepalese insurers may underutilize reinsurance or engage in limited treaty sophistication, diluting their financial effectiveness. Alternatively, the limited maturity of actuarial practices and reinsurance integration in Nepal may inhibit capturing reinsurance benefits within accounting measures. This gap signals an urgent need for enhanced actuarial capacity and risk transfer mechanisms to realize reinsurance's full potential in Nepal.

Management Efficiency significantly influenced ROA but not ROE, emphasizing the distinction between operational effectiveness and shareholder wealth creation. This supports governance and resource-based theories that link efficient management to improved asset utilization and cost control (Dahal et al., 2020; Mishra et al., 2021). Yet, the absence of a corresponding effect on ROE points to external market pressures or capital market imperfections limiting the translation of operational gains into equity returns. It may also reflect a lag effect where internal efficiencies precede financial market recognition.

Earnings Ratio was not supported, challenging conventional expectations that earnings quality directly predicts profitability (Mishra et al., 2021). This divergence suggests that in Nepal's non-life insurance sector, earnings volatility, possibly driven by underwriting cycles, investment income fluctuations, or regulatory reporting lags, obscures the predictive power of earnings-based ratios. The finding calls for integrating more robust performance measures or market-based indicators in future analyses.

Liquidity Ratio's strong negative association with both ROA and ROE supports a liquidity-profitability trade-off consistent with Al-Qadi and Khanji (2018). Excess liquidity appears to represent idle resources invested in low-yield assets, reducing overall returns. This result echoes the buffer stock theory of liquidity, suggesting that while liquidity is essential for meeting short-term obligations, over-maintaining it may signal inefficiency or risk aversion detrimental to profitability (Keynes, 1936). For Nepalese insurers, the challenge lies in optimizing liquidity to balance solvency needs against return maximization, a dilemma amplified by limited access to liquid capital markets and investment instruments.

Conclusion and Implications

This study delivers a rigorous, multidimensional evaluation of Nepalese non-life insurers' financial performance through the CARAMEL framework, exposing how capital adequacy, asset quality, management efficiency, and liquidity fundamentally shape profitability dynamics measured by ROA and ROE. The inconclusive impact of reinsurance and earnings exposes critical blind spots and institutional constraints unique to Nepal's insurance sector, underscoring the sector's operational and regulatory complexities. Theoretically, this study contributes to the growing body of literature on insurance performance analysis by extending the conventional CAMEL model to the more inclusive CARAMEL framework, which better captures operational and risk management dimensions. It affirms that capital strength, asset management, and internal governance are central to financial resilience, while also highlighting the need for further exploration of reinsurance efficacy and the translation of earnings into shareholder value within emerging market contexts.

Practically, the study offers critical insights for insurers, investors, and regulators in Nepal. Insurers should prioritize capital adequacy, maintain high-quality asset portfolios, and strengthen internal management systems to enhance profitability. Policymakers, particularly the Insurance Board of Nepal, may consider tailoring regulatory guidelines that balance solvency with operational efficiency. Investors and financial analysts can leverage these findings to better assess firm-level risk and return dynamics, guiding strategic investment and risk diversification decisions.

Limitations and Future Research

This study, despite its use of nine years of panel data, is limited by data availability issues stemming from recent industry mergers and inconsistent reporting practices. These constraints may affect the comprehensiveness and generalizability of the findings. Future research should incorporate qualitative variables such as governance quality and customer satisfaction to capture dimensions beyond financial metrics. Additionally, examining moderating factors like firm size and market share could provide deeper insights into the conditional effects observed.

Expanding the scope to include life insurance firms or conducting regional comparative analyses would enhance understanding of sectoral heterogeneity. Integrating primary data through surveys or interviews would further strengthen contextual validity and interpretability. Finally, future studies should apply dynamic modeling techniques and mixed-method approaches to unravel the institutional and market mechanisms shaping insurer performance in emerging economies, offering richer, more actionable insights for theory and practice.

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Conflict of Interest

The authors declare no conflicts of interest, financial or otherwise, that could have influenced the conduct or outcomes of this research.

Ethical Statement

This research did not require ethical approval as it does not involve any human or animal experiments.

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