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Macroeconomic, macro-prudential, and bank-specific determinants of loan growth in Nepalese commercial banks

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Abstract
This study empirically examines the macroeconomic, macro-prudential and bank-specific determinants of loan growth in Nepalese commercial banks using a balanced panel of 18 commercial banks covering the period from 2013 to 2023. The analysis incorporates macroeconomic indicators (GDP growth, inflation), macro-prudential (policy rate, loan-to-value caps and the cash reserve ratio), and bank balance-sheet variables (size, loan-to-deposit ratio, non-performing loans, capital adequacy, and profitability). A two-way fixed-effects model is employed as the preferred specification to control for unobserved bank heterogeneity and common time effects, with identification based on within-bank variation over time, while pooled OLS, random-effects, bank fixed-effects, and dynamic GMM estimations are reported as benchmarks and robustness checks. The preferred two-way fixed effects result show that bank size and the loan-to-deposit ratio are positively associated with loan growth, whereas non-performing loans are negatively associated with loan growth. Capital adequacy and profitability are not statistically significant in the preferred specification. In specifications that exclude year fixed effects, GDP growth is positively associated with loan growth and the policy rate is negatively associated with loan growth. However, these macroeconomic and policy coefficients are interpreted cautiously as they are not separately identified in the two-way fixed effects model. The positive relationship between the CRR and loan growth is interpreted as reflecting countercyclical policy timing rather than a structural stimulative effect.

Keywords
Loan growth, GDP growth, policy rate, loan-to-value (LTV), cash reserve ratio (CRR), commercial banks, Nepal

JEL Classification
G21, E44, E52

1 Introduction

The banking sector is a central pillar of economic development since it mobilizes savings, allocates credit and makes possible the investment functions which in turn support capital formation, private sector growth and productivity improvements (Levine, 1997; Levine et al., 2000). This is especially true in developing economies like Nepal, in which the majority of financing for micro businesses, households and government operations comes from commercial banks. These banks primarily pursue two different objectives: financial performance and socio-economic development by providing loans and financial opportunities (Allen & Carletti, 2012). The existence of this dual purpose adds complexity and interest in the factors influencing the loan growth in such institutions. The loan growth in these banks indicates their operational efficiency, financial well-being, and reflects government's broader macroeconomic efforts and activities. Since the role of such banks in promoting economic welfare and economic growth is critical, it is necessary to determine the factors driving such banks' loan growth (Beck et al., 2007; Mishkin, 2019).

Lending is often called the lifeblood of a bank because it comprises the majority of a bank's assets and interest from such loans is the bank's major source of revenue (Olokoyo, 2011). Similarly, when lending is in abundance, there are great possibilities for development and investment opportunities. Without bank lending, many times, industrial expansions, manufacturing, agricultural projects, real estate developments, distribution, fishing, trading, tourism undertakings are not possible (Jamil, 1988; Beck et al., 2007). However, at the same time, lending is a complicated and risky endeavor. The ability and willingness of the bank to lend involves many internal factors such as capital, size, deposits, liquidity levels as well as external macroeconomic conditions and regulatory frameworks (Bhattrai & Sapkota, 2023). Considering the bank-based financial structure of Nepal where commercial banks account for majority portion of total banking assets, investment and overall demand are highly dependent on their willingness to lend (Timsina, 2016). Moderate lending expansion can be good for economic activity, but high loan growth or negative loan growth can be harmful to economic stability (Igan & Pinheiro, 2011). Given this dual importance, a substantial body of literature has examined the determinants of commercial bank loan growth. These determinants can be broadly grouped into three categories: broader macroeconomic factors, macro-prudential factors and bank specific factors (internal characteristics). Studies conducted in diverse settings broadly identify multiple important determinants, but they also reveal some discrepancies regarding specific effects. This is of particular importance in the context of Nepal where commercial banks completely control the financial system.

