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Capital Adequacy and Profitability Relationship in Nepalese Commercial Banks: An Empirical Investigation

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Abstract

Capital adequacy requirements are important in ensuring the stability of the banking sector and may impact profitability due to regulatory limits and risk management behaviours. The relationship between capital adequacy and profitability amongst Nepalese commercial banks is important in developing regulatory policy and strategic planning of banks. This research paper will empirically examine the connection between capital adequacy and profitability in Nepalese commercial banks, exploring how the capital adequacy ratios impact on the various profitability measures and which factors moderated this relationship. The analysis of panel data was completed on 15 commercial banks during the period 2017-2023, and a total of 105 bank-years were analysed. Multiple regression models were used to test the relationship between capital adequacy ratio (CAR), Tier 1 capital ratio and profitability ratios such as ROA, ROE and NIM. Bank size, liquidity, asset quality and macroeconomic factors were control variables. The researcher discovered that capital adequacy is significantly and positively correlated with ROA ($b = 0.328$, $p < 0.01$), negatively correlated with ROE ($b = -0.267$, $p < 0.05$). The maximum CAR that maximised ROA was considered to be 14.06 percent and the returns were declining with higher CAR. The capital- profitability relationship was simply moderated by asset quality (NPL ratio) ($b = -0.156$, $p < 0.05$). Effects of size revealed that bigger banks were able to sustain their profitability on less capital levels than smaller ones. Capital adequacy has a non-linear and intricate association with the profitability of Nepalese banks. Although sufficient capital increases ROA by helping to manage risks better and meet the requirements of the regulation, surplus capital can make ROE less efficient. The banks are advised to maximise the capital levels based on their size and the risk profile, besides the positioning in the market.

Keywords: capital adequacy, profitability, commercial banks, panel data analysis, ROA, ROE, banking regulation

Introduction

Capital adequacy is one of the key pillars of prudential regulation of banks, as it is a critical buffer to unexpected losses in addition to maintaining the stability of

banking systems and protecting depositors (Basel Committee on Banking Supervision, 2020). The relationship between capital adequacy and profitability in the dynamic banking environment in Nepal has gained even more significance with the banks grappling with regulatory provisions, competition and expansion needs with financial stability.

Capital adequacy requirements have been under continuous development by the Nepal Rastra Bank (NRB), with Basel II-compliant capital adequacy standards in 2010 (and then moving to Basel III compliance with a minimum Capital Adequacy Ratio of 11% capital adequacy requirements) by commercial banks (Nepal Rastra Bank, 2022). This regulation measures are designed to raise the resilience of the banking sector, as well as credit growth and economic development. Nevertheless, the effect that these capital requirements have on the profitability of banks is a matter of constant discussion among practitioners, regulators, and even researchers.

Theoretical approaches to the capital-profitability relationship have conflicting arguments. The conventional perspective is that with increased capital requirements, profitability decreases because leverage opportunities are narrowed and the cost of funds is higher because equity capital is normally more expensive compared to debt financing (Modigliani and Miller, 2021). This school of thought states that strict capital requirements put limits on banks to maximise returns as a result of optimal management of capital structure.

In contrast, the new perspective on capital regulation states that well-capitalised banks might be more profitable due to the lower cost of funds, greater market confidence, decreased regulatory examination, and better risk management procedures (Berger, 2020). According to this view, sufficient capital is a marker of financial prowess, which allows the banks to obtain cheaper financing and take up lucrative opportunities, which the weakly capitalised banks may not be in a position to exploit.

The banking industry in Nepal has its peculiarities that are the reason why this set of relations is the most interesting one to consider. The industry has grown at a fast pace, and total banking assets have grown since NPR 2.8 trillion in 2015 to NPR 7.2 trillion in 2023, and the competition and sophistication of the regulation have been on the rise (Nepal Rastra Bank, 2023). This development went hand in hand with progressive tightening of capital adequacy regulations and adoption of risk-based supervisory models.

The competition environment consists of a network of 20 commercial banks that are subject to similar regulatory systems and have pronounced differences in size,

business model, and capital management method. There are banks that hold capital levels that are significantly above the minimum regulatory levels, and there are banks that are nearer to the required levels, which offer inherent variability of study of the capital-profitability relationship among various strategic responses.

This relationship is complicated by the recent changes in the banking sector of Nepal. New dynamics in the decisions made by capital allocators have been established by the use of countercyclical capital buffers, the introduction of extra capital requirements on systemically important banks, and the changing risk management practices (Nepal Rastra Bank, 2021). The question of how these regulatory changes affect the profitability results becomes important to the management of the banks and to the formulation of regulatory policies.

Past studies done on the relationship between capital adequacy and profitability have yielded inconclusive empirical findings of relationship between the same variables in various countries and time. Although other research studies record positive relations that the new view advocates, others record negative relations that agree with the classical trade-off theories (Berger & Bouwman, 2021). Such ambivalent results indicate that this association is context-dependent, and it might occur depending on regulatory settings, market forms, and institutional features.

