

## Non-Performing Assets and Bank Profitability in Nepal: Evidence from a Panel Data

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**Abstract.** This study investigates the impact of non-performing assets (NPAs) on the profitability of Nepalese commercial banks from 2017 to 2022. A panel regression analysis is conducted using annual data from 21 banks over 5 years, comprising 105 observations. Net interest margin (NIM) is the dependent variable while NPAs, loan loss provision, loan-to-deposit ratio, return on investment, and capital adequacy ratio are the explanatory variables. The fixed effects model reveals a statistically significant negative relationship between NPAs and bank profitability, suggesting the need for robust credit risk management. However, limitations include the small sample size and focus only on internal determinants. Future researchers can expand on this foundation by using different research methods, enlarging the sample size, and considering economic conditions, policies, and external factors to gain further insights. The study offers practical implications for mitigating the adverse impacts of NPAs on bank earnings.

**Keywords:** Capital adequacy ratio, Loans and advances to deposit ratio, Loan loss provision, Net interest margin, Return on investment

## **1. Introduction**

The banking sector is critical to a country's economic development because it facilitates the effective distribution of financial resources and promotes economic growth (Schumpeter, 1934). However, the stability and profitability of banks are subject to various internal and external factors. Among the various factors that influence a bank's profitability, the management of non-performing assets (NPAs) holds a position of prominence and emerged as a critical challenge in the contemporary banking landscape. NPAs, commonly referred to as loans or advances in the principal and interest, remain overdue for at least 90 days and are categorized by Nepal Rastra Bank, the central bank, into three classes: substandard, doubtful, and loan losses, contingent upon the extent of the overdue period. The non-performing assets can significantly affect a bank's profitability because they lower interest income, raise provisioning costs, and deplete capital (Gnawali, 2018; Pant et al., 2022). Non-performing loans can be an early warning sign of an impending banking crisis, as they can adversely affect a nation's economic strength by reducing credit growth (Smaoui & Salah, 2012).

During the study period, the Nepalese banking sector consisted of 21 active commercial banks, each offering diverse financial products and serving various customer segments. This banking sector encompassed a blend of fully government-owned, private-public ownership, and joint ventures with foreign banks. It has undergone significant growth and transformation recently, driven by evolving banking regulations and market dynamics. Commercial banks' mergers and acquisitions (M&A) have reduced the number of institutions and increased concentration. This structural shift has resulted in the emergence of dominant players, fundamentally reshaping the banking arena and influencing the behavior and performance of commercial banks in Nepal. Consequently, these changes can directly impact the management of non-performing assets (NPAs) and overall profitability. Furthermore, according to the Economic Survey (2022/23), Nepalese commercial banks reported a non-performing loan (NPL) ratio of 2.49 percent in March 2023, a significant increase compared to the five-year average of 1.6 percent. This notable shift in the NPL ratio raises concerns about the financial health of Nepalese banks. Higher NPLs can result in increased provisioning for loan losses, leading to a reduction in net interest margins and, consequently, a potential impact on bank profits. Therefore, it is imperative to examine this relationship closely to fully understand the implications of rising NPLs on the profitability of Nepalese banks.

Non-performing assets (NPAs) can have far-reaching consequences for banks, eroding their earnings, hindering their ability to generate satisfactory returns, and potentially posing a threat to the stability of the entire financial system. An upward trend in NPAs can significantly impede the efficiency of the banking sector, introducing the risk of a banking crisis by disrupting interest revenues, curtailing investment opportunities, and triggering liquidity crises in the financial system, ultimately leading to bankruptcy and economic downturns (Singh et al., 2021). However, it is essential to recognize that the relationship between NPAs and profitability operates within a dynamic framework influenced by multiple factors. For instance, studies by Nugraha et al. (2021) and Ghimire et al. (2023) suggested that non-performing loans, loan-to-deposit ratios, and the diversity of educational backgrounds among employees collectively impact the profit performance of commercial banks.

As an emerging economy striving for economic stability and growth in Nepal, the banking sector plays a pivotal role. Against the backdrop of evolving market conditions and regulatory dynamics, understanding the intricate interplay between non-performing assets (NPAs) and other critical variables, including loan loss provisioning, loans and advances, return on investment, and capital adequacy, holds paramount significance in shaping the financial performance of commercial banks. Therefore, this research's primary objective was to empirically analyze how NPAs interact with these key factors to influence the profitability of multiple commercial banks in Nepal over time, employing a panel regression analysis. The research findings are expected to provide invaluable insights for all of Nepal's banking sector stakeholders.

This study sheds light on the impact of non-performing assets (NPAs) on Nepal's banking sector. The research findings could help policymakers, regulators, and financial institutions design effective strategies to reduce NPA risks and strengthen the banking industry's profitability and resilience. Additionally, this research contributes to the academic discussion on financial risk management by providing a deeper understanding of how NPAs affect commercial banks. The following sections include the literature review, methodology, result analysis, discussions, and the study's conclusion.

