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Non-Performing Loan in Nepalese Commercial Banks: The Role of Internal and External Factors

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Abstract

Background: Non-performing loan is one of the key indicators for regulators in assessing the bank's financial stability and asset quality, as it refers to the loan where principal or interest payments are overdue by 90 days or more, or when there is uncertainty regarding full repayment. This paper aims to examine the effect of internal and external factors on non-performing loan of Nepalese commercial banks.

Methods: The study employed explanatory research design using 280 quarterly observations for twenty Nepalese commercial banks for the period from the first quarter of 2021 to second quarter of 2024. The econometric models used to analyze the balanced panel data are fixed effect and random effect model.

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Results: The results depict that capital adequacy and credit to deposit ratio have negative significant impact on the NPL, whereas liquidity and prescribed sector's lending have positive significant impact on the NPL. The rate of lending interest has insignificant impact on NPL. Similarly, inflation and GDP growth rate have positive significant impact on NPL of Nepalese commercial banks during the observed period.
Conclusion: The study concludes that the internal factors such as capital adequacy ratio and credit-to-deposit ratio, along with the external factor of GDP growth, significantly influence non-performing loan ratios in Nepalese commercial banks. The study also highlights the need for robust capital management, enhanced credit monitoring, and stable macroeconomic policies to mitigate default risks and improve asset quality within the sector.
Novelty: The literature offers consistent findings for some other studies in the area while a broader analysis is lacking for other banking and financial institutions in the Nepalese context. The present study considers all the commercial banks with quarterly data, and supports the idea that a higher financial performance is correlated to lower level of NPL. Hence, policy makers are advised to monitor internal bank specific and external macroeconomic indicators to reduce NPL.
Keywords: bank specific internal factors, commercial banks, external factors, non-performing loans, prescribed sector lending.

Introduction

Bank loans are classified as non-performing if principal and interest payments are overdue by ninety days or more, or if it is unlikely that future payments will be received in full (The World Bank, 2022). The recent past financial crises in the world have been the focus for professionals and academics due to their critical economic consequences (Agnello & Sousa, 2012; Tomczak, 2023). Those crises were aroused primarily due to the increase in non-performing loans (NPLs) in the banking system (Park & Shin, 2021). NPL is also referred to as 'bad debts' and is critical to the financial health of the banks and the financial system. The ratio of non-performing loans is one of the most common indicators used to identify the banks' loan quality. The increase in the ratio might be the indication of deterioration in the performance of banking sector (Mörttinen et al. 2005). Banking history shows that a rapid build-up of NPL has a crucial role in banking crises (Demirguc-Kunt & Detragiache, 1998; Gonzalez-Hermosillo, 1999). Financial crises are often characterized by a rise in NPLs within banks' loan portfolios. In the aftermath of the 2007–2008 Global Financial Crisis, NPLs have been closely monitored by governments and bank management, as they are linked to bank failures and systemic crises (Ghosh, 2015).

Non-performing loan is a key factor for regulators in assessing the financial stability and the quality of a bank's assets. In the past, NPLs have played a major role in bank failures and are viewed as a warning sign of potential banking crises. A rise in NPLs often signals underlying issues that could lead to an unrecognized banking crisis (Louzis et al., 2012). Moreover, a rise

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in non-performing loans highlights vulnerabilities within the financial system, exposing banks to increased level of credit risk. Hence, numerous studies were conducted to investigate the factors influencing banks' asset quality, including bank-specific characteristics and macroeconomic conditions, across both developing and developed economies (Dimitrios et al., 2016)

As per Kuzucu and Kuzucu (2019) banks, which target to profit in the long run, should keep bad debts to a minimum. The stability of the banking system is essential for economic stability and sustained growth. Understanding the factors driving NPL is crucial for banks, banking regulators, and governments, as it allows them to implement effective preventive measures to safeguard both the banking system and the broader economy from instability (Ali et al., 2020). According to Laeven and Valencia (2013) the systemic banking crises occurred during 1970–2011 is the outcome of peaks in NPLs. In this context, financial institutions that operate in stable, well-regulated markets and with acceptable levels of economic growth do not usually have high NPL rates. On the other hand, those institutions with the worst efficiency ratios and reduced levels of competition tend to have the highest.