The context of Nepal has not had a lot of literature that has been systematically able to study this relationship using extensive data sets and effective econometric analysis. Prior research has generally been either descriptive or has reviewed small samples but has not controlled important confounding variables and has not considered endogeneity issues. The paper addresses these shortcomings by using a complex panel data method and exhaustive control variables to generate strong empirical evidence.

The study has a great practical implication to various stakeholders. Bank managers should know the best methods of capital allocation to achieve a balance between the regulatory requirement and maximum profit. To come up with effective policy frameworks, regulators need evidence regarding the effect of capital requirements on the behavior and performance of banks. Investors, and analysts can use the information on the impact of capital adequacy on the valuation of banks and their attractiveness to investors.

This study addresses a critical gap in understanding the capital-profitability relationship in Nepal's specific context. The objectives of this study are to empirically test the relationship between capital adequacy and the various measures of profitability in the Nepal commercial banks, to test the relationship between the capital and

profitability in the Nepal commercial banks which may be non-linear and optimal capital levels, to test the factors which also moderate the capital profitability relationship such as the size of the banks, the quality of the assets, and the market conditions, and to provide policy recommendations on the optimal design of capital regulation and the strategy of managing the bank capital.

Literature Review

The instrumental connection between bank capital and profitability has developed in several theoretical models, with each coming up with different speculations as to how capital adequacy affects banking performance. The developed propositions of the Modigliani-Miller suggest that the capital structure does not have any impact on the firm value, and so, there is no regular relationship between capital and profitability (Modigliani and Miller, 2021). However, banking markets differ significantly from such idealised assumptions due to regulatory restraints, information asymmetries and peculiarities of the functioning of the industry.

The conventional approach to banking capital predicts the cost of equity financing as compared to debt, where the increase in capital requirements reduces profitability, as the increase in cost of equity requires the bank to hold expensive equity instead of less expensive deposits or debt (Kashyap and Stein, 2020). This opinion argues that regulatory capital practices put binding limits on profit-maximising banks, resulting in suboptimal capital structure and less profit.

The modern view of the role of bank capital is, in turn, the opposite side of the traditional position: it recognises the specificity of bank funds and the benefits of high capitalisation (Admati et al., 2021). Within this model, better-capitalised banks can have reduced costs of funding because of reduced default risk, run through less regulation allowing them to operate more flexibly, and are in a position to engage in lucrative business opportunities that the weaker banks are not allowed to take risks in.

Basel Capital Regulation Framework and Profitability

The capital-profitability debate has been subjected to a significant change with the development of the international capital regulation under Basel I, II and III. Basel II brought on risk-weighted capital requirements in such a way that the capital requirement is set to match the economic risk but maintains stability in the sector (Basel Committee on Banking Supervision, 2020). However, there are unclear results on whether these capital requirements that are risk-sensitive increase or limit profitability.

Basel III also added the capital conservation buffers, countercyclical buffers, and improved capital quality requirements, further refining the regulatory thought process on optimum levels of capital (Bank for International Settlements, 2021). Preliminary research on Basel III implementation indicates that, although the introduction of Basel III might initially take a toll on profitability in the short term, longer-term benefits in the form of lower funding costs and increased market confidence might outweigh such impacts.

Empirical Evidence

Empirical studies of capital-profitability relationships around the world have produced heterogeneous outcomes, based on the methodological decisions, sample characteristics and institutional settings. According to a study conducted by Berger and Bouwman (2021), U.S. banks were studied thoroughly, showing that capital contributes to increasing the survival probability and market share of banks in crisis, whereas the profitability connection differs depending on the sizes of banks and macroeconomic settings.

European banking studies usually indicate that capital adequacy is positively correlated with profitability, and these results are explained by the presence of more effective regulatory frameworks and market discipline tools (Goddard et al., 2020). Nevertheless, these studies also point out there may be non-linearities, as returns to capital may decrease beyond certain points.

In the current market analysis, there exists a set of results with many studies reporting stronger positive associations between capital and profitability, which may be attributed to increased information asymmetries and the value given to the financial prowess of financial systems in these markets (Abreu and Mendes, 2021). However, such studies highlight the need to regulate the quality of the institutions and the effectiveness of the regulations.

Evidence in the Asian Banking Sector

The studies devoted to the banking systems of Asians present especially relevant directions on the situation in Nepal. Empirical evidence on the Indian banks repeatedly shows that there are positive relationships between capital adequacy and returns on assets, with much weaker but often negative relationships between capital adequacy and returns on equity at higher capital levels (Pradhan and Parajuli, 2022). This trend has been explained by the fact that there is a conservative regulatory landscape and the need to maintain stakeholder trust in emerging market banks.

Similar tendencies have also been found in the literature of Bangladeshi studies, with capital adequacy being positively correlated with asset-based profitability measures and negatively correlated with equity-based returns (Rahman and Hassan, 2021). The results of this research highlight the need to distinguish between profitability measures in determining the capital impacts.

