



## Impact of credit risk, operational risk, market risk and leverage on profitability of commercial banks in Nepal

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### Abstract

This study examines the impact of credit risk, operational risk, market risk, and leverage on bank profitability in Nepal. The dependent variables of the study are ROA and ROE and independent variables are NPLR, CIR, MRE and LR. This study employs both descriptive and causal research designs, utilizing secondary data from 10 commercial banks in Nepal over a 10-year period, from 2070/71 to 2079/80, resulting in a total of 100 observations. Data analysis is conducted using SPSS 20 and Microsoft Office Excel 2003 to examine the relationships between various factors affecting bank profitability. Model 1, which relates ROA to predictors such as the Leverage Ratio (LR), Market Risk Exposure (MRE), Non-Performing Loan Ratio (NPLR), and Cost-to-Income Ratio (CIR), shows a moderate correlation, with CIR being the only significant predictor of ROA, indicating a strong negative impact. However, NPLR, MRE, and LR do not significantly affect ROA. Model 2 is examining ROE, reveals a weaker connection, with only LR showing a statistically significant negative relationship, suggesting that higher leverage is associated with lower ROE. The other predictors are NPLR, CIR, and MRE do not significantly affect ROE. Overall, these findings highlight the importance of CIR in determining ROA and leverage in influencing ROE, with other risk factors having limited impact in this context.

**Keywords:** Profitability, credit risk, operational risk, market risk and leverage

### Introduction

Credit risk is the primary risk encountered by banks, and its effective measurement and management are crucial for the success of the business. It refers to the possibility that a borrower might fail to repay a loan, resulting in the loss of both the principal and interest. This risk emerges because borrowers typically rely on future cash flows to meet their current obligations, though it is rarely guaranteed that these funds will be available. The interest payments made by borrowers serve as compensation for lenders assuming credit risk. By managing credit risk effectively, banks not only protect their own financial stability but also contribute to broader systemic stability and efficient capital allocation within the economy (Psillaki *et al.*, 2010) <sup>[21]</sup>. Managing credit risk involves assessing the adequacy of a bank's capital and loan loss reserves, a process that has historically presented challenges for financial institutions.

Operational risks in banking arise from failures or inadequacies in internal processes, human errors, system breakdowns, or external events that disrupt normal operations. Unlike other risk types, operational risk is not directly linked to efforts aimed at generating returns (Fahrul & Rusliati, 2016) <sup>[9]</sup>. The Basel Committee on Banking Supervision categorizes operational risks into seven types, including internal and external fraud, as well as failures stemming from organizational processes, structures, or external incidents. While the severity of these risks can vary across financial institutions, they often stem from operational inefficiencies. To assess operational risk, the Operating Expenses to Operating Income (BOPO) ratio is commonly used, which measures a bank's operational costs in relation to its income, offering insight into its operational efficiency. Achieving efficiency involves minimizing transaction costs while maintaining effectiveness. Banks face operational risks in managing their activities, assets,

and revenue generation (Adam *et al.*, 2018) <sup>[1]</sup>. Proper risk management helps financial institutions identify vulnerabilities, even in areas beyond their expertise, and adopt strategies to mitigate risks, thus reducing systemic vulnerabilities (Cristina *et al.*, 2008) <sup>[7]</sup>.

Market risk refers to the potential for financial losses resulting from changes in the prices of financial instruments such as stocks, bonds, commodities, and currencies. This risk arises when the value of an investment or portfolio decreases due to shifts in market conditions, which include factors like interest rates, economic data, geopolitical events, and market sentiment (Bodnar & Marston, 1996) <sup>[4]</sup>. It is a fundamental aspect of investing and is typically divided into systematic risk (affecting the whole market) and unsystematic risk (specific to individual assets or sectors). Market risk, often called systematic or non-diversifiable risk, includes the possibility of financial losses caused by fluctuations in broader market or economic conditions. This type of risk can result in a decline in the value of investments due to factors such as changes in interest rates, exchange rates, commodity prices, economic indicators, political events, and market sentiment. Market risk affects a wide range of financial assets like stocks, bonds, derivatives, and currencies (Ngugi, 2001) <sup>[17]</sup>.

Leverage is a key element of financial strategy that increases returns by ensuring that the return on borrowed funds exceeds the cost of the debt. Positive leverage happens when a company's return on assets exceeds the pre-tax interest rate on its debt, while negative leverage occurs when the return is lower than the debt cost. Mandelker and Rhee (1984) <sup>[15]</sup> observed that highly profitable companies across different industries tend to maintain low leverage ratios and associate significant stockholder gains with events that increase leverage, such as stock buybacks. Mangalam and Govindasamy (2010) <sup>[16]</sup> explored leverage

further by analyzing its effects on earnings per share and its financial, operational, and overall impact. Financial managers aim to enhance shareholder value by boosting investments and minimizing capital costs. According to Berger and Udell (2006), leverage reduces the cost of external equity, aligning managerial decisions with the interests of shareholders, and playing a significant role in influencing industry performance.

The profitability of commercial banks in Nepal is significantly influenced by factors such as credit risk, operational risk, market risk, and leverage. Credit risk, particularly through non-performing loans (NPLs), directly impacts banks' profitability by increasing provisions for bad debts and reducing loan income (Poudel, 2012) [20]. Operational risks, arising from inefficiencies and system failures, contribute to higher operational costs, thereby reducing profitability. Market risk, which includes fluctuations in interest rates and exchange rates, can further destabilize a bank's earnings, particularly in unstable economic conditions. Finally, leverage amplifies both potential risks and returns; excessive leverage increases a bank's vulnerability to market fluctuations, which could lower profitability if not effectively managed (Ladley, 2013) [14]. Effective risk management is crucial for mitigating these risks and maintaining financial stability in Nepalese banks.