The previous relevant literatures (Kjosevski & Petkovski, 2021; Bhattarai, 2023; Pant, 2023; Salas et. al, 2024) have investigated the macroeconomic variables that may influence NPLs, such as return on equity (ROE), return on assets (ROA), total assets, loans to total assets, total loans, the ratio of operating expense to operating income, capital adequacy ratio, net interest margin, liquidity, bank size, loan loss provision, cost of credit, interest rate, GDP growth rate, inflation, unemployment rate, exchange rate, and others. As per Sadaula and Hamal (2022), the banking business in Nepal is not risk-free, so it must take into account a wide range of factors when managing risk. Moreover, majority of the studies were conducted in the context of industrialized nations such as United States, Spain, Italy, Greece to investigate the effect of factors that on NPL. The studies not only have depicted conflicting results, on the other hand, very limited studies have been conducted factors causing NPL in developing economies, especially in Nepal.

Based on the review of existing literature, it is observed that NPLs primarily relies on yearly data and explanatory variables, overlooking short-term (monthly or quarterly) movements. While some studies use simple regression models, these often lack reliability due to insufficient time points, making advanced panel data models more suitable for capturing both time and spatial dimensions. Hence, this study addresses these gaps by employing panel data regression with quarterly data to model NPLs for Nepalese commercial banks (CBs), enhancing accuracy and robustness. Therefore, this paper's aim is to examine the impact of capital adequacy ratio (CAR), liquidity (LIQ), interest rate for lending (LIR), credit-deposit ratio (CDR), prescribed sector lending (PSL), inflation rate (INF), and gross domestic product growth rate (GDR) on non-performing loan of Nepalese commercial banks. The present study contributes to the body

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of knowledge in financial sector by supporting build a consensus on the bank specific and macroeconomic factors influencing non-performing loans in Nepalese context.

Besides introduction in section 1, the rest of the paper has been organized as follows. Section 2 presents literature review and hypothesis development. Section 3 describes the data, variables and methods employed. Section 4 presents the results and discussion. Finally, the major conclusions, implications, and suggestions for future studies are incorporated.

Literature Review and Hypothesis Development

This section presents a review of theoretical and empirical studies relevant to the NPL in brief. This part attempts to exhibit the relationship between each predictor with response variables as investigated by previous studies.

Theoretical background

Credit risk theory provides a systematic framework for evaluating the likelihood of borrower default and identifying the factors that influence these risks. It combines borrower-specific variables, such as repayment capacity, with macroeconomic factors like GDR, INF, and unemployment, to illustrate how economic cycles impact loan performance. Studies indicate that economic booms often result in more lenient credit standards, which heightens risks during economic downturns (Ruckes, 2004; Ghosh, 2015).

As intermediaries, banks incur various transaction costs in their core operations. Their capacity to manage risk and mitigate asymmetric information among the borrowers and lenders significantly influences their operational efficiency in service delivery (Laryea et al., 2016). Information asymmetry manifests in two major forms, and the are adverse selection, and the moral hazard. Pre-contractual asymmetric information gives rise to adverse selection, whereas moral hazard pertains to post-contractual asymmetric information (Milgrom & Roberts, 1992). Adverse selection happens when borrowers opt for high-risk projects that have a high likelihood of default (Laryea et al., 2016). Moral hazard, on the other hand, involves borrowers taking actions that are not visible to the bank. Less-risky borrowers might leave the market due to concerns about negative returns when market interest rates are higher than expected (Laryea et al., 2016). Furthermore, most investors tend to favor high-risk projects over low-risk ones, ignoring the potential for negative returns on low-risk projects when market interest rates are elevated (Laryea et al., 2016). As a result, the inefficiency in the management of information asymmetries causes the increased credit risk.

Non-performing loan ratio

This study has taken the non-performing loan ratio (NPLR) has been used as the response variable. This ratio refers to the amount of NPLs in a bank's loan portfolio to the total amount of outstanding loans held by the bank (Ciukaj & Kil, 2020) and a higher ratio indicates a greater risk of loss for the bank if loan amounts are not repaid, while a lower ratio suggests that the

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outstanding loans present minimal risk (Rezina et al., 2020). Therefore, the NPL ratio tests a bank's efficiency in earning repayments for its loans. The statuary requirement for NPL as per Nepal Rastra Bank (2023) is up to 5% for the commercial banks. The NPL ratio is also commonly used to represent credit risk measures in numerous previous studies (Castro, 2013; Imbierowicz & Rauch, 2014). Table 1 shows the NPL rate of the South Asian countries in 2022 (The World Bank, 2022), while data for Afghanistan is available only for 2018. Nepal seems maintaining the lower level of NPL in comparison to other countries for the year.

