Relationship between Capital Adequacy and Profitability: A case of Nepalese Banking Industry

INTRODUCTION

Financial sector plays a significant role in the economy of a country. Nations with strong financial institutions are important for increased investment, economic growth, employment, and poverty reduction. Capital adequacy is the amount of capital which a bank holds as reserves against risky assets as per the requirement by its financial regulators to hedge against the probability of bank failure.

Bank capital plays a very important role in maintaining safety and solidarity of banks as banks operate under an environment with a high degree of uncertainty, which can lead to both expected and unexpected loss risk. Given that banks operate in a highly uncertain environment, these risks might reach the depositor's funds. To prevent banks from such risk, banks need to have a proper risk management strategy. The banking sector of Nepal is growing rapidly. Nepal Rastra Bank (NRB), the central bank of Nepal, issues unified directives consisting of various rules and regulations as per the need of the financial sector. The NRB directive includes the capital adequacy norms for the commercial banks representing a sufficient amount of qualitative capital and risk management practices. Growing competition and examples of banking failures, not only in Nepal, but worldwide, have awakened the central bank, policymakers and bankers to make sure the operations are less prone to risks. Over the last few decades, the Nepalese banking industry has transformed significantly due to liberalization, deregulation, advancement in technology, and globalization. In the late 1980s, the financial liberalization policy was introduced. As a result, Nepal's financial system witnessed a structural change where a large no. of domestic as well as joint venture banks entered into the market, leading to an increment of investment in the banking industry. In the early 1990s, the banking sector went through significant changes where liberalization resulted in the entry of new banks, deregulation expanded the scope of operation, technology advancement brought sophisticated techniques to operate and globalization invited a higher degree of competition. Nepal had 272 Banks and Financial institutions (BFIs) during its peak as a result of the open and liberal licensing policy implemented by NRB. The number was high relative to the size of the economy, which could invite unhealthy competition, lack of capacity to finance large-scale projects, and a weak and unstable financial system.

Nepal Rastra Bank (NRB) has developed and enforced capital adequacy requirements based on international practice norms of Basel Committee with an appropriate level of customization based on domestic state of market development. For the internationally active banks, the Basel Accord sets minimum capital standards. Bank for International Settlements issued a capital framework concept commonly known as the 1988 accord, Basel I, which was later designed as the Basel II framework as the development of the financial markets was too quick and the first accord was not sufficient anymore. After the global financial crisis in 2008, Basel III was issued with tighter regulations and requirements to strengthen the banking sector, the structure of the rules of capital and reserves, leverage, liquidity and

funding to ensure that banks maintain sufficient capital to meet financial obligations and absorb unexpected losses. As stated by the regulatory bodies, every bank has to hold a certain percent of capital adequacy to protect the bank from going insolvent. Capital adequacy therefore is considered as a safety valve to protect the depositors by bringing confidence in the financial soundness and stability of the bank with continued assurance that it will honor its obligations to depositors and creditors. This is usually expressed as a capital adequacy ratio of equity that must be held as a percentage of risk-weighted assets. RWA is a measure of the number of banks' assets for risk. To ensure the safety of depositors' commercial banks are obliged to provide sufficient capital to cover for any risk or uncertainty that may occur in future, and develop the right strategy to ensure the survival of the bank with a higher percentage of CAR than the specified percentage and to avoid the intervention of monetary authorities to prevent its decline, which is known Corrective actions.

Capital Adequacy Ratio is one of the main indicators of capital adequacy. This rate can be measured by two tiers (tier 1), a core capital (equity), which can be the financial institution's continuity of its business without interruption. The second tier is extended, which includes core capital slide (property rights) as well as any technical reserves or allowances loaded on income, and is considered as a non-outflow supported core capital. On the other hand, the capital adequacy and profitability influence the soundness and stability of the financial sector. In this connection, investigating the relationship between capital adequacy and profitability in the banking industry is crucial for regulating bodies like Nepal Rastra Bank, bankers, policy makers, researchers, investors, and the public. Through this project, we will try to address the following concerns:

1. What is the existing capital adequacy position of the selected banks?
2. How do capital adequacy indicators (Capital adequacy ratio, loan and advances, non-performing loans and government securities) influence the profitability of banks?
3. What is the relationship between capital adequacy ratio and bank's exposure to credit risk?