The impact of credit risk, operational risk, market risk, and leverage on the profitability of commercial banks in Nepal is significant and multifaceted. Credit risk, which arises when borrowers fail to repay loans on time, directly affects the bank's earnings and overall financial stability (Shrestha, 2020). Operational risk, related to internal issues such as system failures or human errors, can disrupt a bank's operations and negatively impact profitability (Rai & Shrestha, 2021) [22]. Market risk, caused by changes in interest rates, foreign exchange rates, or asset prices, can alter the value of a bank's holdings, thereby influencing its income and risk profile (Adhikari & Paudel, 2019). Furthermore, leverage, the ratio of a bank's debt to equity, can amplify both the potential for profit and the risk of loss, especially in volatile market conditions (Gurung, 2022).

### Problem statement

The profitability of commercial banks is significantly impacted by various types of risks, including credit risk, operational risk, market risk, and leverage. Credit risk emerges when borrowers are unable to fulfill their repayment obligations, causing financial losses (Koirala, 2020) [13]. Operational risk stems from failures in internal processes, systems, or external events that can disrupt the bank's operations and affect its profitability (Shrestha, 2019) [24]. Market risk, which involves changes in financial market conditions, can influence the value of a bank's assets and liabilities. Leverage, while often used to increase returns, can also amplify losses if there are market downturns or poor credit performance (Basel Committee on Banking Supervision, 2011). Despite the importance of these factors, their combined effect on the profitability of commercial banks in Nepal remains an under-researched topic, especially considering the rapidly growing financial market and the evolving regulatory environment (Koirala, 2020) [13].

While previous studies have emphasized the importance of understanding the interaction between these risks and their

impact on bank performance, limited research has focused on how these factors specifically influence the profitability of commercial banks in Nepal (Shrestha, 2019) [24]. Given the distinct economic conditions and banking environment in Nepal, a more focused examination is needed to understand how credit, operational, market risks, and leverage interact and influence financial outcomes in the country's banking sector (Basel Committee on Banking Supervision, 2011) [2]. This study aims to address this gap by analyzing the relationship between these risks and profitability, offering valuable insights for banking professionals and policymakers in Nepal. It will also help in developing effective risk management strategies to minimize their adverse impact on profitability. The research questions of the study are as follows;

- Is there any relationship between non-performing loan ratio, cost to income ratio, market risk exposure and leverage ratio on profitability of commercial banks in Nepal?
- Do non-performing loan ratio, cost to income ratio, market risk exposure and leverage ratio affect on profitability of commercial banks in Nepal?

### Objectives of the Study

The main objective of the study is to examine the impact of credit risk, operational risk, market risk and leverage on profitability of commercial banks in Nepal. To accomplish the main objective, specific objective of the study are:

- To measure the relationship between non-performing loan ratio, cost to income ratio, market risk exposure and leverage ratio on profitability of commercial banks in Nepal.
- To examine the impact of non-performing loan ratio, cost to income ratio, market risk exposure and leverage ratio on profitability of commercial banks in Nepal.

### Hypothesis

**H<sub>1</sub>:** There is a significant effect of non-performing loan ratio on ROA.

**H<sub>2</sub>:** There is a significant effect of cost to income ratio on ROA.

**H<sub>3</sub>:** There is a significant effect of market risk exposure on ROA.

**H<sub>4</sub>:** There is a significant effect of leverage ratio on ROA.

**H<sub>01</sub>:** There is a significant effect of non-performing loan ratio on ROE.

**H<sub>02</sub>:** There is a significant effect of cost to income ratio on ROE.

**H<sub>03</sub>:** There is a significant effect of market risk exposure on ROE.

**H<sub>04</sub>:** There is a significant effect of leverage ratio on ROE.

### Rationale of the study

This study aims to explore the various factors that impact the profitability of commercial banks in Nepal, particularly focusing on credit risk, operational risk, market risk, and leverage. Each of these risks plays a significant role in determining a bank's financial performance. Credit risk arises from the potential for loan defaults, which can negatively affect earnings. Operational risk, resulting from internal inefficiencies or failures, can lead to financial losses. Market risk, driven by fluctuations in the financial markets, affects the bank's ability to maintain consistent profits. Leverage, while amplifying returns, also increases a

bank's exposure to financial instability, influencing overall profitability.

In the context of Nepal's rapidly developing banking sector, it is essential to examine how these risks collectively influence bank profitability. With the banking environment becoming more competitive and complex, understanding the interactions between these risks is crucial for the stability and growth of the sector. This study seeks to offer insights that will help policymakers and bank managers improve risk management strategies, contributing to the overall stability and profitability of commercial banks in Nepal. The findings are expected to inform better financial practices and regulatory approaches for the banking industry.

### Empirical review

Gizaw *et al.* (2015) <sup>[11]</sup> examined the impact of credit risk on the profitability performance of commercial banks in Ethiopia. Using secondary data from eight sample commercial banks over a 12-year period (2003-2014), which was obtained from annual reports of the respective banks and the National Bank of Ethiopia, they analyzed the data using descriptive statistics and a panel data regression model. The findings showed that credit risk measures, such as non-performing loans, loan loss provisions, and capital adequacy, significantly influenced the profitability of commercial banks in Ethiopia. The study highlighted the importance of strengthening credit risk management to maintain the profitability of commercial banks in the country.