## **2. Review of Literature**

Merton (1974), in his seminal work, proposed a credit risk theory that laid the foundation for modern credit risk assessment. This theory emphasizes the significance of comprehending default probabilities and their influence on corporate debt securities. It views a firm's debt as an option to default, which applies to banking, assisting in assessing the likelihood of loans turning into NPAs. This approach empowers, in the realm of banking and financial institutions, to identify potential NPAs and manage them proactively, safeguarding profitability in contemporary settings. Mishra and Ramachandran (2019) argued that the credit risk theory serves as a foundational framework for evaluating and managing the risk associated with lending activities. This theory is of paramount importance as it directly relates to the phenomenon of NPAs, which represent loans or assets at risk of default. Bhattacharya and Thakor (1993) contended that when borrowers fail to meet their repayment obligations, these loans are classified as NPAs, triggering the need for provisions and loan default write-offs that significantly impact a bank's profitability. Berger and Bouwman (2013) further claimed that the level of NPAs erodes current income and constrains capital allocation for productive purposes, further influencing a bank's overall profitability.

Numerous studies have extensively investigated the relationship between non-performing loans (NPLs) and banking institutions' profitability, shedding light on this critical aspect of financial risk management. Jiang and Wang (2018) explored this association in the Chinese banking sector and identified a detrimental and statistically significant effect of NPLs on bank profitability. Similarly, Wibowo and Haryanto (2018) conducted a comprehensive study in Indonesia, revealing an inverse and statistically significant impact of NPLs on banking institutions' profitability. Expanding the scope to UK banks, Yan and Rahman (2018) found NPLs to exert an adverse and statistically significant effect on profitability. Lin and Batten (2019) extended this analysis to the UK and the US, highlighting the persistent adverse impact of overdue loans on bank profitability, which held statistical significance in both nations. Examining European banks across 28 EU countries, Kivilcim et al. (2020) uncovered a noteworthy negative and statistically significant impact of NPLs on profitability, with smaller banks experiencing a more pronounced effect.

Recent research conducted by Grosvenor et al. (2021), Uddin (2022), and Rokhmat et al. (2023) further corroborates these findings, demonstrating that NPLs consistently have an adverse impact on the profitability of banks in various countries. Collectively, these studies provide compelling evidence of a noteworthy and statistically significant negative association between NPLs and bank profitability, underscoring this relationship's global relevance and implications. Turning our attention to the Nepalese context, Adhikari and Rana (2018), Koirala (2017), and Panta (2018), all established a clear nexus between overdue loans and net interest margin, consistently demonstrating an adverse effect on the profitability of commercial banks in Nepal.

In the Nepalese banking sector context, it is crucial to recognize a significant lack of empirical research concerning the intricate relationship between non-performing loans (NPLs) and bank profitability. While international studies have provided valuable insights into this association, Nepalese banks' unique dynamics and challenges necessitate a more tailored examination. To date, there has been limited exploration of this relationship within the specific context of Nepal, leaving a notable gap in the literature. Consequently, this study seeks to bridge this gap by conducting a rigorous analysis of NPLs and their impact on bank profitability in Nepal, contributing to a more

comprehensive understanding of the financial section in the region.

### 3. Research Methodology

This research has utilized an explanatory research design to examine how non-performing assets affect profitability, represented by the proxy of net interest margin. Other independent variables such as loan loss provision, loan and advance to total deposit, return on investment, and capital adequacy ratio serve as controlled variables to account for their potential influence on profitability and its association with non-performing assets. Panel data encompassed five years for each sample bank from the fiscal year 2017/18 to 2021/22, comprising 105 observations. The decision to employ a panel data regression model was driven by its suitability for the research objectives and dataset characteristics, as it allows the benefits of both time series and cross-sectional data by considering multiple observations over time of the 21 commercial banks to examine the relationship.

All commercial banks operating in Nepal were included, and thus, there was no random selection or exclusion criteria applied to the sample to provide a holistic view of the impact of non-performing assets (NPAs) on the entire Nepalese banking industry. The stationarity of the data was assessed for each variable of interest through the Augmented Dickey-Fuller (ADF) test, aiming to mitigate the risk of spurious regression outcomes and unreliable statistical inferences. A correlation analysis was applied to ascertain the association between the net interest margin and the considered independent variables. Additionally, the Hausman test was utilized to determine the suitable mode—Random Effects or Fixed Effects—by comparing estimator efficiency under each method's assumptions during the execution of the panel regression model. The research outcomes were derived using EViews 10 as the employed econometric analytical tool.