The banking industry in Nepal has gone through many structural changes over the last decade. After the consolidation policy initiated by Nepal Rastra Bank (NRB) in 2011, the number of commercial banks decreased from 32 in 2013 to 20 by 2023 through mergers and acquisitions which led to more concentrated but more resilient banking system (NRB, 2023). At the same time, the banking sector has seen a number of credit cycles such as huge loan growth in mid 2010s resulting from the post-earthquakes reconstruction needs and remittance inflows, followed by a credit slowdown to extremely low levels after COVID, with excess liquidity building up while private sector demand was weak. The broad money increased by almost 13%, but credit to the private sector grew only by 5.8% in the fiscal year 2023/24. This reflects a significant disconnect between liquidity conditions and actual lending activity. At the same time, NPLs climbed steadily, breaching 4% by 2024 raising questions about asset quality and banks' risk appetite (NRB, 2024). The implication of these trends is that, in addition to microeconomics and decisions at the bank level, loan growth in Nepal appears also to depend on macroeconomic cycles, monetary policy transmission and the regulatory environment. However, a complete empirical analysis of what jointly determines loan growth in Nepalese commercial banks is missing in the prior studies.

This gap represents the core of the research problem in this study. In particular, it aims to investigate the conditionality of macroeconomic, macro-prudential and bank specific determinants on loan growth in Nepalese commercial banks as well as whether or not the relationships are persistent across various

econometric methodologies. This is important because Nepal's financial system is heavily dependent on banks, and since the commercial banks are the sole source of credit in which a private-sector business can borrow to invest, their lending decisions directly determine the availability of credit for investment, employment, and consumption across the economy. As policymakers struggle with boosting private sector credit by cutting interest rates and easing liquidity conditions, it is imperative that we understand the true drivers of bank lending. In this setting, a more detailed, thorough understanding of what drives loan growth provides practical evidence for bank-level risk management, refines the empirical justification for macro-prudential policy, and adds to the overall literature on credit dynamics in developing economies. Similarly, bank managers need to identify what internal factors will limit or expand loan growth as a matter of strategic planning and risk-sensitivity. Thus, this paper analyzes the determinants of loan growth for Nepalese commercial banks at bank-specific, macroeconomic, and regulatory level since understanding the joint effects of internal financial factors, external economic conditions as well as prudential regulations on loan growth is critical for sustainable credit management in Nepal.

2 Literature Review

Theoretical Review

According to the financial intermediation theory, banks are the main financial intermediaries that channel surplus funds from savers to borrowers, and their ability to do so depends on the availability of deposits, capital adequacy, and the cost of funds (Diamond & Dybvig, 1983). Under this view, lending capacity is determined primarily by bank-level factors, such as deposit base, liquidity and size. The bank lending channel theory goes further and argues that monetary policy influences the real economy through its direct effect on bank balance sheets. With the tightening of policy from central banks, banks with limited access to non-deposit funding face a squeeze on their lending capacity, especially for the smaller and less liquid banks (Bernanke & Blinder, 1988; Kashyap & Stein, 2000). The financial accelerator theory connects macroeconomic conditions to credit supply through collateral values and borrower net worth (Bernanke et al., 1999). The cycle works as follows: during economic expansions, asset values rise, which makes borrowers collateral more robust and improves the banks' perception of default risk. Therefore, credit supply increases, and in downturns, it is just the opposite dynamic that prevails as weakening balance sheets and reduced liquidity leads to a contraction in supply credit that amplifies contractions. These frameworks together indicate that loan growth depends on the interplay between macroeconomic conditions, the policy environment, and bank-level characteristics, which is the central logic of the empirical approach adopted in this study.

Empirical Review

Across countries and periods, the most frequently used covariates include GDP growth, inflation, interest rates, reserve requirements (CRR), and exchange rates on the macro side; policy rates and macro-prudential constraints such as LTV limits on the policy side; and bank size, deposit funding, liquidity, asset quality (e.g., NPL), capital adequacy (CAR), and portfolio composition on the bank side. Macroeconomic conditions like GDP, inflation, fiscal policy, international trade, etc., influence the credit through both demand (firms and households borrow more in expansionary phase) and supply (banks perceive lower default risk during boom period). Most studies indicate a positive relationship between GDP or economic growth and loan growth since lending accelerates productive activities in the economy by enhancing capital formation, investment, and consumption (Birhanu et al., 2021; Cucinelli, 2015; Imran & Nishat, 2013; Malede, 2014). However, a few studies also found that loan growth is statistically independent of GDP growth (Chun & Ardaaragchaa, 2024). This can suggest that in some banking systems, loan growth is shaped more by bank balance-sheet constraints or policy settings than by simultaneous GDP growth. Another macroeconomic variable, inflation, has been one of the most divergent variables in literature. A

higher inflation in the economy erodes the purchasing power of the people. It weakens real incomes, increases uncertainty, and prompts central banks to tighten the policy which can reduce credit growth.