Syafi'i and Rusliati (2016) <sup>[25]</sup> investigated the effects of credit risk, market risk, operational risk, and liquidity risk on the profitability of banks listed on the Indonesia Stock Exchange between 2010 and 2014. Using descriptive and verification methods with a sample of 30 banks, the study applied multiple regression analysis to assess the relationships. The findings revealed that while credit risk did not have a significant impact on profitability, market risk, operational risk, and liquidity risk had a positive effect on profitability. The study also showed that these four risks collectively explained 67.1% of the variance in bank profitability. The research suggested that improving non-performing loans, net interest margin, the operating expenses to operating income ratio, and the loan to deposit ratio could enhance the profitability of banks.

Poudel (2018) <sup>[20]</sup> studied the impact of credit risk on the profitability of commercial banks in Nepal. The research focused on 15 commercial banks operating in Nepal, using data from 2002/03 to 2014/15. A Fixed Effect Model (FEM) of panel data analysis was employed to examine the relationship between credit risk and profitability, with profitability measured by return on equity. The findings indicated that credit risk significantly negatively affects the profitability of commercial banks. Additionally, variables like solvency ratio, interest spread rate, and inflation were found to have an insignificant negative impact on profitability. On the other hand, capital adequacy ratio, total assets, and GDP growth significantly positively influenced profitability, while the inter-bank interest rate had an insignificant positive impact.

Chepkemioi *et al.* (2019) <sup>[6]</sup> investigated the impact of market risk on the financial performance of non-bank financial institutions (NBFIs) listed on the Nairobi Stock Exchange (NSE) from 2012 to 2017. The study utilized the degree of financial leverage (DFL) indicators to measure

market risk, finding that financial leverage was positively associated with NBFI performance. Interest risk, in particular, was found to have the most significant impact on the financial performance of NBFIs in Kenya. Additionally, the study assessed annual data from 2007 to 2014 to examine the effect of interest rate fluctuations on bank profitability in Pakistan, discovering that bank profitability declined due to deposits with other banks and interest rates. In contrast, advances, loans, and investments were found to increase bank profitability. The study also analyzed data from the Casablanca Stock Exchange (CSE) between 2000 and 2016.

Fadun and Oye (2020) <sup>[8]</sup> examined the impact of operational risk management on the financial performance of commercial banks in Nigeria. Using secondary data from the audited financial statements of selected Nigerian commercial banks from 2008 to 2017, the study applied a Linear Multiple Regression Model to analyze the data. The results indicated a positive relationship between operational risk management and the financial performance of banks, highlighting that effective operational risk management practices positively influence financial outcomes. The study recommended that banks allocate adequate resources to understand and manage operational risks to improve their financial performance. It also suggested that future research could benefit from a larger sample size to further explore these relationships.

Cheng *et al.* (2020) <sup>[5]</sup> investigated the influence of credit risk, operational risk, and liquidity risk on the profitability of commercial banks in South Africa, using data from banks listed on the Johannesburg Stock Exchange for the period 2012-2018. The study utilized Smart PLS-SEM analysis to assess the relationships between the variables. The results revealed that credit risk, measured by non-performing loan ratio, capital adequacy ratio, and cost per loan, had a significant positive effect on profitability indicators like return on assets (ROA), return on equity (ROE), and net interest margin (NIM). Liquidity risk, including current ratio, acid-test ratio, and cash ratio, also showed a positive and significant impact on profitability. In contrast, operational risk, characterized by portfolio concentration, bank leverage, lawsuits, and resignation of key directors, was negatively associated with bank profitability. The study concluded that while credit and liquidity risks positively impacted profitability, operational risks needed more management, especially through investment diversification, efficient operational management, and reducing leverage to enhance financial performance.

Oli (2021) explored the relationship between financial leverage and the performance of Nepalese commercial banks by examining determinants such as return on assets (ROA), net profit margin (NPM), and earnings per share (EPS). Using secondary data from 20 commercial banks in Nepal covering the period from 2011/12 to 2016/17, the study applied OLS regression models to assess the significance of financial leverage on bank performance. The findings revealed that the debt to assets ratio, long-term debt ratio, debt to equity ratio, interest coverage ratio, and liquidity ratio had a positive relationship with ROA, NPM, and EPS. However, board size and Tobin's Q were found to have a negative impact on ROA. Additionally, debt to assets ratio, debt to equity ratio, interest coverage ratio, and board size positively influenced NPM and EPS, while long-term debt ratio, debt to equity ratio, bank size, and Tobin's Q

negatively affected these performance measures. The study concluded that the interest coverage ratio was the most influential factor in determining ROA, followed by debt ratios and liquidity.

Shrestha (2022) explored the effect of credit risk on the profitability of Nepalese commercial banks. The study used data from 18 commercial banks between 2013/14 and 2018/19. Credit risk was measured using the total loan to total deposit (TL/TD) ratio, cash reserve ratio (CRR), nonperforming loan to total loan (NPL/TL) ratio, and loan loss provision to total loan (LLP/TL) ratio, while profitability was measured by return on assets (ROA). The Fixed Effect model was employed for analysis. The findings revealed a significant impact of credit risk on profitability, with TL/TD having a positive influence and NPL/TL and LLP/TL having negative effects on profitability. The study recommended that bank management focus on increasing the ratio of total loans to total deposits while reducing nonperforming loans and loan loss provisions to enhance profitability.