#### Variable Relationships

Figure 1 depicts the interrelationship between the dependent and independent variables under the area of interest. Net interest margin is the dependent variable, and non-performing assets, loan loss provision, loan and advances to total deposit, return on investment, and capital adequacy ratio have been used as independent variables.

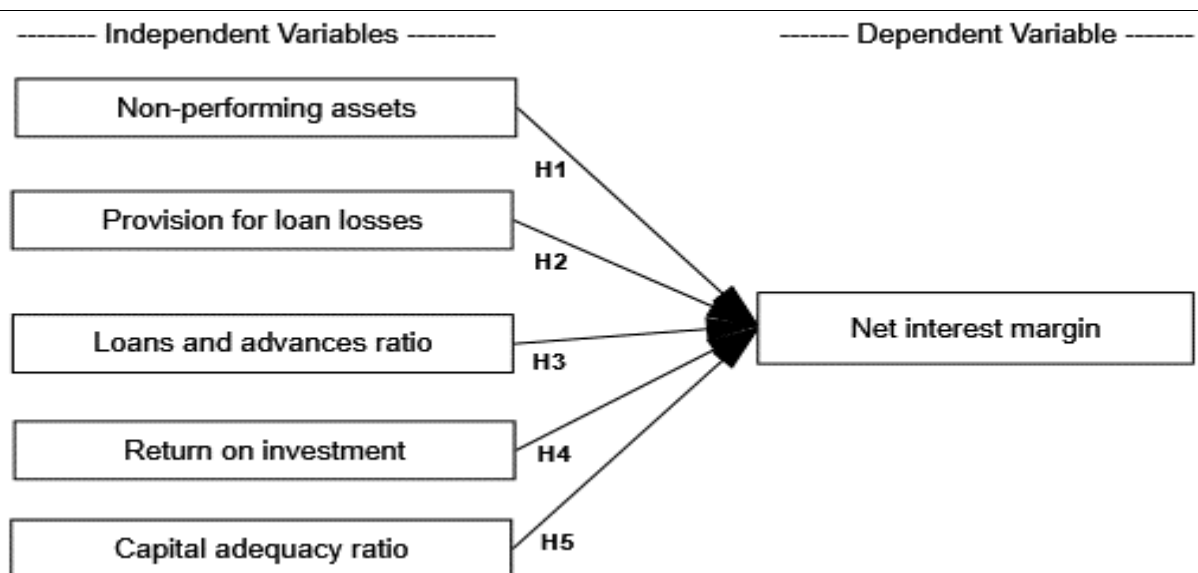


Fig. 1: Research Framework

**a. Net Interest Margin (NIM)**

The net interest margin represents the proportion of net interest income relative to the average earnings generated from the earning assets, usually the loans and securities investment held by commercial banks. The net interest income is the difference between the interest income generated by banks and the total interest paid to their enders and depositors. A higher margin is associated with the banks generating income more from their earning assets than the interest it is paying out to fund providers.

$$\text{Net interest margin (NIM)} = \frac{\text{Net interest income}}{\text{Interest earning assets}} \times 100$$

**b. Non- Performing Assets Ratio (NPA)**

NPA is a ratio that quantifies the number of non-performing assets in a bank's loan portfolio and gauges asset quality. It is computed by dividing the total amount of non-performing assets by the total amount of bank loans and advances. An increased ratio implies a significant proportion of the bank's loans and advances come under the non-performing assets, negatively impacting the bank's financial health and profitability.

$$\text{Non-performing assets ratio} = \frac{\text{Non-performing assets}}{\text{Total amount of loans and advances}} \times 100$$

*Hypothesis H<sub>1</sub>: There is a significant association between the NPAs and NIM of Nepalese commercial banks.*

**c. Loan Loss Provision (LLP)**

The loan loss provision serves as a protective measure against potential future issues arising from borrower defaults, ensuring the ongoing financial stability of banks. A higher provision for loan loss signifies a rise in overdue loans within the total amount of loans and advances. Conversely, a lower ratio indicates the presence of high-quality assets in the loans and advances, reflecting effective management of loans and efforts to mitigate possible loan losses.

$$\text{Loan loss provision ratio} = \frac{\text{Provision for loan losses}}{\text{Total amount of loans and advances}} \times 100$$

*Hypothesis H<sub>2</sub>: There is a significant association between the LLP ratio and the NIM of the Nepalese commercial banks.*

**d. Loans and Advances Ratio (LAR)**

The loans and advances ratio represents the amount of loans and advances granted by banks divided by their total deposits. This ratio serves as a gauge for assessing a bank's efficiency in generating profits through loans and advances using its deposited funds. A higher ratio indicates a more effective utilization of deposits to earn profits through lending. Nevertheless, banks must strike a balance between profitability and liquidity, as an excessively high ratio may also indicate potential liquidity challenges for commercial banks.