Table: 1 Summary of latest NPLs rate

South Asian Countries	NPLs Rate (%)
Nepal	2.4
Afghanistan	8.8*
Bangladesh	8.7
Bhutan	2.9
India	4.8
Maldives	9.4
Pakistan	6.5
Sri Lanka	11.9

** Data available for 2018.*

Capital adequacy and NPL

Capital adequacy ratio (CAR) is the numerical value and expressed as the ratio of total equity to total assets (Rachman et al., 2018). It measures solvency in the capacity of a bank to handle risks. The statuary requirement of CAR as per Nepal Rastra Bank (2023) is minimum 10% for the commercial banks. Madugu et al. (2020) and Abid et al. (2014) found a pessimistic correlation between CAR and NPLs. They depicted that banks with stronger CARs can efficiently manage the default risks for lowering the levels of NPLs. On the one hand, banks with high CAR levels may pursue opportunities more aggressively, resulting in riskier credit portfolios. Consequently, this has a positive impact on non-performing loans (Demirguc-Kunt & Detragiache, 1998; Msomi, 2022). In light of the fact that a greater number of studies have demonstrated a detrimental effect, this investigation also advanced the following hypothesis.

H1: Capital adequacy ratio has significantly negative impact on the NPL ratio.

Credit to deposit and NPL

The operational strategy of a bank's administration has an impact on the credit-to-deposit ratio (CDR). Problematic loans are perceived as a substantial consequence of credit expansion (Jimenez & Saurina, 2006). Gross loan-to-total-deposits ratio (Kumbirai & Webb, 2010; Akhter, 2023) and net loan-to-total-deposits-and-borrowings ratio (Odunga, 2016; Msomi, 2023) are employed to assess credit advancement in the banking sector. Nepal Rastra Bank (2023) has established a maximum statutory requirement of 90% of CDR for commercial institutions. Laryea et al. (2016) discovered a positive correlation between the total advance to

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deposit ratio and NPL. The results were consistent with those of Festić et al. (2011). Nevertheless, other studies (Swamy, 2012; Nasir et al, 2022) have identified a negative correlation between these variables, indicating that NPL may be the result of specific regulations, the origin of the banking system, or specific conditions that compel banks to exercise greater caution and conservatism when extending loans. In the light of above empirical facts, the following hypothesis has been developed for the study.

H2: Credit-deposit ratio has significantly negative impact on NPL ratio.

Liquidity ratio and NPL

The liquidity ratio (LIQ) measures a commercial bank's ability to meet its short-term financial obligations using its liquid assets. Higher liquidity ratio reduces a bank's liquidity risk and enhances management's capacity in servicing as well as monitoring loan, leading to minimized levels of NPL(Chen et al., 2024). The statuary requirement of LIQ as per Nepal Rastra Bank (2023) is minimum 20% for the commercial banks. A bank with more liquid fund often does not prioritize resolving bad loans, as there is sufficient money to operate without focusing on proper loan management, hence shows a mixed liquidity effect on non-performing loans (Bhattarai, 2015). Liquidity was measured by the ratio of total loans to total deposits, a widely used statistic to estimate a bank's liquidity and reflect its fund utilization policy (Patni & Darma, 2017). An increase in LIQ indicates that the bank is issuing more loans, which can lead to a less liquid position. Jameel (2014) found the association of loan-to-deposit ratios and NPL weak. Msomi (2022) in found the positive and significant relationship between liquidity and NPL. The study also cautioned that higher liquidity ratios in banks indicate poor handling of surplus funds, resulting in more lenient loan management practices.

H3: Liquidity ratio has significantly positively impact on the NPL ratio.

Lending interest and NPL

The lending interest rate (LIR) of a bank is the percentage charged by the bank on loans or paid on deposits over a specified period. According to Atoi (2018) during the periods of high lending interest rates, the rate of borrower defaults is expected to rise, leading to an increase in non-performing loans. Bredl (2018) identified lending rates as a factor contributing to NPL in accordance with Stiglitz and Weiss's (1981) theory of adverse selection. Good loanees are priced out of the market as a result of the rise in interest rates, as they are unwilling to pay rates that exceed market rates. As a result, commercial banks are able to attract consumers who are less discerning and are more inclined to pay higher rates. Consequently, banks impose higher interest rates on these hazardous loans, which exacerbates the probability of default. Kjosevski and Petkovski (2021) discovered a positive correlation between interest rates and NPL.

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Companies may become financially vulnerable and default on their loans as interest rates rise. By reducing interest rates, companies can alleviate the burden of interest payments, thereby increasing their profit margins. As a result, businesses are more likely to repay their loans on time and become financially stable. Studies conducted by (Olarewaju, 2020; Msomi, 2022) have demonstrated that lending interest rates have a detrimental impact on NPL.