Pandey (2023)<sup>[18]</sup> examined the impact of credit and market risk on bank performance by analyzing return on assets (ROA) and return on equity (ROE) as dependent variables and credit risk (CRE), non-performing loan ratio (NPLR), and market risk exposure (MRE) as independent variables. The study, which focused on a sample of 10 commercial banks in Nepal from fiscal years 2069/70 to 2078/79, utilized secondary data and employed both descriptive and analytical research designs, including Pearson correlation coefficient and multiple regression analysis. The findings revealed that CRE and NPLR negatively impacted ROA, while MRE had a positive effect. Similarly, both CRE and NPLR were negatively related to ROE, whereas MRE exhibited a positive relationship with ROE. The study concluded that credit risk (CRE) and non-performing loan ratio (NPLR) adversely affect both ROA and ROE, while market risk exposure (MRE) positively influences these key profitability indicators.

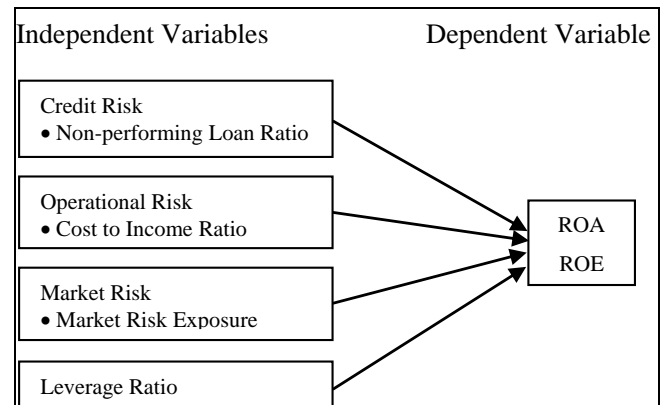
Gautam (2024)<sup>[10]</sup> conducted an empirical study to examine the effect of credit risk and operational risk on the financial performance of commercial banks in Nepal. The research, based on secondary data from six commercial banks for the period 2071/72 to 2078/79, employed descriptive and causal-comparative research designs. Using Pooled Ordinary Least Square regression, the study found that capital adequacy ratio and non-performing loans had an insignificant effect on financial performance. However, it highlighted the significant impact of loan loss provisions, operating efficiency, and bank leverage on the return on assets (ROA). The findings suggest that banks should focus on enhancing loan loss provisions, improving operational efficiency, and managing leverage effectively to boost financial performance.

Riyadi *et al.* (2024) analyzed the impact of credit risk, liquidity risk, and operational risk on the profitability of KBMI Bank, using data from 2019 to 2022. The study employed panel data regression to assess the relationships between these risks (independent variables) and banking profitability (dependent variable). The findings revealed that liquidity risk and operational risk significantly influenced profitability. Specifically, operational risk had a significant negative impact on profitability, while liquidity risk had a significant positive impact. The study emphasized the importance of effective risk in enhancing performance,

recommending that banks focus on controlling credit and operational risks while optimizing liquidity risk management to improve profitability.

**Theoretical framework and definition of variables**

A theoretical framework outlines the relationships between variables in research. Here, ROA and ROE are the dependent variables, measuring profitability, while credit risk, operational risk, market risk, and leverage ratio are the independent variables that potentially influence these profitability metrics which are as derived.



Note: Obtained from Fadun and Oye (2020)<sup>[8]</sup>

Fig 1: Theoretical framework of dependent and independent variables

**a. Return on Assets**

This ratio gauges the profitability a bank generates from investing its assets in various activities, calculated by dividing net income by total assets. ROA assesses the bank's performance, highlighting its capacity to produce profits from its assets. It also reflects how well management can convert the bank's assets into net earnings (Sarkar *et al.*, 1998)<sup>[23]</sup>. While higher liquidity may reduce the return on assets, it tends to have a minimal effect on overall profitability (Almumani, 2013). ROA is typically calculated by dividing net profit by total assets.

$$\text{Return on Assets (ROA)} = \frac{\text{Net Profit}}{\text{Total Assets}} \times 100$$

**b. Return on Equity**

ROE indicates the percentage of profit a company generates for each unit of equity invested in it. While ROE doesn't determine the exact cash return to shareholders since that depends on dividend decisions and stock price growth it provides a strong indication of whether the company can generate returns that justify the investment's associated risks (Berman, Knight, and Case, 2013)<sup>[3]</sup>. ROE is typically calculated by dividing net profit by the average shareholders' equity.

$$\text{Return on Equity (ROE)} = \frac{\text{Net Profit}}{\text{Shareholder's Equity}} \times 100$$

**c. Credit Risk**

Credit risk refers to the potential for financial loss that a lender or creditor may face if a borrower or counterparty fails to meet their contractual obligations, such as repaying a

loan or fulfilling other credit agreements. It reflects the risk exposure of a financial institution or investor in case of a borrower's default or a decline in their creditworthiness. For financial institutions, credit risk includes the total value of loans, credit lines, and other credit facilities granted to borrowers, as well as possible losses from off-balance-sheet items like guarantees, letters of credit, and derivative contracts (Darrel & Kenneth, 2003). The credit risk represents the non-performing loan ratio which is non-performing loan divided by total loan & advances.