$$\text{Loans and advances ratio (LAR)} = \frac{\text{Total loans and advances}}{\text{Total despoist}} \times 100$$

*Hypothesis H<sub>3</sub>: There is a significant association between LAR to the NIM of Nepalese commercial banks.*

**e. Return on Investment (ROI)**

ROI is the net profit earned from various income sources divided by the total investment made by commercial banks. It considers all income streams, including interest income from loans and advances, investment income, fee-based income, and other revenues. It reflects how effectively the bank's capital is being utilized to generate profits. It is hypothesized that the banks with higher returns on investment have better profitability, which could lead to more effective interest rate management and, in turn, influence the NIM.

$$\text{Return on investment} = \frac{\text{Net profit}}{\text{Total investment}} \times 100$$

*Hypothesis H4: There is a significant association between the ROI and the NIM of Nepalese commercial banks.*

**f. Capital Adequacy Ratio (CAR)**

CAR is a regulatory measure that evaluates a bank's financial health and stability. It is the ratio of a bank's equity capital to the risk-weighted exposure of commercial banks. Its primary purpose is to guarantee that banks possess ample capital to absorb potential losses and uphold their financial stability in unfavorable economic situations. A higher capital adequacy ratio may indicate that a bank has more capital to support its lending activities. Banks with higher capital levels may be more confident in extending loans, which has the potential to result in higher interest earnings and subsequently contribute positively to the net interest margin.

$$\text{Capital adequacy ratio} = \frac{\text{Total capital}}{\text{Total risk weighted exposure}} \times 100$$

*Hypothesis: H5: There is a significant association between the CAR and NIM of Nepalese commercial banks.*

The review of related literature suggests that the net interest margin is functionally related to non-performing assets to loans and advances, loan loss provision to loans and advances, loans and advances to total deposits, net profit to total investment, and total equity capital to total risk-weighted exposure. The function relationship of the dependent and independent variables is presented in Equation (1):

$$\text{NIM} = f(\text{NPA, LLP, LTDR, ROI, CAR}) \dots\dots\dots (1)$$

**4. Results**

Table 1 displays the summarized statistics for the relevant variables. Net interest margin exhibits variation across the 105 observations, but the mean and median values indicate a relatively stable and centered distribution. The net interest margin values range from low to high, implying different levels of profitability in the observed data points. The standard deviation of 0.68 indicates that it is not too large, suggesting that the variability is moderate and not extreme because a greater standard deviation value signifies increased variability within the data.

The various statistics of non-performing assets reveal valuable insights into the banks' credit risk and loan performance. The mean score of 1.41 indicates the average percentage of loans that tend to cease to earn interest, providing an overall measure of asset quality. The value of non-performing assets ranges from 0.03 to 4.75, highlighting varying credit risk levels among the banks. The standard deviation of 1.07 confirms the dispersion of non-performing values from the mean, indicating diversity in the credit risk profiles across the observed banks.

The descriptive statistics for loan loss provision provide insights into how banks allocate funds to account for potential losses arising from loans that are not performing well. On average, 2.12 percent of their total loan portfolio set aside funds to cover potential losses from non-performing assets. The median value of (i.e., 1.92) indicates that most banks have provisions lower than the average (i.e., 2.12%) and suggests that many banks might have adopted risk mitigation strategies that involve setting aside a lower percentage of their loans for potential losses. The values range from 0.19 to 4.96, indicating that the different banks employ varying approaches to determine the extent of provisions for possible loan losses. Some Nepalese commercial banks seemed to be more conservative and allocate a higher percentage of their loans, while others took a more optimistic approach and set aside a smaller percentage as their loss provision. The standard deviation (i.e., 0.96) has suggested a moderate degree of dispersion in loan loss provision, indicating that variations in the allocation of provision among the banks are not so highly divergent.

Table 1. Descriptive Statistics

Variables	Observations	Mean	Median	Maximum	Minimum	Std. Dev.
NIM	105	3.04	2.94	5.44	1.09	0.68
NPA	105	1.41	1.11	4.75	0.03	1.07
LLP	105	2.12	1.92	4.96	0.19	0.96
LTDR	105	85.87	87.53	107.01	57.45	7.53
ROI	105	2.14	2.05	4.91	0.95	0.75
CAR	105	14.38	13.38	27.09	11.14	3.02

The loans and advances ratio has reported an average value of 85.87 percent, indicating that commercial banks lend out approximately 86 percent of their total deposits. This suggests that the Nepalese commercial banks allocate a substantial portion of their total deposits to loans and advances, indicating an active lending strategy. The median value (i.e., 87.53) indicated that a significant number of banks have a higher proportion of their total deposits allocated to loans and advances, indicating a broad distribution in lending strategies. The loan and advances ratio that ranges from 57.45 to 107.01 showed that some Nepalese commercial banks are more conservative in lending out from their deposit, whereas others have a more aggressive lending strategy. However, the standard deviation 7.53 indicated a moderate dispersion regarding how the banks distribute their total deposits between loans and advances.