H4: Lending interest rate has significantly positive impact on the NPL ratio.

Prescribed sector lending and NPL

Numerical ratio of prescribed sector lending (PSL) to total credit of the bank serves as a measure of a bank's Prescribed sector loan ratio. In the context of Nepal, Nepal Rastra Bank (NRB) mandates lending to specific Prescribed sectors to promote economic development. These sectors include agriculture, small and medium enterprises (SMEs), and renewable energy. According to NRB's guidelines, CBs are required to allocate a stated percentage of their credit to these sectors. For instance, 'A' class licensed institutions must lend 10% of the credit to the energy sector, 15% of their credit to the agriculture sector and 15% combined to small and cottage industry sectors (Nepal Rastra Bank, 2023). This includes lending to specified sectors such as agriculture and micro or small enterprises. The credit policy of the bank plays an essential role in determining the subsequent levels of NPL. In the study of Rahman et al. (2017) it is revealed that sensitive sector's loan, and prescribed sector's loan have significant positive effect on NPLs.

H5: Prescribed sector's lending has significantly positive impact on NPL ratio.

Inflation and NPL

The rate of inflation (INF) is a metric that quantifies the percentage increase in the general price level of products and services over a specific period, thereby indicating the rate at which purchasing power is diminishing. Inflation does not have a direct effect on NPLs (Darmawan, 2018). Inflation has the potential to have a detrimental impact on NPLs, as it will increase the ability of debtors to repay loans by decreasing the actual value of unpaid debt (Fajar & Umanto, 2017). In contrast, CBs will require an elevated risk premium, which will result in subsequent increased INFs and interest payments, as increasing inflation levels are perceived as a sign of macro-economic uncertainty (Shonhadji, 2020). The cash flow of creditors is reduced as a result of this scenario, which in turn reduces their capacity to repay their loans. The literature also strongly implies that the INF and NPLs have a higher correlation. For instance, Mpofu and Nikolaidou (2018) demonstrated that the high prevalence of impaired loans is a consequence of inflation expectations in several sub-Saharan African countries with flexible exchange rate regimes. Similarly, inflation had a substantial and positive effect on non-performing loans (NPLs) according to Msomi (2022) and Akhter (2023).

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H6: Inflation premium has significantly positive impact on NPL ratio.

Gross domestic product growth and NPL

The growth rate on gross domestic product (GDPR) measures the percentage change in a country's GDP over a specific period, typically quarterly or annually. Empirical studies showed a negative correlation between real GDP growth rate and NPLs (Mohaddes et al., 2017; Apan & Islamoglu, 2019, Msomi, 2022; Akhter, 2023). The literature explains this correlation by stating that a substantial positive GDP growth rate generally leads to higher revenue, enhancing borrowers' ability to service their debts, which subsequently results in lower non-performing loans (NPLs). Conversely, when the economy decelerates down and growth on GDP is relatively low, the NPL level is expected to increase.

H7: Gross domestic product has significantly *negative impact on NPL ratio.*

Based on the above aforementioned literature review and the Table 2, the following conceptual framework has been developed.