$$\text{Non-performing Loan Ratio} = \frac{\text{Non-performing Loan}}{\text{Total Loan \& Advances}} \times 100$$

#### d. Operational Risk

Operational risk refers to the potential financial loss caused by failures or shortcomings in internal processes, systems, personnel, or external events. It covers various risks such as fraud, system breakdowns, human errors, legal challenges, or disruptions from natural disasters. Unlike market or credit risks, operational risk stems from the routine activities within an organization. Managing operational risk effectively involves identifying, evaluating, and reducing risks that could impact the organization's operations and its ability to achieve its goals (BCBS, 2001). The operational risk refers to cost to income ratio which is operating cost divided by operating income.

$$\text{Cost to Income Ratio (CIR)} = \frac{\text{Operating Cost}}{\text{Operating Income}} \times 100$$

#### e. Market Risk

Market risk refers to the potential financial loss an individual or entity, such as a financial institution or investor, could experience due to unfavorable changes in market factors. These factors include interest rates, foreign exchange rates, stock prices, commodity prices, and other financial indicators that affect the value of investments, trading portfolios, and assets. Market risk emphasizes the sensitivity of portfolios and financial positions to market changes and stresses the need to manage the potential effects of market fluctuations (Hull, 2012) <sup>[12]</sup>.

Market Risk Exposure = Foreign Currency Risk Exposure X 5%

#### f. Leverage Ratio

The leverage ratio in banking is a financial metric that compares a bank's core capital (Tier 1 capital) to its total assets. It is designed to assess the bank's ability to absorb losses and maintain financial stability, especially during periods of economic stress. A higher leverage ratio indicates a stronger capital position relative to the bank's assets, suggesting better resilience against potential financial shocks. This ratio is a key component of the Basel III regulatory framework, which sets minimum capital requirements for banks to promote stability in the global financial system (Basel Committee on Banking Supervision, 2010) <sup>[1]</sup>.

$$\text{Leverage Ratio (LR)} = \frac{\text{Tier 1 Capital}}{\text{Total Risk Weighted Assets}} \times 100$$

### Research Methodology

This study uses both descriptive and causal research designs. Descriptive research is used to analyze the average and standard deviation, and to describe the nature and features of the from tables, along with basic calculations of the collected data. The causal comparative research design is used to analyze the correlation coefficient and regression analysis of the sampled banks. Using random sampling methods, this study selects 10 commercial banks out of a total of 20 commercial banks in Nepal. This ensures a manageable yet representative subset for analysis, balancing resource constraints with the need for reliable insights about the broader population. The investigation is therefore based on 100 observations. The study is based on secondary data gathered from 10 commercial banks in Nepal for a period of 10 years, from 2070/71 to 2079/80. The variables used in the study include return on assets (ROA), return on equity (ROE), non-performing loan ratio (NPLR), cost to income ratio (CIR), market risk exposure (MRE), and leverage ratio (LR). The main sources of data include various issues of Banking and Financial Statistics, Quarterly Economic Bulletin, and Bank Supervision Report published by Nepal Rastra Bank, as well as the Annual Reports of the selected commercial banks. This section provides data that is analyzed for this study. Without any data, nothing can be studied. Therefore, for any statistical investigation, the collection of data is crucial.

#### Model specification

Different quantitative statistical methods have been utilized to derive insights from the research data and interpret them effectively. SPSS 20 and M/S Office Excel 2003 are used for data analysis. The study utilizes two regression models for data analysis, as outlined below:

##### First model

In this first model, ROA is taken as dependent variable and non-performing loan ratio (NPLR), cost to income ratio (CIR), market risk exposure (MRE) and leverage ratio (LR) are taken as independent variables. The first model is presented as follows:

$$\text{ROA} = \beta_0 + \beta_1 \text{NPLR}_{it} + \beta_2 \text{CIR}_{it} + \beta_3 \text{MRE}_{it} + \beta_4 \text{LR}_{it} + \varepsilon$$

##### Second Model

In this second model, ROE is taken as dependent variable and non-performing loan ratio (NPLR), cost to income ratio (CIR), market risk exposure (MRE) and leverage ratio (LR) are taken as independent variables. The second model is presented as follows:

$$\text{ROE} = \beta_0 + \beta_1 \text{NPLR}_{it} + \beta_2 \text{CIR}_{it} + \beta_3 \text{MRE}_{it} + \beta_4 \text{LR}_{it} + \varepsilon$$

$\beta$  = Constant term

ROA = Net income divided by total assets

ROE = Net income divided by shareholder equity

$\text{NPLR}_{it}$  = Non-performing loan divided by total loan

$\text{CIR}_{it}$  = Operating cost divided by operating income

$\text{MRE}_{it}$  = Natural logarithm of market risk exposure

$\text{LR}_{it}$  = Tier 1 capital divided by total assets

$\beta_1 - \beta_4$  = Beta coefficient

$\varepsilon$  = Error term

**Analysis and Results**

**Descriptive Statistics**

Descriptive statistics refers to a branch of statistics that involves the analysis and summarization of data to provide a concise and meaningful description of its main characteristics. It has analyzed the data using statistical tools for research variables such as ROA, ROE, NPLR, CIR, MRE, and LR, focusing on key measures like minimum, maximum, mean, and standard deviation, which are presented in the table 1.