The average return on investment is reported at 2.14, and the median value of 2.05 suggests that the distribution of return on investment is slightly positively skewed. This meant that a larger number of commercial banks have a relative return on investment below the average, and a few banks with higher return on investment values are pulling the median slightly higher. Moreover, it is reported to vary from 0.95 to 4.91 and suggests a considerable range of investment profitability among banks. However, the standard deviation (i.e., 0.75) suggested a moderate variation in profit situation across commercial banking institutions.

The average value of the capital adequacy ratio has been reported as 14.38, whereas the median value has been reported as 13.38, indicating that some commercial banks have maintained capital adequacy lower than the average value. The ratios have ranged from a minimum of 11.14 to a maximum of 27.09, representing a wide range of capital adequacy levels among the banks. The standard deviation also suggested a notable variation in capital adequacy levels across commercial banks. Hence, the descriptive statistics provided valuable insights into the Nepalese commercial banking sector, exhibiting a diversity and variation in key financial indicators of interest that highlighted their significance for policy and operational considerations.

**Data Stationary**

To avoid misleading inferences regarding the relationship between the variables, this study has employed an Augmented Dickey-Fuller (ADF) test, originally introduced by Dickey and Fuller (1979), to conduct unit root tests on the data series, as depicted in Equation 2.

$$\Delta Y_t = \alpha_1 + \beta_{1t} + \beta_2 Y_{t-1} + \sum_{i=1}^m \delta_i \Delta Y_{t-i} + \varepsilon_t \dots \dots \dots (2)$$

While  $\alpha$ ,  $\beta$ , and  $\delta$  symbolize the parameters corresponding to the variables used in the research, the term  $\varepsilon_t$  signifies the error generated by white noise. The 'm' designates the maximum lag length of the series, its determination being based on empirical analysis. The operator  $\Delta$  represents a differentiating function, while  $Y_t$  denotes a variable within the dataset. The null hypothesis asserts that  $Y_t$  is a non-stationary series, specifically expressed as  $H_0: \beta_2=0$ . Conversely, the alternative hypothesis posits that the variable  $Y_t$  is stationary, articulated as  $H_1: \beta_2 < 0$ . The rejection of the null hypothesis occurs when  $\beta_2$  demonstrates a notably negative value ( $H_1: \beta_2 < 0$ ). Alternatively, if the calculated ADF statistics exceed the critical values as recommended by McKinnon (1996), or if the p-values fall below 5 percent, the null hypothesis ( $H_0$ ) is rejected in favor of the alternative hypothesis. In this case, the series is deemed stationary, and the time series is described as integrated of order zero, denoted as  $I(0)$ . However, non-rejection of the null hypothesis at this threshold indicates the presence of a non-stationary series, implying the necessity to apply the test iteratively on the series' differences until stationarity is attained and the null hypothesis is ultimately discarded. The outcomes of the Augmented Dickey-Fuller (ADF) unit root tests on the data series are presented in Table 1.

Table 2. The Summary Result of Unit Root Test

Variables	ADF t-statistic#	P-Value	Order of Integration
NIM	-9.018	0.000*	I (0)
NPA	-4.638	0.002*	I (0)
LLP	-5.200	0.000*	I (0)
LTDR	-5.393	0.0001*	I (0)
ROI	-6.215	0.000*	I (0)
CAR	-4.505	0.002*	I (0)

#Critical values for 1%, 5%, and 10% are -4.048682, -3.453601, and -3.1524, respectively.

'\*\*' indicates significance at a 1 percent level

The results reported indicate that all the variables of interest are stationary at a level and thus exhibited an integration of order zero,  $I(0)$ .

**Correlation Coefficients**

Table 3 presents the correlation results, displaying the associations among variables under study: net interest margin, non-performing assets, loan loss provision, loans and advances ratio, return on investment, and capital adequacy ratio. The correlation coefficient results show a statistically significant negative correlation between the banks' net interest margin and non-performing assets (i.e.,  $r = -0.2732$ ,  $p = 0.0048 < 0.05$ ). This suggests that as non-performing assets increase, the net interest margin tends to decrease, indicating a potential adverse impact of non-performing assets on the profitability of commercial banks. However, it is notable that the correlation does not imply causation and further regression analysis is needed to determine the direction and strength of the relationship between profitability and non-performing assets of the banks while controlling for other variables in the model. Regarding the other variables, net interest margin has exhibited a significant negative association with the loan loss provision and has shown a positive relationship with other variables: loans and advances ratio, return on investment, and capital adequacy ratio. The results suggest the



importance of carefully managing the non-performing assets while capitalizing on profitable lending activities to enhance the net interest margin in the banking sectors. In sum up, these results enhance deeper understanding of the factors that influences the profitability of Nepalese commercial banks, that is valuable to provide guidance to stakeholders seeking to enhance their financial performance and stability.