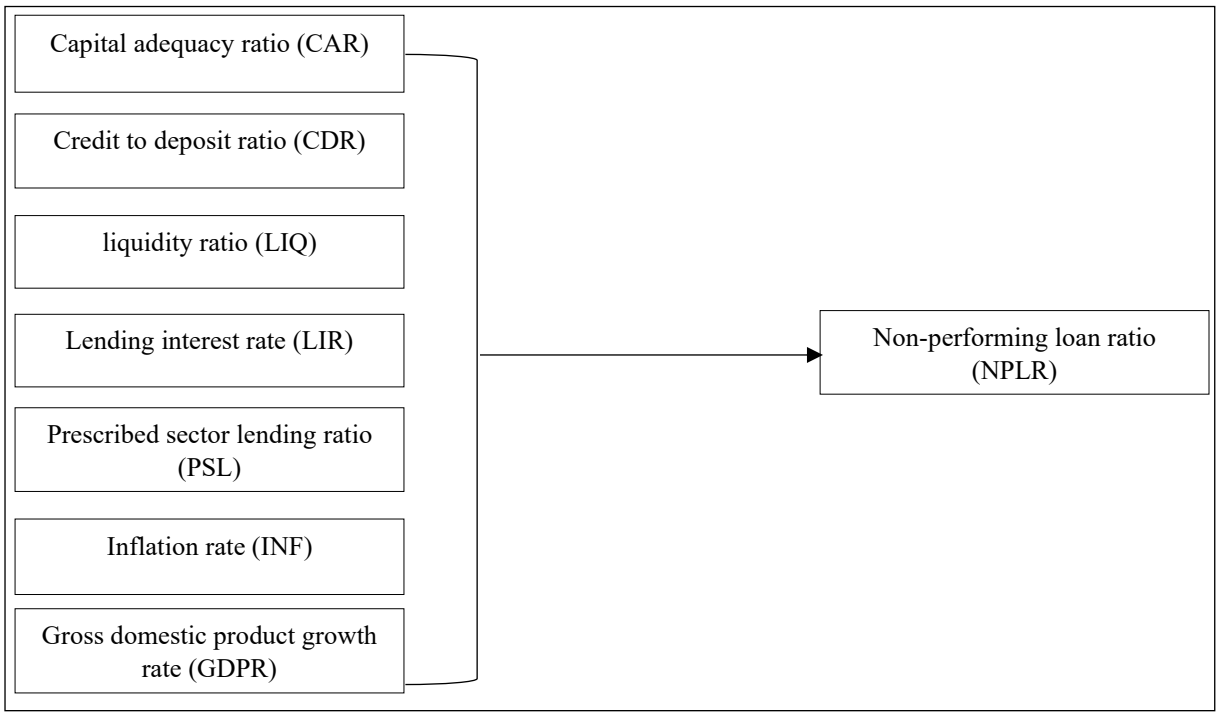

Figure 1: *Conceptual Framework*

Research Methods

The population for this paper is the total number of CBs operating in Nepal. The study has been based on positivism philosophy and employed explanatory research design. The study utilized

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280 quarterly observations for twenty Nepalese commercial banks for the period from the first quarter of 2021 to second quarter of 2024. The econometric approach used is a panel fixed effect and random effect model for the balanced panel data collected from the database of Nepal Rastra Bank, the central bank of Nepal, and website of the sampled banks.

Table 2: Operationalization of variables and expected priori sign

Author	Symbol	Description	Expected sign
(Naili & Lahrichi, 2022; Msomi, 2022; Akhter, 2023)	NPLR	The ratio of the amount of NPL in a bank's loan portfolio to the total amount of outstanding loans (%)	
	Predictors		
(Madugu et a1 2020; Msomi, 2022; Akhter, 2023)	CAR	Total capital to risk-weighted assets ratio (%)	Negative
(Nasir et al., 2022; Akhter, 2023)	CDR	Gross loans and advances to total deposit ratio (%)	Negative
(Patni & Darma, 2017; Msomi, 2022)	LIQ	Liquid assets to current liabilities ratio (%)	Positive
(Kjosevski & Petkovski, 2021; Msomi, 2022)	LIR	The lending interest rate charged by banks on loan (%)	Positive
(Rahman et al., 2017)	PSL	Prescribed sector lending up to the limit as directed by NRB (%)	Positive
(Msomi, 2022; Akhter, 2023)	INF	The percentage increase in the general price level of goods and services over a specific period (%)	Positive
(Msomi, 2022; Akhter, 2023)	GDPR	The percentage change in a country's Gross Domestic Product (GDP) over a specific period (%)	Negative

The response and independent variables have been chosen based on the study of existing literature as shown in Table 2. Further, the dataset, which is of a panel nature, includes two dimensions: a spatial (cross-sectional) dimension consisting of individual units (banks) and a time dimension covering various quarters from 2021Q1 to 2024Q2. Therefore, a variety of models have been employed, starting with the most basic ones, each suitable under specific assumptions. The models utilized in this study are detailed below along with their respective assumptions.

According to Gujarati and Porter (2009), pooled OLS regression model operates under the assumption that the dual nature of panel data, which includes both cross sections and time, is disregarded. The model presumes that the regression coefficients are consistent over time and across different cross-sections. Crucially, it overlooks any unobserved heterogeneity that might exist among the various cross-sectional units. In the context of panel data estimation, the fixed effects models (FEM) and random effects models(REM), as elaborated by Wooldridge (2013), are employed. Panel data methodology was used to reduce heterogeneity and multicollinearity concerns and also increase the effectiveness of estimations, building on the work of Baltagi