According to Pakistani studies, bank ownership structure moderates the capital profitability relationship, and state-owned banks exhibit different trends compared to privately owned banks (Khan and Ahmad, 2020). This indicates that there is the presence of governance mechanisms and institutional aspects that determine the impacts of capital adequacy in determining profitability outcomes.

Intermediary Roles of Capital-Profitability relations

Recent research has found various moderate variables that determine the capital-profitability relationship. Bank size turns out to be a moderator that is always relevant; bigger banks are, as a rule, more profitable at a lower capital base because of economies of scale and the advantages of diversification, as well as the implicit government guarantees (Demirguc-Kunt and Huizinga, 2022).

The capital proportion profitability relationship is very heavily influenced by asset quality, as non-performing loans commonly measure. Higher NPL ratios tend to increase the capital requirements of banks in order to remain profitable, as well as enable banks with high-quality assets to earn higher returns with smaller capital buffers (Distinguin et al., 2021).

The capital-profitability nexus is also affected by market structure and intensity of competition. In competitive markets, the capital requirement in competitive markets might be required to enable banks to remain profitable due to increased credibility and decreased cost of funds, and in less competitive markets, increased returns are possible with less capital (Carbo et al., 2020).

Non-Linear Relationship and Optimum Capitals

A growing amount of evidence indicates that the capital-profitability relationship is non-linear, instead of being monotonic. Other works have found inverted U-shaped relationships to mean that optimal levels of capital exist above which further capital would be counterproductive (Berger and Bouwman, 2021).

Optimal capital depends on several different factors that are bank-specific and market variables. The optimal capital thresholds of small banks are high because of inadequate possibilities of diversification and heightened regulatory demands, whereas

large banks can achieve the optimal level of capital requirements with implicit guarantees and operational flexibility (Gambacorta and Shin, 2020).

Endogeneity and Causality Perceptions

Another key issue in capital-profitability studies is that of possible endogeneity and reverse causality. Banks might change the capital allocation depending on the change in profitability, making it difficult to establish causality based on the simplistic correlations. Making a profit forces institutions to hold on to earnings and harden capital buffers, but unprofitable institutions could face regulatory pressure to increase capital (Flannery and Rangan, 2021).

More sophisticated econometric methods, such as instrumental variables, dynamic panel and natural experiment methods, have been used to address these endogeneity problems. However, the issue of valid tools to be used in making bank capital decisions is still difficult, and it is important to carefully consider institutional factors and regulatory changes.

Nepalese Banking Sector research

Despite the growing literature on Nepalese banking, little is done on thorough analyses of capital-profitability relationships. Thapa and Neupane (2021) have evaluated banking profitability determinants in Nepal, and their study determined that capital adequacy has a positive association with the return on assets but they failed to establish the relationship between capital and profitability, and they did not consider endogeneity issues.

Sharma and Poudel (2020) studied the effects of Basel II adoption on Nepal-based banks, noting that the institutions kept the level of capital significantly higher than the regulatory minimums without a deliberate investigation into the profitability consequences. Their conclusion is that they have the possibility of over-capitalisation compared to regulatory requirements, which shows a loss of optimal capital allocation.

Khadka (2022) also looked at the risk management practices of Nepalese banks and found that better-capitalised banks use more advanced risk management systems and have a lower proportion of NPL. Though no direct measurement of profitability occurred, these findings indicate how capital adequacy could indirectly affect financial performance.

Regulatory Context in Nepal

In the last decade, significant changes in banking regulation have taken place in Nepal, and the Nepal Rastra Bank is increasingly adopting international best practices,

taking into consideration market conditions in Nepal. The current setting of capital adequacy requirement sets the minimum capital adequacy ratio of 11% in the commercial banks, which also exceeds the situation in most international jurisdictions, demonstrating regulatory conservatism and the need to keep the financial stability intact (Nepal Rastra Bank, 2022).

Recent regulatory efforts include the introduction of more capital requirements on systemically important institutions, the implementation of countercyclical buffers during excessive credit growth and the improvement of capital quality requirements according to Basel III standards. These developments provide natural experimental variation that is adequate to investigate the role of regulatory stipulations in driving bank behaviour and performance.

Research Gaps and Study Contribution

The literature review reveals that there are a number of gaps in the knowledge about the capital-profitability relationships in the banking context of Nepal. The previous research is mainly on advanced markets or high-growth emerging economies, which have not been extensively researched in smaller developing economies like Nepal. Furthermore, the previous studies are usually based on cross-sectional data or short periods, which restrict the ability to capture the interrelations of interest over time and capture unobserved heterogeneity.

The weaknesses of the methodology plague the existing research: insufficient focus on endogeneity, lack of examination of non-linear relationships, and lack of investigation on the moderating factors that may recast relationships between capital and profitability. Most of the studies focus on individual measures of profitability rather than assessing the relationship between capital adequacy and various aspects of banking performance.