**Table 1:** Descriptive statistics of research variables

	N	Minimum	Maximum	Mean	Std. Deviation
ROA	100	.14	2.72	1.5013	.51195
ROE	100	1.47	42.94	15.4903	5.75290
NPLR	100	.01	5.12	1.3391	1.16136
CIR	100	22.42	92.67	39.2378	9.68642
MRE	100	4.09	6.59	5.4975	.52947
LR	100	3.92	21.42	10.8809	2.53378

Table 1 shows the descriptive statistics of research variables such as ROA, ROE, NPLR, CIR, MRE and LR among 100 observations. The minimum value of NPLR is 0.01% where maximum value indicates the CIR which is 92.67%. The of ROA is .5013, ROE at 15.4903, NPLR with a average of 1.3391, CIR at 39.2378, MRE averaging 5.4975, and LR

**Table 2:** Relationship between Independent Variables with ROA and ROE

		ROA	ROE	NPLR	CIR	MRE	LR
ROA	Pearson Correlation	1	.728**	-.246*	-.474**	.167	.292**
	Sig. (2-tailed)		.000	.014	.000	.096	.003
ROE	Pearson Correlation	.728**	1	-.117	-.091	.005	-.174
	Sig. (2-tailed)	.000		.248	.368	.960	.083
NPLR	Pearson Correlation	-.246*	-.117	1	.293**	.063	-.263**
	Sig. (2-tailed)	.014	.248		.003	.530	.008
CIR	Pearson Correlation	-.474**	-.091	.293**	1	-.086	-.393**
	Sig. (2-tailed)	.000	.368	.003		.396	.000
MRE	Pearson Correlation	.167	.005	.063	-.086	1	.155
	Sig. (2-tailed)	.096	.960	.530	.396		.123
LR	Pearson Correlation	.292**	-.174	-.263**	-.393**	.155	1
	Sig. (2-tailed)	.003	.083	.008	.000	.123	
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							
c. Listwise N=100							

Table 2 examines the relationship between the dependent variables, ROA and ROE, and independent variables like NPLR, CIR, MRE, and LR. The correlation coefficient of NPLR negatively affects both ROA (-0.246) and ROE (-0.117), with the impact on ROA being statistically significant. CIR has a significant negative correlation with ROA (-0.474), suggesting that higher costs relative to income reduce profitability, but it does not significantly affect ROE. MRE shows weak, insignificant correlations with both ROA and ROE, while LR is positively correlated with ROA (0.292), indicating that higher leverage may improve ROA, though its effect on ROE is negative but not statistically significant. Overall, ROA is more significantly influenced by NPLR, CIR, and LR, while ROE shows weaker relationships with the independent variables.

**b. Regression Analysis**

The regression analysis is carried out to determine whether the dependent variable is Influence by the given independent variables or not. In this analysis ROA and ROE

with a mean of 10.8809. The standard deviation is high in CIR which is greater variability and less in ROA which is lowest variability indicates the nearest to mean point of data set.

**Inferential statistics**

This study examines the impact of credit risk, operational risk, market risk, and leverage on the profitability of commercial banks in Nepal, using data from 10 fiscal years (2070/71 to 2079/80) and a sample of 100 observations from 10 commercial banks. The data are analyzed using M/S Office Excel and SPSS 20. Correlation analysis is employed to assess the direction of the relationship between the dependent and independent variables, along with regression analysis.

**a. Correlation coefficient**

A positive Pearson's correlation indicates that as one variable increases, the other also tends to increase, reflecting a direct relationship. In contrast, a negative correlation means that when one variable rises, the other tends to decrease. The strength of the correlation is also crucial: values close to +1 or -1 signify a strong relationship, while values near 0 suggest a weak or no relationship. This concept is useful for understanding how ROA and ROE are related to NPLR, CIR, MRE, and LR.

are dependent variables and NPLR, CIR, MRE and LR are independent variables. There is regression model is divided by two parts are model 1 and model 2. The equation of regression model is as follow:

**First Model**

In the first model, return on assets (ROA) is taken as dependent variable and non-performing loan ratio (NPLR), cost to income ratio (CIR), market risk exposure (MR) and leverage ratio (LR) are taken as independent variables. The model is presented as follows:

$$ROA = \beta_0 + \beta_1NPLR + \beta_2CIR + \beta_3MRE + \beta_4LR + e.$$

**Table 3:** Model Summary for Model 1 (ROA)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.512 <sup>a</sup>	.262	.231	.44888

a. Predictors: (Constant), LR, MRE, NPLR, CIR

Table 3 presents the Model Summary for Model 1, which examines the relationship between the dependent variable (ROA) and the predictors (LR, MRE, NPLR, CIR). The model shows an R value of 0.512, indicating a moderate correlation between the predictors and ROA. The R Square value of 0.262 suggests that approximately 26.2% of the variance in ROA is explained by the predictors in the model. The Adjusted R Square, which accounts for the number of predictors in the model, is 0.231, indicating a slightly lower explanatory power when adjusting for potential overfitting. The standard error of the estimate is 0.44888, providing an indication of the average distance between the observed values and the predicted values of ROA.

**Table 4:** Analysis of Variance for Model 1 (ROA)

Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	6.805	4	1.701	8.444	.000 <sup>b</sup>
	Residual	19.142	95	.201		
	Total	25.947	99			
a. Dependent Variable: ROA						
b. Predictors: (Constant), LR, MRE, NPLR, CIR						

Table 4 shows the ANOVA results for Model 1, which analyzes the impact of leverage ratio (LR), Market Risk Exposure (MRE), Non-Performing Loan Ratio (NPLR), and Cost-to-Income Ratio (CIR) on Return on Assets (ROA). The regression sum of squares is 6.805, with an F-statistic of 8.444 and a p-value of .000, indicating that the model is statistically significant. This means the predictors collectively explain variations in ROA. The residual sum of squares is 19.142, and the total sum of squares is 25.947.