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et al. (2005). Basically, panel data regression models are superior to the pooled OLS model because they account for heterogeneity across individual cross-sectional units (such as banks) through a differential intercept term that varies by bank but remains constant over time. Hence, such models for the analysis of cross-section data in historical series are considered the best tools to conduct a causal analysis (Stimson, 1985). As per Mishra et al. (2021), the primary distinction between the FEM and REM lies in the REM model's assumption that the individual cross-sectional effect is a random variable with a zero mean, uncorrelated with the independent variables across all the time periods, whereas the FEM does not make this assumption. The study has adopted theoretical model for NPLs as applied by Dao et al. (2020) and Msomi (2022). It has also attempted to improve this by introducing a variety of independent variables to match the realities of commercial banks' situation in Nepal. The research can be analyzed in the following sequence:

$$NPLR_{i,t} = \beta_0 + \beta_1 CAR_{i,t} + \beta_2 CDR_{i,t} + \beta_3 LIQ_{i,t} + \beta_4 LIR_{i,t} + \beta_5 PSL_{i,t} + \beta_6 INF_{i,t} + \beta_7 GDPR_{i,t} + u_{it}$$

This study employed a hierarchical panel data approach, utilizing a combination of OLS, FEM, and REM techniques. Specifically, multiple experiments were conducted to validate the suitability of the panel layout used in this research. the Hausman test is employed to differentiate between fixed effect (FE) regression model and random effect (RE) regression model. The results of these tests indicate which strategy is more appropriate.

Results and Discussion

This section presents the results of descriptive statistics, Pearson's correlation coefficients, VIF, OLS, FEM and REM for the Nepalese commercial banks during the study period. Table 3 depicts the basic descriptive characteristics of the NPLR, CAR, CDR, LIQ, LIR, PSL, INF and GDPR in aggregate for the study. The average value of NPLR is 2.04% with a minimum of 0.11% to maximum of 5.49%. The study shows that the average level of NPLR is below 5%, indicating the better performance of Nepalese bank (Nepal Rastra Bank, 2023). Similarly, it is also lower than the average NPLR of South Asian countries (The World Bank, 2022). The mean, SD, minimum, and maximum value of CAR are 13.40%, 1,52%, 10.16%, and 23.31%, respectively, indicating that the commercial banks are maintaining their capital above the minimum statuary requirement i.e 10% (Nepal Rastra Bank, 2023). The average value of CDR is 83.16% indicating a high range in CDR from 62.22% to 99.69% within the same industry and it is less than the statuary requirements of 90% (Nepal Rastra Bank, 2023). This indicates that Nepalese banking sector's operational efficiency has not met the regulatory compliance at the upper level.

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Table 3: Descriptive statistics for all variables

Variable	Observation	Mean	Std. Dev.	Min	Max
NPLR	280	2.048	1.395	0.110	5.490
CAR	280	13.403	1.520	10.160	23.310
CDR	280	83.168	6.288	62.220	99.690
LIQ	280	26.517	6.418	15.440	72.910
LIR	280	8.789	1.613	3.610	11.730
PSL	280	28.920	10.206	4.260	77.230
INF	280	1.481	0.404	0.900	1.955
GDPR	280	0.885	0.499	0.133	1.400

The maximum level of net liquidity available during the study period is 72.91% indicating less efficiency in investing and lending the fund as the statuary requirement is minimum 20%. The lending interest rate ranged in between 3.61% to 11.73% with an average of 8.78%, indicating the high difference among banks. Prescribed sector lending averaged 28.92% with 4.26% and 77.23% as minimum and maximum values respectively. It indicates that the banking sector comply with the regulations of the central bank. of Nepal Inflation rate and GDP growth rate have low standard deviation in comparison to other variables indicating low variability. These are the key macro-economic predictors in this analysis. The data were analysed on a quarterly basis.

Table 4: Pairwise correlations

Variables	NPLR	CAR	CDR	LIQ	LIR	PSL	INF	GDPR
NPLR	1.000							
CAR	-0.100	1.000						
	(0.096)							
CDR	-0.103	-0.189***	1.000					
	(0.085)	(0.002)						
LIQ	0.176**	0.286***	-0.649***	1.000				
	(0.003)	(0.000)	(0.000)					
LIR	0.287***	-0.330***	0.414***	-0.201***	1.000			
	(0.000)	(0.000)	(0.000)	(0.001)				
PSL	0.326***	0.312***	0.017	0.000	-0.015	1.000		
	(0.000)	(0.000)	(0.772)	(0.996)	(0.797)			
INF	0.402***	-0.205***	0.307***	-0.012	0.821***	0.065	1.000	
	(0.000)	(0.001)	(0.000)	(0.846)	(0.000)	(0.281)		
GDPR	0.155**	-0.177***	0.497***	-0.164***	0.673***	0.033	0.771***	1.000
	(0.010)	(0.003)	(0.000)	(0.006)	(0.000)	(0.580)	(0.000)	

*Note: *** denotes that p < .01*

The pairwise correlation matrix (Table 4) has been computed to investigate the correlation between the selected predictor variables and the NPLR of the commercial banks in Nepal that were sampled. When the correlation coefficient of variables surpasses 0.80, the issue of multicolinearity arises (Pervez & Ali, 2024). The study is not affected by multicollinearity, as there is no significant correlation between the variables (Bhowmik & Sarker, 2021).