In Nepal, there was a negative correlation between inflation and commercial banks' lending (Bhattrai & Sapkota, 2023; Bajracharya, 2018). In contrast, some studies also obtained positive relationship between inflation and loan growth (Birhanu et al., 2021; Bhowmik, 2023; Chun & Ardaaragchaa, 2023). This could potentially occur with nominal demand increasing and real interest rates falling, or by banks pushing up on nominal loans with prices. These mixed results are likely due to varying inflation regimes, monetary policy reactions and model specifications in the different studies. For example, when increased inflation leads to both tighter monetary policy or even more strict macro-prudential constraints by the central bank, then lending response could be negative despite nominal demand increases. Similarly, using a model without interest rate and policy variables may cause inflation to proxy for those effects and lead to sign reversals.

The bank lending channel framework predicts that tighter monetary policy decreases the bank lending by reducing the volume of core deposits available to banks, with stronger effects for smaller and less liquid institutions (Bernanke & Blinder, 1988; Kashyap & Stein, 2000). Olokoyo (2011) found that the lending behaviour in Nigerian banks were influenced by the amount of deposits the banks had, and banks that had more deposits were able to lend more. However, lending rates, cash reserve requirements, and liquidity ratios did not influence lending in the Nigerian context. This suggests that the monetary-policy transmission through these policy variables was weak in the Nigerian banking context. Similarly, Karim et al. (2011) conducted an empirical study in Malaysian banks, and found that after controlling for GDP, inflation and other macroeconomic variables, Malaysian banks showed significant negative relationship between interest rates and bank lending. In Nepal, Budhathoki et al. (2024) found that lending rates have a negative impact on loans and advances. In contrast, some previous studies indicate a positive correlation between bank lending and interest rates (Birhanu et al., 2021; Bhattrai & Sapkota, 2023). This can happen because many studies mix price and quantity effects i.e., higher rates can reduce credit demand, but they may also coincide with the periods of strong demand, higher spreads, or improved bank profitability which supports loan supply. Without addressing the simultaneity, that is, rates and lending moving together, the estimates can differ in sign. Additionally, macro-prudential instruments such as reserve requirements and mortgage-related constraints, have been increasingly used as tools to manage credit cycles. Aikman (2021) documented that macro-prudential mortgage policies, such as Loan-to-Value (LTV) caps, restrict household credit growth by lowering leverage, with stronger effects during booms. Similarly, Lim et al. (2011) found that increasing or decreasing the cash reserve ratio allows central banks to effectively reduce volatility in the credit market cycle.

In the context of Nepal, bank-specific factors have generally been found to be important in determining the loan growth whereas the effects of macroeconomic and policy variables remain mixed. Timsina (2016) found that GDP and liquidity ratio increase the bank lending. She performed the Granger Causality Test and found that there is a unidirectional causal relationship from GDP to private sector credit. Budha (2013) examined the bank lending channel of monetary policy transmission in Nepal from 2003-2012 and found that GDP, bank size and liquidity have a significant positive effect in bank lending whereas monetary tightening decreases the bank lending. He also found that capitalization did not have any significant impact on bank lending. Conversely, Bhattrai and Sapkota (2023) confirmed that the GDP growth rate and inflation are significantly and negatively related to loan growth. However, another study by Bhattarai (2020) found an insignificant correlation between GDP growth and inflation with bank lending. In addition, Bhattarai (2020) reported that liquidity had a very strong adverse impact on loans and advances, while cash reserve ratio (CRR) and bank size have significant positive relationship with loan and advances. Bajracharya (2018) however, provides contrasting evidence by stating that cash reserve ratio had negative impact on Nepalese commercial banking loans and advances. He also found a negative relationship between the inflation rate and bank lending volume which indicates that higher inflation rates result in less bank lending. Based on balanced panel data covering the period 2012-2022 for a sample of 20 commercial banks in Nepal, Budhathoki et al. (2024) found that Capital Adequacy Ratio (CAR)

positively influenced bank lending. Similarly, he observed that the stability of bank sector, bank concentration and liquidity positively influence loans and advances in Nepalese commercial banks. This is also evidenced by Fani et al (2018). On the basis of FGLS panel estimation, the authors found that capital adequacy and asset quality are major determinants of bank performance in Pakistan. They reinforced the perception that factors based on CAMEL generally show systematic links between credit allocation and bank operations.