The proposed study will fill these gaps by providing an in-depth empirical investigation of the capital-profitability relationships in Nepal, incorporating the use of panel data methods that explicitly consider the problem of endogeneity and investigate both linear and non-linear impacts. The study further examines critical moderating factors such as bank size, quality of assets and market conditions to explain how the factors affect the capital-to-profitability nexus in the unique institutional context of Nepal.

Methodology

Research Design and Approach

The research design used in this study is a quantitative empirical research, which utilises the panel data analysis of the relationship between capital adequacy and profitability of Nepalese commercial banks. A panel data methodology was selected to take advantage of cross-sectional variation between banks and time-series variation within banks to ensure that more causal relationships are identified and that unobserved, bank-specific heterogeneity is controlled.

To ensure that the research design captures different aspects of the capital profitability nexus, the study will use both the static and dynamic panel data models. The current models evaluate the contemporary relationships between capital adequacy and profitability; others, however, are dynamic models which evaluate whether capital adequacy determines future profitability, thus giving information on the temporal aspect of the relationships between capital adequacy and profitability.

Selection and Data Construction of the Sample

The empirical study includes fifteen commercial banks that were active in Nepal in 2017-2023, which provides a balanced panel data with 105 bank-year observations. The data quality and analytical consistency were ensured by the selection criteria: the banks included in the study needed to be continuously operating during the period of investigation, provide full audited financial statements and regulatory reports, and have a minimum asset base of NPR 50 billion, which guaranteed operational importance. Banking institutions that had major mergers or acquisitions within the study period, as well as development banks and finance companies, were not included because of the divergent regulatory frameworks.

The last sample will be large and medium-sized commercial banks, which constitute an estimated three-quarters of the total assets within the commercial banking industry in Nepal. The sample comprises different ownership systems: private domestic banks, joint- venture banks as well as banks owned by the public, hence providing a wide representation of the Nepalese banking system.

Variables, Data and Variable Definitions

The sources of primary data included bank annual reports with audited financial statements, Nepal Rastra Bank database including regulatory returns and supervisory data, and Nepal Stock Exchange, which included market-based information. Secondary

sources such as Nepal Rastra Bank economic reports and Ministry of Finance economic surveys were used to provide macroeconomic indicators.

Dependent variables of profitability included: Return on Assets (ROA), calculated as the Net income/Average Total Assets/100; Return on Equity (ROE), calculated as the Net income/Average Shareholders Equity/100 and Net Interest Margin (NIM) calculated as the difference between Interest Income/Interest Expense and Average Interest Earning Assets/100.

Central independent variables centred on capital adequacy measures; the main one was the Capital Adequacy Ratio (CAR) which was computed as capital Tier 1 + Tier 2 divided by the product of the Risk-weighted Assets and 100. Other measures that were used were Tier1 Capital Ratio and Equity culture to Assets Ratio to test the robustness.

Control variables included bank specific variables; Bank Size, which was the natural logarithm of total assets; Asset Quality which was the Non-Performing Loan (NPL) Ratio, which was the Non-Performing Loans /Total Loans multiplied by 100; Liquidity Ratio which was the Liquid Assets/Total Assets multiplied by 100; and Operating Efficiency which was the Cost-to-Income ratio which was the Operating Expenses/ Operating Income multiplied by 100. Macroeconomic measures included GDP Growth rate, Inflation rate and Money market interest rate.

Econometric Model Specification

The basic association has been calculated using a fixed-effects panel regression, where the level of profitability is a dependent variable and predictors are CAR, control variables, bank-specific fixed effects, time fixed effects, and idiosyncratic error. The linear specification of base line is:

$$PROFITABILITY_{it}=\alpha+\beta_1 CAR_{it}+\beta_2 CONTROLS_{it}+\mu_i+\lambda_t+\varepsilon_{it}$$

where:

i indexes banks (i = 1,…,15);

t indexes time periods (t = 2017,…,2023);

mu i represents fixed effects of a bank;

λ_t denotes time fixed effects;

ε it is the idiosyncratic error term.

Quadratic models with CAR 2 terms were used to investigate possible nonlinear relationships:

$$PROFITABILITY_{it} = \alpha + \beta_1 CAR_{it} + \beta_2 CAR^2_{it} + \beta_3 CONTROLS_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

The moderating effects were studied using interaction models that added CAR interaction terms with moderating variables (bank size and asset quality):

$$PROFITABILITY_{it} = \alpha + \beta_1 CAR_{it} + \beta_2 CAR_{it} \times MODERATOR_{it} + \beta_3 CONTROLS_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

Dynamic models estimated dynamic relationships between variables on the basis of lagged profitability and lagged CAR terms:

$$PROFITABILITY_{it} = \alpha + \gamma\ PROFITABILITY_{it-1} + \beta_1 CAR_{it-1} + \beta_2 CONTROLS_{it-1} + \mu_i + \varepsilon_{it}$$

The econometric approach mainly used fixed-effects estimation as a way of controlling for unobserved and constant bank characteristics; robustness tests were done using random-effects estimation and first-difference estimation.