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Additionally, the NPLR of the Nepalese CBs sampled are substantially correlated with all selected variables, with the exception of CAR and CDR. The study demonstrated that CAR and CDR are negatively correlated with NPLR, but the correlation is not statistically significant. NPLR is substantially positively correlated with other predictors, including LIQ, LIR, PSL, INF, and GDPR.

Table 5 shows the variance inflation factor for each predictor variable and its average value is 2.65. VIF ranges from 1.15 to 4.89 indicating no multicollinearity in a matrix of explanatory variables because Richter et al. (2015) and Ahmed et al, (2021) taken the benchmark value for VIF for all variables if less than 5 will have no multicollinearity between the independent variables, and good for research.

Table 5: Variance inflation factor (VIF)

Variable	VIF	1/VIF
INF	4.89	0.205
LIR	3.69	0.271
GDPR	3.04	0.328
CDR	2.42	0.414
LIQ	2.06	0.484
CAR	1.36	0.736
PSL	1.15	0.871
Mean VIF	2.65	

The Hausman test has been implemented due to panel dataset for distinguishing between the fixed effect (FE) regression model and the random effect (RE) regression model. Under null hypotheses, the random effect is the preferred method, while under alternative hypotheses, the fixed effect is the preferred method. In this scenario, the fixed effect regression model is the most suitable option (Table 6).

Table 6: Hausman Test Result

Test hypothesis (H_0): The coefficient difference is not systematic

chi2(0) = 0.000
Prob > chi2 = Vb−VB is not positive definite

From the Hausman Test, the Fixed Effects Model (FEM) is selected, as the probability value is 0.000, indicating significant differences between FEM and REM. The results of the Pooled OLS, Fixed Effects (FEM), and Random Effects (REM) estimates are displayed in Table 7. The R-squared values for Pooled OLS, FEM and REM are 36.1%, 47.7% and 34%, respectively, indicating that the independent variables explain a considerable proportion of the variation in the response variable, NPL. The balanced panel dataset consists of 280 observations for twenty Nepalese CBs for the study period. Therefore, the discussion of

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findings focused on the results of the Fixed Effects Model as it was found to be the appropriate model.

Table 7: Regression models for NPLR as response variable

	Models		
Variable	**Pooled OLS**	**REM**	**FEM**
CAR	-.180*** (.052)	-.176*** (.051)	-.186*** (.055)
CDR	-.026 (.017)	-.033** (.014)	-.033** (.014)
LIQ	.027* (.015)	.043*** (.014)	.046*** (.014)
LIR	.007 (.081)	.013 (.080)	-.001 (.084)
PSL	.049*** (.007)	.035 (.012)***	.024 (.015)
INF	1.954*** (.369)	1.877*** (.321)	1.929*** (.329)
GDPR	-.717*** (.236)	-.589*** (.182)	-.587*** (.183)
Constant	2.152 (1.718)	2.652 (1.639)	3.033 (1.717)*
Observations	**280**	**280**	**280**
R -squared	0.361	0.340	0.477
F-test	21.982		32.957
Prob > F	0.000	0.000	0.000

*Note: Standard errors in parenthesis; *, ** and ***denote the level of significance at 10%, 5% and 1% respectively; NPL is the non-performing loans ratio; CAR is the capital adequacy ratio; CDR is the credit to deposit ratio; LIQ is the liquidity ratio; INR is the real interest rate; PSL is the prescribed sector lending ratio, INF is the inflation rate; GDP is the Gross Domestic Product growth rate.*

CAR exhibits a negative and significant effect on NPLR at the 1% level (coefficient: -0.186). This is aligned with the findings of Madugu et al. (2020); Abid et al. (2014). The findings of the study contrasts with the results of Demirguc-Kunt and Detragiache, (1998); and Msomi, (2022). This study suggests that as CAR increases, NPLR decreases. Therefore, it is argued that banks with stronger CAR are better equipped to manage default risks. CDR has a negative and significant effect on NPLR at the 5% level (coefficient: -0.033). This finding is similar with the findings of Swamy (2012); Nasir et al. (2022). However, this result contradicts with the results of Laryea et al. (2016), and Festić et al. (2011), implying that a higher credit-to-deposit ratio helps reduce the incidence of NPLR, possibly due to improved credit monitoring and better loan performance.