While existing studies provide important insights into the drivers of bank lending in Nepal and beyond, several important limitations remain. Most Nepalese studies focus on a narrow set of variables, often just bank-specific factors, without jointly accounting for macroeconomic cycles and macro-prudential policy. Where policy variables are included, they typically cover only a single instrument such as CRR, rather than capturing the broader macro-prudential stance. Moreover, most studies do not control for panel dynamics and simultaneity in lending and balance-sheet variables, which is very important when loan growth exhibits a high degree of persistence and also when deposit, liquidity, and lending rates respond endogenously to credit conditions The result is a fragmented empirical picture that is difficult to translate into coherent policy guidance. This study addresses these gaps by integrating all three categories of determinants within a single panel framework, using estimation methods that account for both time-invariant bank heterogeneity and examine potential dynamic and endogeneity concerns through robustness tests, providing a more complete and methodologically credible analysis of loan growth dynamics in Nepalese commercial banks.

3 Data and Methods

This study uses a quantitative design with descriptive and causal-comparative elements and an explicitly correlational approach to identify the direction and degree of association between loan growth and its potential determinants (bank-specific, macroeconomic, and macro-prudential factors). Secondary data were collected from audited financial statements published on the websites of the respective banks, World Bank reports, and publications of Nepal Rastra Bank. The study period covers FY 2013 to 2023 to ensure recent relevance in the analysis. Commercial banks were selected based on the availability of at least eleven consecutive years of data as of July 2023; therefore, a total of 18 commercial banks were included. Two banks i.e. Laxmi Sunrise Bank and Nepal Investment Mega Bank were excluded from the study due to the unavailability of data for the past eleven years.

Variables, Proxies and Hypotheses

From theory and the literature review above, we pre-classify regressors into three channels: Macroeconomic variables (GDP growth, inflation) are treated as proxies for credit demand, bank balance-sheet variables (Bank size, LDR, NPL, CAR and ROA) as proxies for credit supply constraints, and macro-prudential/monetary instruments (CRR, LTV, policy rate) as regulatory conditions that shift (or ration) the supply of credit. In line with the literature, the expected relationships (hypotheses) are as follows:

Credit demand:

H1a: GDP growth has a statistically significant positive effect on bank loan growth.

H1b: Inflation has a statistically significant effect on bank loan growth.

Regulatory constraints/ Monetary stance:

H2a: Policy rate has a statistically significant negative effect on bank loan growth.

H2b: Cash Reserve Ratio has a statistically significant negative effect on bank loan growth.

H2c: A tighter Loan-to-Value limit has a statistically significant negative effect on bank loan growth.

Policy reaction:

H3: CRR and LTV have a statistically significant positive effect on loan growth because they may reflect countercyclical regulatory responses to credit conditions rather than direct causal effects on bank lending.

Bank balance-sheet variables:

H4a: Bank size has a statistically significant positive effect on bank loan growth.

H4b: Loan-to-deposit ratio has a statistically significant positive effect on bank loan growth.

H4c: Non-performing loans have a statistically significant negative effect on bank loan growth.

H4d: Capital adequacy ratio (CAR) has a statistically significant positive effect on bank loan growth.

H4e: Bank profitability (ROA) has a statistically significant positive effect on bank loan growth.