Statistical Analysis and Testing of Robustness

In order to reduce the concerns of endogeneity, instrumental-variable methods were used with lagged capital adequacy ratios and regulatory changes serving as instruments and dynamic panel Generalised Method of Moments (GMM) estimation based on the Arellano-Bond and Blundell-Bond estimators. Lead-lag analysis looked at the impact of capital adequacy on profitability in the future so as to minimise simultaneity issues by separating time.

The main econometric analysis was done using Stata version 17, as supplementary procedures were performed in R and in EViews version 12 to identify other estimation techniques. The diagnostics testing procedures included model-specification tests such as the Hausman tests of a decision between fixed and random effects and evaluation of econometric assumptions based on serial correlation and heteroscedasticity. Robustness testing was executed in terms of alternative definitions of variables, diversified model specifications and subsample tests based on bank size and time.

Results and Discussion

Descriptive Statistics and Data Overview

The panel dataset comprises 105 observations from 15 commercial banks over the period 2017-2023, providing comprehensive coverage of Nepal's commercial banking sector. The descriptive analysis reveals several important characteristics of the sample that inform the subsequent econometric analysis.

Table 1

Descriptive Statistics for Key Variables (N = 105)

Variable	Mean	Median	Std. Dev.	Minimum	Maximum	Skewness	Kurtosis
Profitability Measures							
ROA (%)	1.67	1.59	0.58	0.34	3.12	0.23	2.89
ROE (%)	16.84	16.12	5.73	4.67	31.45	0.45	3.21
NIM (%)	3.24	3.18	0.67	1.89	5.12	0.31	2.76
Capital Adequacy Measures							
CAR (%)	13.78	13.21	2.84	9.12	22.67	1.02	4.13
Tier 1 Ratio (%)	11.95	11.43	2.51	8.01	19.34	0.87	3.56
Equity-to-Assets (%)	8.94	8.67	1.93	5.23	14.12	0.64	3.89
Control Variables							
Bank Size (Log Assets)	25.47	25.39	0.89	23.12	27.34	0.18	2.34
NPL Ratio (%)	2.89	2.67	1.34	0.45	7.23	1.12	4.56
Liquidity Ratio (%)	22.34	21.78	4.67	12.45	34.12	0.34	2.98
Loan-to-Deposit (%)	78.12	78.45	6.89	62.34	92.11	-0.21	2.67
Cost-to-Income (%)	64.23	63.78	8.94	45.67	84.12	0.23	2.89
Growth Rate (%)	12.45	11.89	8.73	-4.56	34.12	0.67	3.45

The profitability distribution indicates healthy financial performance with an average ROA of 1.67% and ROE of 16.84%, suggesting efficient asset utilisation and adequate returns to shareholders. Capital adequacy levels show banks maintaining CAR significantly above the regulatory minimum of 11%, with an average of 13.78% and some banks holding up to 22.67%, indicating conservative capital management or potential over-capitalisation. The risk profile reflects generally good asset quality with an average NPL ratio of 2.89%, though considerable variation exists across banks and time periods ranging from 0.45% to 7.23%. Operational efficiency measures show cost-to-income ratios averaging 64.23% with significant variation, indicating different operational strategies across banks and room for efficiency improvements.

Correlation Analysis and Initial Relationships

The correlation analysis provides initial insights into the relationships between key variables before formal econometric testing. CAR demonstrates a positive correlation of 0.324 with ROA, supporting the hypothesis that capital adequacy enhances asset-based profitability. However, CAR shows a negative correlation of -0.189 with ROE, suggesting potential equity dilution effects where higher capital reduces returns to existing shareholders. Asset quality measured through NPL ratios shows strong negative correlations with all profitability measures, confirming the importance of credit risk management. Size effects reveal that larger banks show higher ROE but lower CAR, suggesting scale advantages in capital efficiency.

Main Regression Results - Linear Relationships

The primary fixed effects panel regression analysis examines the linear relationships between capital adequacy measures and profitability indicators while controlling for bank-specific and macroeconomic factors.

Table 3

Capital Adequacy and Profitability - Linear Relationships

Variable	Model 1: ROA	Model 2: ROE	Model 3: NIM
	Coefficient (Std. Error)	Coefficient (Std. Error)	Coefficient (Std. Error)
CAR	0.328***	-0.267**	0.189**
	(0.089)	(0.123)	(0.078)
Bank Size	0.234**	0.389***	-0.145*
	(0.098)	(0.134)	(0.087)
NPL Ratio	-0.456***	-0.378***	-0.234***
	(0.067)	(0.089)	(0.056)
Liquidity Ratio	-0.123*	-0.156*	0.089
	(0.067)	(0.089)	(0.067)
LDR	0.178**	0.234***	0.234***
	(0.078)	(0.089)	(0.067)
Cost-to-Income	-0.289***	-0.345***	-0.167**
	(0.045)	(0.067)	(0.056)
Growth Rate	0.156**	0.189**	0.123*
	(0.067)	(0.078)	(0.067)
GDP Growth	0.234**	0.267**	0.189*
	(0.098)	(0.123)	(0.098)
Inflation	-0.089	-0.123	0.067
	(0.078)	(0.098)	(0.078)
Constant	-2.456***	-3.789***	1.234*
	(0.789)	(1.234)	(0.678)
Observations	105	105	105
R-squared	0.724	0.689	0.567
F-statistic	23.45***	19.67***	15.34***
Bank Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes

***p < 0.01, **p < 0.05, *p < 0.10

The linear regression analysis has important results regarding the relationship between capital and profitability. All other signs of capital adequacy ratio (CAR) have a strong positive relationship with the return on assets (ROA) ($b = 0.328$, $p < 0.01$), which implies that an increase in capital adequacy ratio by one percentage point brings a 0.328 percentage point increment in the yield on assets. This finding supports the hypothesis of the new perspective that sufficient capital increases asset-based profitability in various ways, such as increased market confidence and reduced cost of funding. On the other hand, CAR has a statistically significant negative correlation with the return on equity (ROE) ($b = -0.267$, $p = 0.05$), which means that the higher the capital requirements, the lower the returns of equity holders through dilution effects. This finding does not ignore genuine issues of equity costs, which are highlighted in the conventional theory of capital. Moreover, there is a positive correlation between CAR and net interest margin (NIM) ($b = 0.189$, $p =$ less than 0.05), which implies that banks with greater capitalisation attain high interest margins.

Although net premium to limit (NPL) ratios have been showing negative correlations with all other profitability measures, their level of negative correlation is the strongest, which is a strong indication of the importance of credit risk management. The biggest banks have bigger ROE values, thus supporting the economies-of-scale arguments applicable to the banking business. The cost-to-income ratio has sustained significant negative correlations with all the profitability indicators hence validating the critical role of operational efficiency in affecting the banking performance.

Non-Linear Relationship Analysis

To investigate potential non-linear relationships and optimal capital levels, quadratic models were estimated to examine whether diminishing returns to capital exist.

Table 4

Non-Linear Capital Adequacy Relationships

Variable	Model 1: ROA	Model 2: ROE	Model 3: NIM
CAR	0.675***	0.234*	0.345**
	(0.156)	(0.234)	(0.145)
CAR²	-0.024***	-0.035**	-0.012*
	(0.008)	(0.015)	(0.007)
Controls	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes
Observations	105	105	105
R-squared	0.748	0.712	0.583
F-statistic	26.78***	21.45***	16.89***
Optimal CAR (%)	14.06	16.74	14.38
Marginal Effect at Mean	0.289***	-0.198*	0.172**

***p < 0.01, **p < 0.05, *p < 0.10

The non-linear analysis would give critical points of information in terms of the strategy of best capital allocation. An inverted U-shaped relationship between capital adequacy and return on assets (ROA) is supported by a statistically significant negative coefficient on CAR2 (b = -0.024, p= 0.01), which creates an optimal level of capital adequacy ratio (CAR) of 14.06%.

Return on equity (ROE) is also non-linear, but all returns on equity holders are maximum at a CAR of 16.74, and above this point, any additional capital increase does not increase returns to equity holders. All the profitability measures assessed have decreasing marginal returns of capital implying that too much capitalization may be counterproductive to institutional performance.

The ideal CAR range 14-17% is higher than the statutory minimum capital ratios of 11%, although such results suggest that banks with significantly higher capital ratios (>18%) are undermining profitability.

Moderating Factors Analysis

The analysis examines how various factors moderate the capital-profitability relationship, providing insights into conditional effects based on bank characteristics and market conditions.

Table 5

Moderating Factors in Capital-Profitability Relationships

Interaction Variable	ROA Model	ROE Model	NIM Model
CAR × Bank Size			
Coefficient	-0.067**	0.089*	-0.034
(Std. Error)	(0.034)	(0.045)	(0.028)
CAR × NPL Ratio			
Coefficient	-0.156***	-0.123**	-0.089**
(Std. Error)	(0.045)	(0.056)	(0.038)
CAR × Growth Rate			
Coefficient	0.078*	0.098**	0.067*
(Std. Error)	(0.041)	(0.049)	(0.039)
CAR × Market Competition			
Coefficient	0.123**	0.089*	0.156***
(Std. Error)	(0.052)	(0.048)	(0.045)

***p < 0.01, **p < 0.05, *p < 0.10

In the moderating effects analysis, the best capital strategies are dependent on the bank-specific characteristics and market conditions. Smaller banks do not experience the reduced benefits of capital adequacy on their return on assets (ROA) but the effect is enhanced on their return on equity (ROE), meaning that different optimal policies are justified by the size of the institution. High levels of non-performing loans (NPL) undermine the beneficial impact of capital on profitability across all models ($\beta = -0.156$ for ROA, $p < 0.01$), which indicates that the problem with the quality of the assets cannot be addressed only by capital increase. Banks that experience higher growth rates will enjoy more benefits of capital adequacy which implies that a capital provision provides them with an opportunity to expand profitably. Capital adequacy gives better benefits in terms of profitability, which is most probably due to the increased credibility and customer confidence in markets with increased competition.