STUDY DESIGN

This project uses descriptive and analytical research design, to examine the relationship of capital adequacy on the profitability of commercial banks in Nepal from the fiscal year 2008 to 2022. The study also considers political events as checkpoints to conduct pre-event and post-event analysis. The focus variables will be:

- Capital Adequacy Ratio is one of the main indicators of capital adequacy.
- Loans and Advances: It assesses a bank's liquidity by comparing a bank's total loans to its total deposit for the same period.
- Government securities to total investment: This ratio explains the percent of investment in the government securities out of the total investment.
- Non-Performing Loan: When a borrower is default and fails to make scheduled payment of the principal or interest, it becomes a non-performing loan. To improve the economic growth of the bank, it must minimize the NPL.

20 commercial banks are operating in Nepal, excluding development banks and including the government owned, joint, and international banks. Due to time and resource factors, the sample would be composed of a few commercial banks, development banks, and government-owned banks. Among multiple class A and class B banks, we take a total of 15 banks as samples to make the study more concise and result-oriented. The sample is presented below.

Table 1 **List of Banks used for the project**

Bank	Type	Established Date (A.D.)	Merger History
Rastriya Banijya Bank Limited	Government	1966	No
Nepal Bank Limited	Government	1937	No
Agricultural Development Bank Limited	Government	1968	No
Standard Chartered Bank Limited	Joint Venture Class 'A'	1987	No
Himalayan Bank Limited	Joint Venture Class 'A'	1993	Yes
Everest Bank Limited	Joint Venture Class 'A'	1994	No
Nepal SBI Bank Limited	Joint Venture Class 'A'	1993	No
Nabil Bank Limited	Class 'A'	1984	Yes
Sanima Bank Limited	Class 'A'	2012	No
Citizens Bank International Limited	Class 'A'	2007	No
NMB Bank Limited	Class 'A'	2008	No

Siddhartha Bank Limited	Class 'A'	2002	No
Machhapuchhre Bank Limited	Class 'A'	2012	No
Prime Commercial Bank Limited	Class 'A'	2007	No
NIC Asia Bank Limited	Class 'A'	1998	Yes

The following ratios will be used in this study:

- Capital Adequacy ratio (Capital to Risk Weighted Assets Ratio)

  CAR= Total Capital fund/Total Risk Weighted Assets
- Loans and Advance to Assets ratio

  Loans and Advance to Assets ratio = Total loan and advances/Total Assets
- Government Securities to total Investments

  Government Securities to total Investments= Investment in Government securities/Total investment
- Non-Performing Loan

  NPL=Non-Performing Loan/Total loan
- Return on Equity

  ROE= Net Profit/Total shareholders' equity

ANALYSIS

The table below consists of a summary of all the descriptive variables used in this study. The independent variables are CAR, AAR, GSIT & NPLR while the dependent variable is ROE. ROE is one of the major factors of bank profitability. It helps to understand the overall situation of the selected banks. Besides that, it also provides a clear understanding about the profitability and capital adequacy indicators.

Table 2 **Descriptive Statistics of Variables**

	ROE	CAR	AAR	GSIT	NPL
count	225	225	225	225	225
mean	16.1008	10.93938	0.606667	0.944133	1.915244
std	9.443715	8.081704	0.139252	0.156474	2.578672
min	-23.47	-44.17	0	0	0
25%	12.57	10.86	0.57	0.97	0.5
50%	15.2	12.15	0.65	1	1.2
75%	18.57	13.7	0.7	1	2.3
max	72.35	36.25	0.8	1	21.6

The CAR is a measure of how much capital a bank has available, reported as a percentage of the bank's risk weighted credit exposures. As stated by the unified directives, a bank must maintain minimum CAR of 11%. In the above table, the maximum value of CAR is 36.25% and the minimum is -44.17%. Similarly, the mean of CAR is 10.93% which is its average value. Since the average CAR of all the banks is slightly lower than the minimum capital requirement set by NRB, we conclude that the banks chosen have somehow almost enough capital to protect their depositors' money against risk. The NPL ratio is used to measure the level of the bank's credit risk and the quality of outstanding loans. The mean value of NPL is 1.91% with a standard deviation of 2.5%. The maximum value is 21.6% and the minimum value is 0.01%. The difference between maximum and minimum value is very large, but such low numbers are very rare given the market and economic conditions. Increasing NPL suggests that banks have a high probability of a large number of credit defaults that will affect the profitability and net-worth of banks and also wear down the value of the asset.