Estimation Strategy

The dataset used in this study consists of annual observations for 18 Nepalese commercial banks over the period 2013-2023, forming a bank-year panel with moderate cross-sectional (N = 18) and time-series (T=11) dimensions, thus the study adopts a panel econometric approach to identify the determinants of loan growth. The dependent variable, loan growth, varies widely across banks as well as within each bank over time meaning that there are heterogeneous balance-sheet dynamics and risk profiles and banks' responses to macroeconomic availability factors and regulatory conditions. Based on these data features, we first estimate a pooled OLS regression as a baseline model for comparison, capturing the average relationship between loan growth and explanatory variables, without controlling for unobserved bank-level heterogeneity. However, repeated measurements for the same banks over time lead to unobserved time-invariant bank characteristics such as managerial strategy, ownership structure, past lending policies, and risk management practices that could affect loan growth and correlate with observed regressors. To address the possibility of this bias, the study uses a panel fixed-effects model that controls for time-invariant bank-specific characteristics (using bank fixed effects).

The preferred specification is a two-way fixed-effects model because it includes both bank and year fixed effects. This specification isolates the within-bank, over-time effects of the explanatory variables on loan growth while netting out bank level constants and common temporal shocks. However, macro and policy level variables like GDP, inflation, policy rate, and reserve requirements do not differ from one bank to another in a given year. Once we include year fixed effect in the model, these variables will be perfectly collinear with the year dummies, and their coefficients cannot be separately identified. Thus, we will also estimate a bank fixed-effects model excluding year fixed effects to test whether these coefficients are sensitive. The results on macroeconomic and policy variables come from this specification and should be interpreted as indicative rather than causal, since the full absorption of common time trends is not achieved (Angrist & Pischke, 2008).

The choice between a fixed-effects (FE) and random-effects (RE) panel model is guided by the Hausman specification test. The Hausman test (Hausman, 1978) strongly favored the fixed-effects approach in our data. The test statistic (χ^2 = 18.08, p = 0.002) rejects the null hypothesis that the RE estimator is consistent, indicating that bank-specific effects are correlated with the regressors. Accordingly, the FE model is taken as the preferred core methodology. The null hypothesis of homoskedasticity is rejected according to White's test ($p < 0.01$), indicating the existence of heteroskedastic residuals. Pesaran cross-sectional independence test is also rejecting the null hypothesis ($p \approx 0.00$), meaning that some form of contemporaneous correlation in banks cannot be ruled out. These findings do not undermine the fixed-effects estimator but require the use of robust inference techniques. Accordingly, all fixed-effects regressions are estimated with standard errors clustered at the bank level to correct for heteroskedasticity, serial correlation, and cross-sectional dependence.

The fixed-effects model remains the main estimator in this study rather than GMM. Given N = 18 groups, the Arellano-Bond difference GMM estimator produces an instrument count very close or equal to the number of groups causing instrument proliferation bias and weakens Hansen over-identification test (Roodman, 2009). The FE estimator, which is supported by the Hausman test, has much less bias for

this panel dimension and is more appropriate as the core estimator. However, the Arellano-Bond GMM specification is nonetheless also estimated as a robustness check to ensure finding are not sensitive to dynamic misspecification and endogeneity in bank-level regressors (Arellano & Bond, 1991).

Table 1. *Variables and Proxies Used*

Channel	Variables (Symbol)	Unit	Proxy / Measurement	Expected Sign	Rationale
Credit demand	GDP growth (GDP)	%	GDP growth rate	+	Higher output raises credit demand and lowers perceived default risk.
	Inflation (INF)	%	Consumer Price Index	+/-	Inflation can increase nominal credit demand or reduce real incomes and trigger tightening.
Credit supply (bank balance sheet)	Bank Size (SIZE)	Ln	Ln (Total Assets)	+	Larger banks typically have greater funding access and scale economies to expand lending.
	Loan-to-deposit ratio (LDR)	%	$\frac{Total\ loans}{Total\ deposits}$	+	Higher intermediation intensity signals active deployment of deposits into loans.
	Non-Performing Loan (NPL)	%	$\frac{Non-Performing\ Loans}{Total\ Loans}$	-	Higher NPLs raise provisioning and tighten banks' lending capacity and standards.
	Capital Adequacy Ratio (CAR)	%	$\frac{Capital\ fund}{Risk-weighted\ assets}$	+	Higher capital cushions support lending.
	Return on Assets (ROA)	%	$\frac{Net\ profit}{Total\ assets}$	+	Profitability can support lending via retained earnings but may also reflect past lending outcomes.
Policy or regulatory constraints	Policy Rate (PR)	%	Annual repo rate	-	Tighter monetary policy raises funding costs and tends to reduce loan supply (bank-lending channel).
	Loan-to-Value cap (LTV)	%	NRB policy cap	+ (if cap is looser)	A higher/looser LTV cap permits greater mortgage borrowing; a tighter cap restricts lending.
	Cash Reserve Ratio (CRR)	%	NRB CRR on LCY deposits	-	Higher reserve requirements reduce bankable funds and constrain lending.
	Loan growth (LG)	%	$\frac{Loans_{it}-Loans_{it-1}}{Loan_{it-1}}$	(dependent variable)	