Whereas, LIQ shows a positive and significant effect on NPLR at the 1% level (coefficient: 0.046). The study produced similar result as that of Msomi (2022). This suggests that greater liquidity availability may reduce the stringency of loan underwriting standards, potentially

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increasing NPLR. However, Bhattarai (2015) found a mixed effect of liquidity on non-performing loans. The findings also contrasts with the studies of Chen et al., (2024); and Patni and Darma (2017). But, LIR is negative but insignificant in the FEM (-0.001). This result implies that interest rate changes have little effect on NPLR. The finding contradicts Atoi (2018); Bredl (2018); Stiglitz and Weiss's (1981); and Kjosevski and Petkovski (2021), who theorized that rising interest rates lead to adverse selection and increased NPLR. The present study aligns with the studies of Olarewaju, 2020; and Msomi, 2022). The study found that PSL has a positive but insignificant effect on NPLR in the FEM (coefficient: 0.024) and is similar with the finding of Rahman et al. (2017). This suggests that the performance of this variable is inconsistent across banks in the panel.

INF demonstrates a significant positive effect on NPLR at the 1% level (coefficient: 1.929). This is consistent with the findings of Mpofu and Nikolaidou (2018); Msomi (2022), and Akhter (2023). This finding is consistent across models and indicates that industrial production increases might not directly reduce NPLR due to lagging effects in loan repayment improvements. However, the findings of the study contrasts with the finding of (Fajar & Umanto, 2017). The study also showed that GDPR shows a negative and significant effect on NPLR at the 1% level (coefficient: -0.587). This implies that as GDPR grows, borrowers' repayment capacity improves, leading to a reduction in NPLR. This finding aligns with studies by (Mohaddes et al., 2017; Khaliq & Thaker, 2017; Apan & Islamoglu, 2019, Msomi, 2022; Akhter, 2023).

Table 8. Results of hypothesis testing

SN	*Hypothesis*	*Decision*
H1:	*Capital adequacy ratio has significantly negative impact on the NPL ratio*	*Supported*
H2:	*Credit-deposit ratio has significantly negative impact on NPL ratio*	*Supported*
H3:	*Liquidity has significantly positive impact on NPL ratio*	*Supported*
H4:	*Lending interest rate has significantly positive impact on the NPL ratio*	*Not supported*
H5:	*Prescribed sector's lending has significantly positive impact on NPL ratio.*	*Supported*
H6:	*Inflation has significantly positive impact on NPL ratio.*	*Supported*
H7:	*GDP growth has significantly negative impact on NPL ratio.*	*Supported*

Conclusion

The objective of this paper was to investigate the influence of firm-specific internal as well as macroeconomic that is external variables (CAR, CDR, LIQ, LIR, PSL, INF, and GDPR) on NPLR in Nepalese commercial banks. From the analysis, CAR, CDR, and GDPR negatively affect NPLR, while net liquidity and industrial production positively and significantly impact NPLR. Interest rate and prescribed sector lending have an insignificant effect on NPLs. Based on the results of the Fixed Effects Model (FEM), the determinants of NPLs in Nepalese commercial banks are capital adequacy ratio, credit-to-deposit ratio, and GDPR, as these factors are statistically significant and have the most notable impact.

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Thus, it is highly recommended that CBs in Nepal should focus on maintaining an optimal capital adequacy ratio above the regulatory minimum to mitigate default risks effectively. Additionally, strengthening credit-monitoring systems to enhance the credit-to-deposit ratio will reduce the likelihood of NPLs. As GDP growth positively affects loan repayment capacity, policymakers should work toward sustaining economic growth through stable and supportive macroeconomic policies. The positive effect of liquidity on NPLs highlights potential inefficiencies in loan management practices. Banks should prioritize stricter loan underwriting standards and improve risk management frameworks to ensure efficient use of available liquidity. Furthermore, the insignificant impact of interest rates on NPLs calls for a deeper investigation into the role of interest rate policies and lending practices in Nepal's banking sector.

The dataset of this study is restricted by its scope, which comprises 280 quarterly observations spanning three and a half years. Future research can be conducted by examining the long-term effects and expanding the dataset to encompass a broader time frame. Additionally, it is possible to investigate additional macroeconomic variables to gain a more comprehensive comprehension of the factors that influence NPLs in Nepalese commercial banks.

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