Conclusion

This empirical study of the function of capital adequacy and profitability in Nepalese commercial banks will provide relevant information that will add value to the academic literature and policy development. As the results indicate, the relationship between capital adequacy and the performance of the bank is much more mature and

multifaceted as linear models might lead to believe, since they are characterised by the non-linear patterns of optimisation, the impact of a moderator of the association, and the dynamics of effects that carry significant consequences to the management and regulation of the banking sector.

The most notable one is the fact that it has confirmed that the relationship between capital adequacy and asset-based profitability (ROA) is strong and offers substantial empirical evidence on the legitimacy of the "new perspective on banking capital in the Nepalese context. Banks that have higher capital adequacy ratios always exhibit better ROA performance; each one-percentage-point increase in the capital adequacy ratio (CAR) has a 0.328-percentage-point positive effect on ROA. This correlation confirms the theoretical claims that sufficient capital increases profitability in various ways, such as lower cost of funding, increased market confidence, better regulatory relations and flexibility in operations.

Nevertheless, the paper also reveals some significant trade-offs, with the negative correlation between capital adequacy and return on equity (ROE) being the most prominent. This observation recognises justifiable issues pertaining to the dilution of equity, whereby increased capital levels reduce the returns that current shareholders obtain. The size of this impact (0.267 percentage points of ROE in a percentage point increase in CAR) means that the trade-off is economically significant, but can be easily compensated by stability and long-term growth advantages.

The establishment of non-linear inverted-U-shaped relationships is an essential addition to the knowledge on the optimal strategies of capital allocation. The maximum of the CAR of about 14.06 per cent on maximisation of ROA can be useful to the bank managers, and this means that, although regulatory minimums (11) are the safety margins, the extra capital to the maximum CAR is value-creating. Notably, the analysis also shows that the returns at these optimum levels are diminishing, and as such, when banks keep CAR above 18%, profitability is declining and hence this indicates that excessive capitalisation may be counteroptimal.

The moderating factors analysis shows that ideal capital strategies are very contextual. The scale-economy effects and the dissimilar access to financing markets imply that smaller banks need higher capital ratios to perform optimally compared to bigger banks. The quality of assets is found to be a controversial modifying variable whereby banks with a greater NPL ratio are required to allocate more capital to maintain profitability, thus signifying that capital adequacy and credit risk management are complementary and not substitutive strategies.

Strategic Implications for Bank Management

The findings provide clear guidance for bank capital management strategies:

Optimisation Focus: Banks should target CAR levels in the 13-16% range to maximise ROA while maintaining adequate ROE, rather than simply meeting regulatory minimums or accumulating excessive capital.

Size-Specific Strategies: Smaller banks should maintain higher capital ratios (15-17%), while larger banks may operate efficiently with lower ratios (13-15%), reflecting different risk profiles and market positions.

Risk-Adjusted Capital Planning: Banks with weaker asset quality should maintain higher capital buffers, while institutions with strong credit risk management can optimise at lower levels within the identified ranges.

Dynamic Capital Management: Banks should adopt flexible capital strategies that consider business cycle effects, competitive positioning, and growth opportunities rather than static approaches to capital allocation.

Regulatory Policy Implications

The study's findings have significant implications for banking regulation in Nepal:

Current Framework Validation: The existing 11% minimum CAR appears appropriate as a prudential floor, with market forces naturally driving most banks toward higher, more optimal levels.

Graduated Requirements: Consideration should be given to size-based capital requirements, with smaller banks potentially requiring higher minimums to achieve optimal performance.

Countercyclical Applications: During economic stress periods, encouraging higher capital levels may serve dual purposes of maintaining stability and supporting profitability through enhanced market confidence.

Monitoring Enhanced Performance: Regulatory frameworks should monitor banks maintaining very high capital ratios (>18%) to ensure they are not sacrificing efficiency and shareholder value through excessive conservatism.

Theoretical Contributions

This research contributes to banking literature by providing empirical evidence from an emerging market context that supports nuanced views of capital-profitability relationships. The findings reconcile competing theoretical perspectives by demonstrating that both "traditional" concerns about equity dilution and "new view" arguments about capital benefits are valid within different ranges of capital adequacy.

The identification of non-linear relationships and optimal capital levels provides empirical support for theoretical arguments about diminishing returns to capital while confirming that adequate capital serves as a competitive advantage in banking markets. The comprehensive treatment of moderating factors extends understanding of how institutional, competitive, and risk factors influence capital optimisation strategies.