For this project, we use both fixed effect model and random effect model for regression analysis to estimate the relation between the independent and dependent variable. The time series dimension is the year from 2008 to 2022 and the cross-sectional variables are CAR, AAR, GSIT and NPL. The dependent variable is the ROE and the independent variables used are CAR, AAR, GSIT and NPL.

Table 4 **Fixed and Random Effect Models**

Stats	Fixed Effect	Random Effect
R-squared	4.87%	0.7487
F-statistic	2.6361	164.62
P-value	0.0352	0.000

Generally, fixed effects model is preferred when there are entity-specific effects that might be correlated the selected independent variables which can help control for omitted variable bias. Reversely, if entity-specific effects are not a concern and random effects assumptions of exogeneity of entity-specific effects holds true, the random effects model can be more efficient and provide valid coefficient estimates.

This study shall go along with the random effect model but for assurance the study conducts both the fixed effect and random effect and ultimately decide with Hausman Test for choosing between the two. As panel data analysis is a widely-used method in econometrics that combines cross-sectional and time-series data to provide valuable insights into complex relationships among three factors, Bank, Year and independent variables, the use of the fixed effect (FE) model and the random effect (RE) model becomes evident. These models allow to account for unobserved heterogeneity among the selected banks and to assess the impact of various independent variables on a dependent variable in a similar way to normal pooled regression. In the Fixed Effect Model, it uncovers individual-specific effects, instead of taking into consideration the entity-specific effects, i.e., that of the Bank, which are constant over time. The effects mentioned can be the environmental effects, regulatory and other compliance-related issues, or the changes in the economic indicators, which can be a significant cause of impact to the dependent variable. As the results displayed in the table above, the R-squared value for the fixed effect model is 0.0487, indicating that the independent variables CAR, AAR, NPL and GSIT are responsible for 4.87% of the variation in ROE. This relatively low R-squared suggests that other unobservable factors not included in the model might be influencing ROE, like the number of banks, capital structure or the changes in BASEL regulations.

Among the independent variables, GSIT seems to have statistical significance with a p-value of 0.0473. Normally, considering the significance level of 5%, Investment in government securities to total securities investments has a meaningful relationship with ROE. The positive coefficient of 9.9983 reveals that if there is an increase in investment in government securities, it corresponds to an increase in ROE, while keeping all the other variables constant at this point. On the other hand, the coefficients of CAR, AAR, and NPL are not statistically significant, which derives that these variables might not have a significant linear relationship with ROE. Changes in these variables do not hugely impact the change or fluctuations of ROE. In the fixed effect model, the paper also examines the F-test for poolability, which yields a p-value of 0.0000, indicating that individual Banks used in this study have differing intercepts. This result specifically supports the use of the fixed effect model

as this points to explicit accounting for individual-specific effects. The statistical framework used in this study, controlling these effects, the fixed model provides a more accurate representation of the connection between the independent variables AAR, CAR, NPL and GSIT with the dependent variable ROE.

The paper is going to focus more on the Random Effect Model, which is inclusive of time variations and time-invariant effects. This model combines both time-invariant individual-specific effects and time-varying random errors. This model also provides different aspects of the data by accounting for both the fixed bank-specific factors and the random fluctuations that entities might experience over the timeframe of 2008 to 2022. As per the analysis mentioned in the table above, the R-squared value for the random effect model increases to 0.7487, which is very high compared to the fixed effect model. This implies that the independent variables combined of CAR, AAR, GSIT and NPL collectively explain around 74.87% of the fluctuations that are observed in ROE. This higher R-squared suggests a stronger fit of the model to the data compared to the fixed effect model. In this model, similar to the fixed effect, GSIT continues to bang its place for having the statistically significant relationship with ROE. Tts coefficient of 13.543 and a low p-value of 0.0003 supports that change in this variable will highly impact the ROE change considering the timeframe from 2008 to 2022. The outcome is also similar in the case of fixed effect model where similar results were observed. However, other independent variables CAR, AAR, and NPL do not establish significant relationships with ROE in this model which is also similar in that of fixed effect model. The negative and inverse relationship between CAR and ROE was observed in previously published papers in the case of Nepal and other south Asian countries as well, which is the exact replica with different coefficients in this study as well.