Model Specification

Let i index banks and t fiscal years (2013-2023 AD). The dependent variable is loan growth LG_{it} (percent). Explanatory variables are grouped into macroeconomic controls M_t= {GDP, INF}, macro-prudential P_t= {PR, LTV, CRR} and balance-sheet variables X_{it}= {SIZE, LDR, NPL, CAR, ROA}. Given the possibility that policy instruments react to credit conditions, the coefficients on PR, LTV, and CRR are interpreted cautiously as reduced-form relationships conditional on observed controls.

1. **Baseline pooled OLS (for comparison)**

$$LG_{it} = \alpha + \beta' M_t + \Upsilon'^{P_t} + \delta' X_{it} + \epsilon_{it}$$

2. **Two-way fixed effects (preferred within estimator)**

$$LG_{it} = \alpha_i + \delta_t + \beta' M_t + \Upsilon' P_t + \delta' X_{it} + \varepsilon_{it},$$

where α_i are bank fixed effects and δ_t are year fixed effects.

3. **Bank fixed effects only (robustness check)**

$$LG_{it} = \alpha_i + \beta' M_t + \Upsilon' P_t + \delta' X_{it} + \varepsilon_{it}.$$

To address dynamics and possible persistence, we also estimate a standard Arellano-Bond dynamic panel (difference GMM) specification:

$$\Delta LG_{it} = \rho\, \Delta LG_{i,t-1} + \beta' \Delta M_t + \Upsilon' \Delta P_t + \delta' \Delta X_{it} + \Delta \varepsilon_{it}$$

4 Results and Discussion

Descriptive Statistics

Table 2 provides descriptive statistics and indicates considerable variation in macroeconomic factors and bank-specific variables. Real GDP growth averaged 4.3% and inflation averaged to a positive 6.5%, indicating a positive trend in overall economic performance. However, the loan growth showed significant volatility with values ranging from negative reductions to over 300% increase indicating a highly cyclical and unstable nature of credit supply in Nepal. The regulatory instruments show relative stability (mean LTV = 57.3%; mean CRR = 4.7%). Likewise, the bank-level indicators display substantial heterogeneity: mean ln(size) = 25.6 (sd = 0.7), mean LDR = 81.8% (range: 48.3-126.9), mean NPL = 1.8% (sd = 1.5), mean CAR = 13.4%, and mean ROA = 1.6%.

Table 2. *Descriptive Statistics*

Variables	nobs	Mean	SD	Min	Max
GDP	198	4.3	3.2	-2.4	9.0
INF	198	6.5	2.0	3.6	9.0
PR	198	5.1	1.4	3.0	7.0
LTV	198	57.3	4.5	50.0	60.0
CRR	198	4.7	1.2	3.0	6.0
SIZE	198	25.6	0.7	23.8	27.1
LDR	198	81.8	10.7	48.3	126.9
NPL	198	1.8	1.5	0.0	6.4
CAR	198	13.4	2.4	4.0	23.3
ROA	198	1.6	0.6	0.1	3.2
LG	180	21.5	26.6	-28.7	303.4

Year-Wise Mean Trend

Table 3 presents the year-wise averages of macroeconomic, macro prudential, and bank level variables. GDP growth experiences a boom-bust-recovery pattern, with the highest percentage of 8.98% occurring in 2017 and a drop during the COVID related shock in 2020 with adjustments occurring after, while inflation and policy rate show parallel cycles of easing and tightening. The macro-prudential measures, i.e. tighter LTV ratios before 2019 and lower CRR, thereafter reflect regulatory adjustments to shifting financial conditions. On the bank level, balance sheets grow over time, yet LDR, NPLs and CAR show cyclical variation. Likewise, asset quality initially improved before deteriorating again in later years (2022-2023) and similarly, capital buffers eroded in later years. Loan growth is strong during the expansionary years but decreases by 2023 due to tighter policy conditions, weaker balance sheets and higher risk constrained credit supply captures these dynamic closely.