**Table 5:** Regression Coefficient of Model 1 (ROA)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.521	.568		2.677	.009
	NPLR	-.051	.042	-.116	-1.228	.222
	CIR	-.021	.005	-.395	-4.021	.000
	MRE	.123	.087	.127	1.418	.159
	LR	.018	.020	.087	.881	.380
a. Dependent Variable: ROA						

Table 5 shows the significance of the regression coefficients for Model 1, which examines the predictors of ROA. Among the predictors, only CIR (p = 0.000) is statistically significant, suggesting that it has a significant negative impact on ROA. In contrast, NPLR (p = 0.222), MRE (p = 0.159), and LR (p = 0.380) are not statistically significant, implying they do not have a meaningful effect on ROA in this model.

**Second Model**

In the second model, return on assets (ROE) is taken as dependent variable and non-performing loan ratio (NPLR), cost to income ratio (CIR), market risk exposure (MR) and leverage ratio (LR) are taken as independent variables. The model is presented as follows:

$$ROE = \beta_0 + \beta_1 NPLR + \beta_2 CIR + \beta_3 MRE + \beta_4 LR + e.$$

**Table 6:** Model Summary for Model 2 (ROE)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	.283 <sup>a</sup>	.080	.042	5.63204
a. Predictors: (Constant), LR, MRE, NPLR, CIR				

Table 6 presents the Model Summary for Model 2, which explores the relationship between the dependent variable (ROE) and the predictors (LR, MRE, NPLR, CIR). The model has an R value of 0.283, suggesting a weak positive correlation between the predictors and ROE. The R Square value of 0.080 indicates that only 8% of the variance in ROE is explained by the predictors included in the model. The Adjusted R Square of 0.042, which adjusts for the number of predictors, reflects a minimal explanatory power, further highlighting the limited impact of the predictors on ROE. The standard error of the estimate is 5.63204, indicating a relatively large average deviation between the observed and predicted values of ROE.

**Table 7:** Analysis of Variance for Model 2 (ROE)

Model	Sum of Squares	df	Mean Square	F	Sig.	
2	Regression	263.096	4	65.774	2.074	.090 <sup>b</sup>
	Residual	3013.391	95	31.720		
	Total	3276.487	99			
a. Dependent Variable: ROE						
b. Predictors: (Constant), LR, MRE, NPLR, CIR						

Table 7 presents the ANOVA results for Model 2, which examines the relationship between ROE and the predictors: LR, MRE, NPLR, and CIR. The regression sum of squares is 263.096, with 4 degrees of freedom, yielding a mean square of 65.774. The F-statistic is 2.074, and the p-value is 0.090, indicating that the model is not statistically significant at the 0.05 level. This suggests that while the predictors may explain some variation in ROE, their collective effect is not strong enough to be considered statistically significant. The residual sum of squares is 3013.391, and the total sum of squares is 3276.487.

**Table 8:** Regression Coefficient of Model 2 (ROE)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	24.309	7.128		3.410	.001
	NPLR	-.733	.521	-.148	-1.408	.162
	CIR	-.091	.065	-.154	-1.403	.164
	MRE	.487	1.090	.045	.447	.656
	LR	-.637	.249	-.280	-2.554	.012
a. Dependent Variable: ROE						

Table 8 shows the regression coefficients for Model 2, which analyzes the relationship between ROE and the predictors: NPLR, CIR, MRE, and LR. The constant term is 24.309, with a t-value of 3.410 and a p-value of 0.001, indicating it is statistically significant. Among the predictors, only LR has a significant effect on ROE, with an unstandardized coefficient of -0.637, a standardized beta of -0.280, a t-value of -2.554, and a p-value of 0.012. This suggests that as LR increases, ROE decreases. In contrast, NPLR, CIR, and MRE are not statistically significant predictors of ROE, as their p-values (0.162, 0.164, and 0.656, respectively) are above the 0.05 threshold.

## Discussion

This study examines the impact of credit risk, operational risk, market risk, and leverage on bank profitability in Nepal. NPLR negatively affects both ROA (-0.246) and ROE (-0.117), with a significant impact on ROA. This result is consistent with the findings mentioned by Ekinci (2016), Poudel (2018) [20], Chiomal *et al.* (2020), Chioma *et al.* (2021), Chhetri (2021), Shrestha (2022), Pandey and Joshi (2023) [18] and Pandey (2023) [18] but inconsistent with the finding mentioned by Cheng *et al.* (2020) [5]. CIR has a significant negative correlation with ROA (-0.474). This result is consistent with the finding mentioned by Qabajeh *et al.* (2023), Riyadi *et al.* (2024) and Cheng *et al.* (2020) [5] but contradicts with the finding mentioned by Fadun and Oye (2020) [8], Chiomal *et al.* (2020) and Chioma *et al.* (2021), suggesting that higher costs reduce profitability, but has no significant effect on ROE. MRE shows weak positive insignificant correlations with both ROA and ROE. This result is consistent with the finding mentioned by Syafi'i and Rusliati (2016) [25], Odumah and Miroga (2023) and Pandey (2023) [18]. LR is positively correlated with ROA (0.292), suggesting that higher leverage may improve ROA, although it negatively affects ROE, but not significantly. This result contradicts with the finding mentioned by Cheng *et al.* (2020) [5] and Dulal *et al.* (2023). Overall, ROA is more influenced by NPLR, CIR, and LR, while ROE shows weaker associations with the variables.