Comparing both the models, the random effect model, like predicted before, appears to provide a better fit for the data, as it is supported by its higher R-squared value. This suggests that the random variation across Banks and the timeframe of 2008 to 2022 plays a substantial role in explaining the variation in ROE. The fixed effect model is appropriate when individual-specific effects remain constant over time, as it confidently captures all the Bank-specific factors that influence the Return on Equity, a very useful method to control the unobserved heterogeneity. On the other hand, the random effect model is suitable when both time-invariant individual-specific effects and time-varying random errors are present. It offers insights into the combined impact of these factors on the dependent variable, in this case, ROE. In both models, GSIT depicts a positive and direct impact on ROE. This finding underscores the significance of the Investment in government securities as a predictor of higher Return on Equity, regardless of the model chosen. However, the lack of significance for CAR, AAR, and NPL across both models suggests that their linear relationships with ROE might be limited or might require further exploration through different specifications or data transformations. The findings from these models contribute to a more nuanced comprehension of the factors that drive Return on Equity. While the random effect model appears to offer a better fit in this case, considering the underlying assumptions and the context of the analysis, when

choosing between the fixed effect and random effect models, it is important to make sure which model better suits the explanation of the hypothesis mentioned in the above sections.

Hausman Test is then conducted to see if the model should use fixed effect or random effect. The null hypothesis of the Hausman test is that there is no systematic difference between the estimates obtained from the fixed effects model and the random effects model. If the p-value associated with the Hausman test is greater than a chosen significance level of 5%, usually it is insufficient evidence to reject the null hypothesis. Therefore, the random effects model is considered appropriate. The Hausman test statistic of 1.1655770468332118 is less than the critical value from the chi-squared distribution, indicating selection of random effects model as it is more appropriate for the data feed. This means that the random effects model is consistent and efficient compared to the fixed effects model. It handles the error terms that is found in the model, i.e., statistically the terms sigma_u and sigma_e. The null hypothesis stated by the test is that the Random effect is applicable. Alternative hypothesis is that the fixed effect model is appropriate. Difference in coefficients is not systematic as the p-value is greater than 0.05. If the calculated Hausman statistic is greater than the critical value from the chi-squared distribution with appropriate degrees of freedom, it suggests that the random effects assumptions are violated, and the fixed effects model is more appropriate. The Hausman statistic is a numerical value that quantifies the difference between the fixed effects and random effects estimates, taking into account the standard errors of the estimates. It is used in the calculation of the p-value for the Hausman test. The specific value of the statistic 1.165 itself does not have a straightforward interpretation. The p-value associated with the Hausman statistic is 0.88. This p-value represents the probability of observing a Hausman statistic as extreme as the one computed under the assumption that the null hypothesis is true. In this case, a high p-value, i.e., the one closer to 1 suggests that the difference between FE and RE estimates is likely due to random sampling variability. This supports the conclusion that the random effects model is appropriate. Since the Random Effect Model is selected, now we check for pathologies that might be in the model used. Commonly tested pathologies while conducting regression are multicollinearity and heteroscedasticity. To check for the multicollinearity, the Variance Inflation Factor is checked, which was 18.22 on average. Any VIF more than 5 is considered not to be good, but as this paper is based on factual data, alteration or data scrapping is not an option, thus, this study ignores the problem of multicollinearity as of now. Moving towards the problem of heteroscedasticity, it means that the variability of the residuals, i.e., meaning the differences between observed and predicted values of the chosen random effect model, is not constant across all levels of the CAR, AAR, GSIT, and NPL. The spread or dispersion of the residuals changes as the values of the predictor variables change. Robust command has also been applied to remove the heteroscedasticity effect on the results in the fixed model. Although other test like Breusch-Pagan test, Cook-Weisberg test or Irtest is done on advanced research to remove the effect of heteroscedasticity on panel data, for now only robust is used for analysis.

The random model regression with robust standard errors, when compared to the earlier results, the primary difference is in the standard errors, t-statistics, and p-values of the coefficient estimates. It can be observed that the standard errors of the coefficient estimates have been adjusted to account for heteroscedasticity using robust standard errors. The t-statistics and p-values associated with the coefficient estimates have changed due to the adjustment in standard errors. The t-statistic is calculated as the ratio of the coefficient estimate to its standard error. Since the standard errors have changed, the t-statistics and p-values have also changed accordingly. The R-squared values are unaffected by the robust standard errors, which means that the goodness of fit of the model remains the same in both cases. The F-statistics for overall model fit and poolability are also unaffected by robust standard errors. Due to the adjustment in standard errors and the subsequent change in t-statistics and p-values, the coefficient estimate for GSIT is now statistically significant at the 5% significance level with p-value = 0.0427, whereas it was not significant in the previous. By adjusting the standard errors, the study ensures that the hypothesis tests and confidence intervals remain valid even in the presence of heteroscedasticity issues.