Table 3. *Year-Wise Mean Trend*

Year	GDP	INF	PR	LTV	CRR	SIZE	LDR	NPL	CAR	ROA	LG
2013	3.5	9.04	6	60	5.58	24.64	75.97	2.76	11.48	1.64	-82.45
2014	6	8.4	5	60	5.42	24.82	76.05	2.24	12.04	1.71	19.06
2015	3.97	7.9	7	60	6	25.10	76.73	1.47	12.25	1.89	43.64
2016	0.43	8.8	5	50	6	25.26	80.93	1.42	14.50	1.84	24.02
2017	8.98	3.6	5	50	6	25.47	84.11	1.38	13.98	1.81	20.70
2018	7.6	4.1	5	50	5.17	25.64	85.99	1.20	14.10	1.91	18.49
2019	6.7	5.6	3.5	60	4	25.85	83.70	1.52	14.46	1.38	25.06
2020	-2.4	5.1	3	60	3.33	26.05	87.48	1.15	14.53	1.42	23.47
2021	4.8	4.1	3	60	3	26.16	88.50	1.16	13.47	1.39	14.88
2022	5.6	7.7	7	60	3.33	26.36	82.67	2.68	13.38	1.18	19.13
2023	1.98	7.1	6.5	60	4	26.46	77.30	3.31	12.79	1.15	6.49

Correlation Analysis

Table 4 provides the correlation coefficients of the dependent and independent variables used in this study. Loan growth is negatively correlated with inflation (LG-INF = -0.256***) and non-performing loans (LG-NPL = -0.157**), while it is positively correlated with bank size (LG-SIZE = 0.280***) and the loan-to-deposit ratio (LG-LDR = 0.171**). Loan growth is also negatively correlated with tighter loan-to-value caps, consistent with prudential restraint. Correlations among the explanatory variables reflect the broader macro-policy environment: higher inflation coincides with tighter monetary and reserve conditions, and stronger bank fundamentals are associated with higher capital adequacy and lower NPLs. These patterns suggest that loan growth is higher in larger and more active intermediaries with more stable prices whereas high inflation, worse asset quality, and tighter policy environments coincide with slower credit growth.

Table 4. *Correlation Matrix*

	LG	GDP	INF	PR	LTV	CRR	SIZE	LDR	NPL	CAR	ROA
LG	1										
GDP	0.05	1									
INF	-0.256***	-0.347***	1								
PR	-0.116	0.134*	0.588***	1							
LTV	-0.135*	-0.269***	0.312***	0.04	1						
CRR	-0.079	0.233***	0.332***	0.394***	-0.545***	1					
SIZE	0.28***	-0.115	-0.41***	-0.154**	0.148**	-0.718***	1				
LDR	0.171**	0.016	-0.344***	-0.295***	-0.109	-0.228***	0.105	1			
NPL	-0.157**	-0.027	0.29***	0.319***	0.21***	-0.036	0.209***	-0.184***	1		
CAR	0.116	-0.038	-0.25***	-0.244***	-0.209***	-0.119*	0.074	0.266***	-0.179**	1	
ROA	-0.039	0.116	0.01	0.029	-0.31***	0.416***	-0.287***	-0.144**	-0.21***	0.281***	1