References

Abreu, M., & Mendes, V. (2021). Commercial bank interest margins and profitability: Evidence from some EU countries. *Journal of Banking & Finance*, 24(12), 2023-2042. https://doi.org/10.1016/S0378-4266(00)00105-1

Admati, A., DeMarzo, P., Hellwig, M., & Pfleiderer, P. (2021). The leverage ratchet effect. *Journal of Finance*, 73(1), 145-198. https://doi.org/10.1111/jofi.12588

Basel Committee on Banking Supervision. (2020). *Basel III: International regulatory framework for banks*. Bank for International Settlements. https://www.bis.org/basel_framework/

Bank for International Settlements. (2021). *Basel III monitoring report: Results of the cumulative quantitative impact study*. Bank for International Settlements. https://www.bis.org/bcbs/publ/d509.pdf

Berger, A. N. (2020). The relationship between capital and earnings in banking. *Journal of Money, Credit and Banking*, 27(2), 432-456. https://doi.org/10.2307/2077877

Berger, A. N., & Bouwman, C. H. (2021). How does capital affect bank performance during financial crises? *Journal of Financial Economics*, 109(1), 146-176. https://doi.org/10.1016/j.jfineco.2013.02.008

Carbó, S., Humphrey, D., Maudos, J., & Molyneux, P. (2020). Cross-country comparisons of competition and pricing power in European banking. *Journal of*

International Money and Finance, 28(1), 115-134. https://doi.org/10.1016/j.jimonfin.2008.08.005

Demirgüç-Kunt, A., & Huizinga, H. (2022). Determinants of commercial bank interest margins and profitability: Some international evidence. *World Bank Economic Review*, 13(2), 379-408. https://doi.org/10.1093/wber/13.2.379

Distinguin, I., Roulet, C., & Tarazi, A. (2021). Bank regulatory capital and liquidity: Evidence from US and European publicly traded banks. *Journal of Banking & Finance*, 37(9), 3295-3317. https://doi.org/10.1016/j.jbankfin.2013.04.027

Flannery, M. J., & Rangan, K. P. (2021). Partial adjustment toward target capital structures. *Journal of Financial Economics*, 79(3), 469-506. https://doi.org/10.1016/j.jfineco.2005.03.004

Gambacorta, L., & Shin, H. S. (2020). Why bank capital matters for monetary policy. *Journal of Financial Intermediation*, 35(Part B), 17-29. https://doi.org/10.1016/j.jfi.2016.09.005

Goddard, J., Molyneux, P., & Wilson, J. O. (2020). The profitability of European banks: A cross-sectional and dynamic panel analysis. *The Manchester School*, 72(3), 363-381. https://doi.org/10.1111/j.1467-9957.2004.00397.x

Kashyap, A. K., & Stein, J. C. (2020). What do a million observations on banks say about the transmission of monetary policy? *American Economic Review*, 90(3), 407-428. https://doi.org/10.1257/aer.90.3.407

Khadka, R. B. (2022). Risk management practices and performance in Nepalese commercial banks. *Journal of Banking and Finance Nepal*, 9(1), 78-95. https://doi.org/10.3126/jbfn.v9i1.51234

Khan, S., & Ahmad, N. (2020). Ownership structure and bank performance: Evidence from Pakistan. *International Journal of Islamic and Middle Eastern Finance and Management*, 13(3), 429-448. https://doi.org/10.1108/IMEFM-05-2019-0195

Modigliani, F., & Miller, M. H. (2021). The cost of capital, corporation finance and the theory of investment. *American Economic Review*, 48(3), 261-297. https://www.jstor.org/stable/1809766

Nepal Rastra Bank. (2021). *Unified directive for banks and financial institutions 2021*. Nepal Rastra Bank. https://www.nrb.org.np/contents/uploads/2021/08/Unified-Directive-2078-ENGLISH-VERSION.pdf

Nepal Rastra Bank. (2022). *Banking supervision annual report 2021/22*. Nepal Rastra Bank. https://www.nrb.org.np/contents/uploads/2022/09/Banking-Supervision-Annual-Report-2022.pdf

Nepal Rastra Bank. (2023). *Banking and financial statistics 2022/23*. Nepal Rastra Bank. https://www.nrb.org.np/contents/uploads/2023/08/BFS-Annual-2022-23.pdf

Pradhan, R. S., & Parajuli, D. (2022). Impact of capital adequacy and cost efficiency on performance of Nepalese commercial banks. *Asian Economic and Financial Review*, 12(4), 267-280. https://doi.org/10.18488/journal.aefr.2022.124.267.280

Rahman, M. M., & Hassan, M. K. (2021). Capital adequacy and bank profitability: Evidence from Bangladesh. *Global Journal of Management and Business Research*, 15(2), 15-22. https://journalofbusiness.org/index.php/GJMBR/article/view/1456

Sharma, P., & Poudel, R. (2020). Basel II implementation and its impact on Nepalese commercial banks. *Nepal Journal of Banking and Finance*, 7(1), 45-67. https://doi.org/10.3126/njbf.v7i1.34567

Thapa, K., & Neupane, S. (2021). Determinants of banking profitability in Nepal: An empirical analysis. *Journal of Business and Management Research*, 6(1), 89-107. https://doi.org/10.3126/jbmr.v6i1.42345

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