CONCLUSION AND IMPLICATION

Study of analyzing the determinants of commercial bank profitability in Nepal shows that inclusion of external factors such as the shape the size of bank, industry specific factors like concentration and banking sector development, macroeconomic variables like GDP growth, inflation rate and exchange rate and other profitability indicators like ROA would have made differences in the results. Further studies can address other Capital adequacy indicators, absolute number of branches, and annual inflation rate, net interest margin, etc., while conducting their studies. Simultaneous negative relationship between capital and profitability provides recommendations for banks to improve market performance by managing and efficiently making use of capital. A large amount of capital or quality loans might generate high CAR for banks, but reduces the amount of profit in the long run. To maintain an adequate level of capital as directed by the NRB, besides raising equity capital, banks also can reduce risk-weighted assets, this in turn can help them with the BASEL regulatory framework as well.

Some research around the world has shown the positive relationship of CAR when ROA is taken as their profitability indicator. But as the finance basics suggest, for developing economies like Nepal, ROE would be a better measure. This paper does not study the in-depth implications of the BASEL III accord, which could have a major impact upon the results and the outcome. The outcomes of this paper furnish proof regarding the endogeneity of the capital ratio. With the absence of any systematic correlation between the capital held and the profitability observed within the realm of banking, it can be inferred that the diverse capital ratios emerged as consequences of competitive markets functioning perfectly. In such a scenario, these markets would erase any structured connection between the capital amount and the overall performance of the banks. Another significant discovery from this study indicates a significant and negative reduction in profitability for all banks associated with the Common Equity Tier 1 capital ratio (CAR). This suggests that as a bank's financial stability increases, its profit generation tends to decrease, which, in opposition to and contradicts the theoretical understanding of capital sufficiency as praised a lot by the recent Basel III regulations. These regulations aim to enhance the soundness and stability of the global banking system by urging banks to enhance their capital resilience to achieve greater profitability. The primary deduction is that credit risk exerts a favorable influence on profitability when gauged using NPL in proportion to total assets, ROA. Inversely, the CAR exhibits an unfavorable impact on profitability when measured through ROE, which in the case of Nepal is one of the best predictors of profitability position of banks. On a policy level, considering the differential effect of credit risk on profitability, this paper supports the fact that there isn't a universal solution to an adequate capital level that maximizes profitability. Hence, distinct policy directives are necessary for all classes of banks in Nepal. Given the association between NPLs and ROE, the paper advises commercial banks to take measures aimed at enhancing their strategies for managing credit risk. This will consequently bolster their operational efficiency. On the other hand, with regards to the connection between CAR and profitability, this paper

advises policymakers not to enforce a blanket application of CAR policies, because elevating the capital requisites of banks to augment their financial robustness does not guarantee increased profitability over time.

Some recommendations:

- An optimal capital level helps to create balance between capital adequacy and profitability. If a bank holds a higher degree of CAR, it might affect the profitability of the bank due to the higher amount of unused capital fund. So, it is recommended for banks to hold an optimal capital level.
- The advances to asset ratios show a negative relationship between the advances to asset ratio. It means that if a bank gives away a loan without proper analysis, it may be riskier towards higher default. Thus, it is recommended for banks to make a proper analysis before lending.
- Government securities are one of the safest forms of debt instrument, as an increase in government securities leads to an increase in profitability. It is less risky, so the bank is recommended to invest more in government securities.
- An increase in nonperforming loans decreases the profitability of the bank as NPL and ROE have a negative relationship with each other. As presented in the data, the NPL of banks is increasing, which has caused a decrease in its net profit. So, banks need to make effective policies and analysis to reduce the level of non-performing loans.
- This paper recommends that NRB to ensure that the gains of the banking reform processes are sustained, more decisive measures aimed at tightening the risk management framework in the commercial banking sector will create a positive effect on the profitability positions of banks.

Studies and research on a similar field are highly suggested to overcome the challenges and limitations faced by this paper. Data maintenance is one of the major issues as few banks have reports published in Nepali and the uniformity among the annual reports published is very poor. Also, this paper sampled 15 commercial banks among the rest, further studies are suggested to utilize all the banks in the system for optimal and strong results, which can help decision makers and regulators to have an idea about the impact of capital adequacy on the profit position of banks in Nepal.