Model 1, which examines the relationship between Return on Assets (ROA) and predictors such as the leverage ratio (LR), Market Risk Exposure (MRE), Non-Performing Loan Ratio (NPLR), and Cost-to-Income Ratio (CIR), demonstrates a moderate correlation. The model explains a moderate portion of the variance in ROA, but after adjusting for the number of predictors, the explanatory power is somewhat reduced, suggesting that the model may be influenced by overfitting. The overall significance of the model is confirmed by the ANOVA results, indicating that the predictors, as a group, have a statistically meaningful relationship with ROA. However, only CIR stands out as a significant predictor of ROA, this result is consistent with the finding mentioned by Chiomal *et al.* (2020), Chioma *et al.* (2021), Qabajeh *et al.* (2023), Riyadi *et al.* (2024) and Gautam (2024) [10], with a strong negative impact. In contrast, NPLR, MRE, and LR are not statistically significant, indicating that these variables do not have a meaningful effect on ROA in this particular model. This result is consistent with the finding mentioned by Syafi'i and Rusliati (2016) [25], Gautam (2024) [10] and Cheng *et al.* (2020) [5] but contradicts with the finding mentioned by Gizaw *et al.* (2015) [11], Poudel (2018) [20], Chiomal *et al.* (2020), Cheng *et al.* (2020) [5], Chioma *et al.* (2021), Chhetri (2021), Shrestha (2022), Pandey and Joshi (2023) [18], Odumah and Miroga (2023), Kelvin (2016), Muriithi *et al.* (2016) and Oli (2021).

In Model 2, which explores the relationship between Return on Equity (ROE) and the same set of predictors, the results suggest a weaker connection. The model explains only a small portion of the variance in ROE, and the explanatory power is even further reduced when accounting for the number of predictors. The model's overall significance is not strong, as indicated by the ANOVA results, meaning the predictors do not collectively provide a meaningful explanation for variations in ROE. Among the individual predictors, only LR is statistically significant, with a

negative effect on ROE, this result is consistent with the findings mentioned by Syafi'i and Rusliati (2016) [25], Kelvin (2016), Muriithi *et al.* (2016) and Cheng *et al.* (2020) [5]. This suggests that higher values of LR are associated with lower ROE, while the other predictors are NPLR, CIR, and MRE do not show a statistically significant relationship with ROE, this result is consistent with the finding mentioned by Syafi'i and Rusliati (2016) [25], Chiomal *et al.* (2020) and Gautam (2024) [10] but contradicts with the finding mentioned by Gizaw *et al.* (2015) [11], Poudel (2018) [20], Chiomal *et al.* (2020), Cheng *et al.* (2020) [5], Chioma *et al.* (2021), Chhetri (2021), Shrestha (2022) [24], Pandey and Joshi (2023) [18], Qabajeh *et al.* (2023), Riyadi *et al.* (2024) and Odumah and Miroga (2023). Despite this, the significance of LR highlights its importance as a predictor for ROE within this model.

## Conclusion

In conclusion, the analysis of the impact of credit risk, operational risk, market risk, and leverage on the profitability of commercial banks in Nepal reveals a complex relationship between these factors and financial performance. The Non-Performing Loan Ratio (NPLR) negatively affects both Return on Assets (ROA) and Return on Equity (ROE), with a significant impact on ROA. The Cost-to-Income Ratio (CIR) is significantly negatively correlated with ROA but does not significantly affect ROE. Market Risk Exposure (MRE) and Leverage Ratio (LR) show weaker connections to profitability, with LR positively affecting ROA but having no significant impact on ROE. The regression analysis highlights that CIR is the most significant predictor of ROA, explaining 26.2% of its variance, while ROE's explanatory power remains weak. These findings emphasize the importance of managing operational efficiency (CIR) to enhance profitability, especially ROA, while credit risk and leverage have a more limited impact on ROE.

## Implications

The implications of the study are derived from the impact of credit risk, operational risk, market risk, and leverage on the profitability of commercial banks in Nepal, as presented in the following points.

- Higher NPLR negatively affects ROA and ROE, with a significant impact on ROA, emphasizing the need for effective credit risk management.
- A significant negative relationship with ROA highlights the importance of controlling operational costs to improve profitability, although it has no significant effect on ROE.
- Weak and insignificant correlation with both ROA and ROE suggests that market risk has a lesser impact on profitability compared to credit and operational risks.
- Positive correlation with ROA indicates that higher leverage can improve profitability, but its negative effect on ROE requires careful management of leverage.
- CIR is the most significant predictor of ROA, emphasizing the role of cost management in enhancing bank profitability.
- Only LR is significantly related to ROE, with a negative impact, suggesting that excessive leverage can harm equity returns.

- Banks should focus on managing credit risk, controlling costs, and balancing leverage to optimize profitability, particularly ROA and ROE.
- Future studies could explore the combined impact of macroeconomic factors, such as inflation, interest rates, and GDP growth, on the relationship between credit risk, operational risk, market risk, leverage, and profitability in the banking sector, particularly in emerging economies like Nepal.

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