Table 3. Results of Correlation

Variables	NIM	NPA	LLP	LTDR	ROI	CAR
NIM	1.000					
	-----					
NPA	-0.273	1.000				
	0.005**	-----				
LLP	-0.166	0.763	1.0000			
	0.031**	0.000*	-----			
LTDR	0.209	0.310	0.314	1.000		
	0.033**	0.001*	0.001*	-----		
ROI	0.616	0.058	0.048	-0.325	1.000	
	0.000*	0.005*	0.024**	0.001*	-----	
CAR	0.130	-0.149	-0.049	-0.081	0.242	1.000
	0.036**	0.000*	0.002*	0.043**	0.013*	-----

(\*) indicates signification at a 1 percent level  
 (\*\*) indicates signification at a 5 percent level

**Econometric Model**

Table 4 reported the results of the Hausman Test of comparison between the fixed effects and random effects models to select the appropriate model to examine the relation of profitability with non-performing assets of commercial banks. If the statistic is significant, this test rejects the null hypothesis that the RE Model is appropriate and accepts the alternative hypothesis that the FE Model is more appropriate. The calculated Chi-Square ( $\chi^2$ ) statistic is 13.2557, with a corresponding p-value of 0.0211, less than a 5 percent significance level. This affirms that the FE Model is more suitable than the RE Model.

Table 4. Hausman Test for Model Selection

Variable	Fixed	Random	Var (Diff.)	Prob.
NPA	-0.2944	-0.1686	0.0035	0.0004
LLP	-0.0604	-0.0490	0.0034	0.0595
LTDR	0.0258	0.0011	0.0004	0.0870
ROI	0.8164	0.6420	0.0036	0.0035
CAR	-0.0451	-0.0010	0.0008	0.4567

$\chi^2$  (5) Statistics = 13.2665

$\chi$  (Prob) = 0.0321\*\*

(\*\*) indicates significance at a 5 percent level

**FE Model Specification**

FE approach is considered when it accounts for individual-specific effects or time-specific effects in panel data analysis. More specifically, the fixed effect model specification assumed that the unobserved variable ( $\alpha_i$ ) had correlated results with any of the explanatory variables,  $X_i$ ; i.e.,  $\text{Corr}(\alpha_i, X_i) \neq 0$ . Equation (3) provides the FE model specification:

$$NIM_{it} = \gamma_0 + \gamma_1 NPA_{it} + \gamma_2 LLP_{it} + \gamma_3 LAR_{it} + \gamma_4 ROI_{it} + \gamma_5 CAR_{it} + \alpha_i + \epsilon_{it} \dots \dots \dots (3)$$

Where,

$\gamma_0$  = intercept (including individual-specific effects)

When the variables in Equation (3) are averaged over time, it is presented in the form shown in Equation (4).

$$\overline{NIM}_{it} = \gamma_0 + \gamma_1 \overline{NPA}_{it} + \gamma_2 \overline{LLP}_{it} + \gamma_3 \overline{LAR}_{it} + \gamma_4 \overline{ROI}_{it} + \gamma_5 \overline{CAR}_{it} + \alpha_i + \overline{\varepsilon}_{it} \dots\dots\dots(4)$$

In order to remove the effect of unobserved effect  $\alpha_i$  prior to estimation, Equation (4) is subtracted from Equation (3).

$$(NIM_{it} - \overline{NIM}_{it}) = \gamma_0 + \gamma_1 (NPA_{it} - \overline{NPA}_{it}) + \gamma_2 (LLP_{it} - \overline{LLP}_{it}) + \gamma_3 (LAR_{it} - \overline{LAR}_{it}) + \gamma_4 (ROI_{it} - \overline{ROI}_{it}) + \gamma_5 (CAR_{it} - \overline{CAR}_{it}) + (\varepsilon_{it} - \overline{\varepsilon}_{it}) \dots\dots\dots(5)$$

Now, simplifying Equation (5), Equation (6) presents the transformed Equation to estimate the relationship under the fixed effect model as:

$$\Delta NIM_{it} = \gamma_0 + \gamma_1 \Delta NPA_{it} + \gamma_2 \Delta LLP_{it} + \gamma_3 \Delta LAR_{it} + \gamma_4 \Delta ROI_{it} + \gamma_5 \Delta CAR_{it} + \varepsilon_{it} \dots\dots\dots(6)$$

Here, the symbol  $\gamma_0$  is intercepted (after removing the individual-specific effects),  $\Delta NPA_{it}$  is the difference between non-performing assets ( $NPA_{it}$ ) and the average of non-performing assets ( $\overline{NPA}_{it}$ ). Similarly,  $\Delta LLP_{it}$  is the difference between loan loss provision ratio ( $LLP_{it}$ ) and their average value ( $\overline{LLP}_{it}$ ).  $\Delta LAR_{it}$  represents the difference between loan and advances ratio ( $LAR_{it}$ ) and their average value ( $\overline{LAR}_{it}$ ).  $\Delta ROI_{it}$  stands for the difference between the return investment ( $ROI_{it}$ ) and their average value ( $\overline{ROI}_{it}$ ),  $\Delta CAR_{it}$  is the difference between the capital adequacy ratio ( $CAR_{it}$ ) and their average value ( $\overline{CAR}_{it}$ ), and finally,  $\varepsilon_{it}$  is the difference between  $\varepsilon_{it}$  and  $\overline{\varepsilon}_{it}$ .

**Relation of Non-Performing Assets on Bank's Profitability**

Table 5 presents the regression outcomes derived from the FE Model, showing the relationship between the net interest margin, non-performing assets, and other variables under consideration. The R-squared value indicates that almost 68 percent of the variations observed in the net interest margin are attributed to the explanatory variables, namely non-performing assets, loan loss provision ratio, loan and advances ratio, return on investment, and capital adequacy ratio. The F-statistic of 6.67 (P=0.000) suggests that the probability of obtaining such an F-statistic under the null hypothesis of no relationship between variables is minimal and suggests that the model's independent variables collectively contribute significantly to explaining the variation in the dependent variable. This simply indicates that the model is significant overall.

Table 5. Fixed Effect (FE) Model

Variable	Coefficient	Std Error	t-Statistic	Prob
C	2.6371**	1.2444	1.7646	0.0446
NPA	-0.1371*	0.0962	-1.8011	0.0057
LLP	-0.0604**	0.0994	-0.6082	0.0448
LAR	0.0224**	0.0107	1.0108	0.0315
ROI	0.8164*	0.0967	8.4422	0.0001

CAR	-0.0221*	0.0353	-0.6271	0.0053
$NIM = 2.6371 - 0.1371(NPA) - 0.0604(LLP) + 0.0224(LAR) + 0.8164(ROI) - 0.0221(CAR)_t$				
Number of panel observations = 105			$R^2 = 67.81\%$	
F- Statistics = 6.665 (0.000)				
(*) significant at a 1 percent level of significance				
(**) significant at a 5 percent level of significance				

The FE multiple regression results with a negative coefficient of non-performing assets (NPA) suggests that *ceteris paribus*, a one-unit increase in NPA is associated with a decrease of 0.1371 ( $p=0.000$ ) units in the net interest margin (NIM), and the relationship is significant at 1 percent level. The negative coefficient suggests that a higher NPA is linked to a lower net interest margin. Similarly, the negative coefficients of loan loss provision ratio (LLP) indicate that each one-unit increase in LLP is associated with a decrease of 0.0604 units in NIM, keeping other variables constant. The relationship is significant at a 5 percent level of significance. Concerning the coefficient corresponding to the loan and advances ratio (LAR), it indicates that a rise of one unit in this variable corresponds to a NIM increase of 0.0224 units while keeping the other relevant variables unchanged. The relationship is statistically significant at the 5 percent significance level. Concerning the return on investment (ROI), for each unit increase in ROI, there is an associated increase of 0.8164 units in NIM, holding others unchanged, and the relationship is significant at the 1 percent significance level. Finally, the negative coefficient of 0.0221 for the capital adequacy ratio (CAR) indicates that a one-unit increase in CAR is linked to a reduction of 0.0221 units in NIM, keeping all other variables constant, and the relationship is statistically significant at the 1 percent level. However, this result does not align with the results reported by the correlation coefficient.

## 5. Discussions

The negative coefficient associated with non-performing assets (NPA) implies a notable connection between higher levels of NPA and diminished net interest margins (NIM). This finding raises concerns about potential credit risk, which could have adverse implications for the profitability of commercial banks in Nepal. The findings of this study are consistent with prior expectations and validate several established theories. For example, Merton (1974), in *Credit Risk Theory*, underlines the need for careful lending practices by banks to prevent credit risk and potential loan defaults; Hawley (1893), in the *Risk Theory of Interest*, advocated for risk management to maximize profits, while Markowitz (1952), through the *Portfolio Selection Theory*, emphasized the reduction of risk associated with non-performing assets to improve profit outcomes.

Moreover, the findings align with the prior research that has consistently demonstrated the deleterious impact of non-performing loans (NPLs) on bank profitability. For example, studies by Jiang and Wang (2018), Lin and Batten (2019), Uddin (2022), Wibowo and Haryanto (2018), Yan and Rahman (2018), among others, have consistently highlighted the adverse and statistically significant influence of NPLs on bank profitability across various countries. These collective findings also reinforce the notion that the high levels of NPLs can erode a bank's profitability. Panta (2018) further argued that an increase in NPLs is likely to lead to a reduction in profitability, primarily due to the associated decline in interest income. Moreover, this finding holds particular relevance within Nepal's peculiar economic conditions and banking policy framework, where the economic conditions and regulatory policies exhibit distinct characteristics compared to other regions, accentuating the importance of effective credit risk management strategies.

The negative association between the loan loss provision and bank profitability is noticeable as the evidence has revealed a strong negative nexus between NPA and loan loss provision (LLP). This

relationship is closely tied to the robust positive correlation between NPA and LLP. Increased NPLs might call for larger loan loss provision allocations, negatively impacting profitability. These results are consistent with the notion that elevated NPLs call for increased provisions to reduce credit risk successfully. This result resonates with the widely recognized concept that higher levels of NPLs necessitate elevated provisions to manage credit risk effectively. This finding aligns with Bhattarai (2017), Dahal (2022), and Koirala (2017), unveiling a negative association between the variables.

A significant outcome of the relationship between NIM and loans and advances to deposit (LAR) ratio implies that as the proportion of loans to deposits grows, banks tend to experience an enhancement in their net interest margin. It could be attributed to deploying a larger portion of deposits towards lending activities due to the growing demand for loans within the economy, with the higher spread between the interest earnings and interest payments on deposits. This outcome holds across countries as revealed by studies such as Hasan et al. (2023) that concluded to emphasize the notion about increased loans and advances to deposit ratio tending to coincide with a higher NIM.

The coefficients of ROI with 0.8164 ( $p < 0.01$ ) suggest that higher returns on investments enhance net interest margins for commercial banks. It supports the notion that higher returns from investments can contribute to widening the interest spread, thereby positively influencing banks' net interest margin. Comparable research outcomes have emerged across diverse global contexts, evident in studies conducted by Chen et al. (2021); DeYoung et al. (2020); Guney and Moyer (2007); and Hasan et al. (2019).

## **6. Conclusions**

This study analyzed the impact of NPAs on the profitability of Nepalese commercial banks from 2017-2022 using panel data techniques. Particularly, it examined the relationship between multiple independent variables, namely, non-performing assets (NPA), loan loss provision ratio (LLP), loans and advances ratio (LAR), return on investment (ROI), and capital adequacy ratio (CAR), and their impact on the net interest margin (NIM) of commercial banks in Nepal. Employing the FE econometric model, validated through the Hausman test, it rigorously explored the relationships among these variables. Notably, the findings revealed a robust and negative association between NPA and LLP with bank profitability, while loans and advances ratio and return on investment exhibit positive relationships with the profitability of Nepalese commercial banks. The notable and statistically significant relationship between NPA and LLP with NIM underscores the importance of effective credit risk management and loan quality control for sustaining healthy bank profitability. While acknowledging the influence of other variables within the model's dynamics, it is evident that NPA and LLP emerge as pivotal factors that demand careful attention from policymakers and bank management. Banks can potentially enhance their net interest margins and overall profitability by addressing non-performing loans and provisions for possible loan losses with effective strategies for mitigating credit risk.

The statistically significant positive relationship between return on investment (ROI) and NIM, on the other hand, supports the conclusion of the influential role of ROI in shaping the bank's profitability; as the return on investment increases, so does the net interest margin, signifying the potential for improved performance. This outcome aligns with the notion that prudent investment decisions can yield substantial returns and contribute positively to a bank's profitability. Therefore, banks can magnify their profitability by effectively allocating resources and capitalizing on high-return opportunities. Moreover, it has evidenced a direct link between loan and advances ratio (LAR) to the NIM, and it can be concluded that prudent loan management and strategic lending practices can contribute to healthy financial performance. Thus, by optimizing the loans and advances to total deposits and aligning them with market dynamics, banks can potentially harness a valuable avenue for enhancing their net interest margins and ensuring sustained profitability.

Based on the conducted research analysis and the identified relationships among the variables of

interest, this study provides actionable insights to bolster the profitability and resilience of commercial banks in Nepal. The study offers practical implications. Particularly, the implications of this finding resonate at both operational and policy levels, underscoring the necessity for robust credit assessments, ongoing credit monitoring, and the implementation of compliant loan policies. These measures are vital to effectively mitigate the adverse effects of escalating non-performing loans on the profitability of Nepal's commercial banks.

The contribution to understanding the dynamics of our chosen research topic provides valuable insights and paves the way for future research opportunities to enhance the understanding of the relationships between the variables of interest. However, this study has limitations, including a small sample size and a focus on internal factors, while external factors cannot be ignored. Future researchers can expand on this foundation by using different research methods, enlarging the sample size, and considering economic conditions, policies, and external factors to gain further insights.

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