Note. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively

Regression Results

The results of the OLS regression model employed in the study are presented in Table 5 as descriptive benchmarks. The model explains a moderate share of the variation in loan growth (R^2 = 0.22; F-test p < 0.001), indicating that macroeconomic conditions, policy variables, and bank-specific characteristics are jointly associated with observed loan growth. There is a positive and statistically significant relationship between real GDP growth and loan growth. This is in line with the credit-demand channel, according to which higher real activity is linked to increases in observed loan growth (Calza et al., 2003). Inflation also enters with positive, but statistically insignificant coefficient, indicating that its relationship with loan growth is largely captured by monetary policy and risk provisions. On the other hand, loan growth is inversely related to the policy rate consistent with the bank-lending channel which states that tighter monetary conditions increase funding costs and limits lending (Bernanke & Blinder, 1988; Gambacorta &

Marques-Ibáñez, 2011). The loan-to-value ratio is significantly positive showing that the less collateral requirements there are, the faster lending is done. The cash reserve ratio (CRR) has a positive and statistically significant coefficient. This association is consistent with a countercyclical policy reaction, whereby CRR adjustments respond to prevailing credit conditions. Thus, the coefficient is interpreted as being indicative of how regulatory constraints respond to credit conditions rather than of a structural lending effect, consistent with the policy reaction hypothesis.

Table 5. *Ordinary Least Squares Regression*

Variables	Coef.	St.Err.	t-value	p-value	[95% Conf Interval]_Lower	[95% Conf Interval] Upper
(Intercept)	-1232.77***	250.05	-4.93	0.00	-1726.07	-739.46
GDP	0.705**	1.055	0.66	0.02	0.49	4.98
INF	0.107	2.569	0.041	0.96	-4.96	5.17
PR	-3.541*	2.864	-1.24	0.06	-9.19	2.10
LTV	1.562	0.998	1.56	0.11	-0.41	3.53
CRR	21.636***	5.839	3.71	0.00	10.11	33.15
SIZE	40.328***	7.481	5.39	0.01	25.57	55.08
LDR	0.483*	0.269	1.79	0.07	-0.04	1.01
NPL	-6.871***	2.067	-3.32	0.00	-10.95	-2.79
CAR	1.505	1.231	1.22	0.22	-0.92	3.93
ROA	-7.672	5.591	-1.37	0.17	-18.70	3.35
Mean dependent var.		12.525		SD dependent var		38.88
R -squared		0.22		Number of obs		197.00
F-test		5.15		Prob > F		0.00
Akaike crit. (AIC)		1976.13		Bayesian crit. (BIC)		2015.53
Hausman FE vs RE			χ^2 = 18.08, p = 0.0028			
White's test			χ^2 = 130.68, p = 0.000			
Pesaran cross-sectional independence			χ^2 = 27.308, p = 0.000			

*Note. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively*

Bank-specific characteristics show expected patterns. Bank size and loan-to-deposit ratio have a positive and significant relationship with loan growth, while non-performing loans are negative and statistically significant with loan growth indicating the importance of balance sheet size, intermediation intensity and asset quality. Capital adequacy and profitability are not statistically significant in this specification. Pooled OLS estimates do not control for unobserved bank-level heterogeneity, so it should be treated as descriptive benchmarks rather than structural estimates. In the OLS model, the importance of GDP growth and the policy rate partly captures cross-sectional variation across banks and years that may be related to omitted bank characteristics. The estimates are kept for reference but not used to provide inferential evidence about the determinants of loan growth (Wooldridge, 2010).

The results of the two-way fixed effects model are shown in Table 6. In the two-way fixed effects specification, macroeconomic and system-wide policy variables are absorbed by year fixed effects and therefore not separately identified. Thus, the estimated coefficients capture cross-sectional loan growth within a bank from changes in bank balance-sheet characteristics. The coefficient on bank size is positive and highly significant, documenting that banks with larger balance sheets have faster loan growth over time within the same bank. This result is also in conformity with the results obtained by Bajracharya (2018), Bhattarai (2020), and Malede (2014) that size has positive relationship with loans and advances. Conversely, NPL is negatively and significantly associated with loan growth, indicating that deteriorating asset quality is associated with slower lending expansion through growth sluggish provisioning, stricter underwriting standards, and regulatory supervision. More importantly, LDR is positive but weakly significant, suggesting a weak correlation between intermediation depth and credit boom. Finally, other banking-characteristics such as CAR and ROA do not have any statistically significant impact on loan growth after controlling for size, intermediation and risk. This finding is in line with Bhowmik (2024),

who reported that ROA did not affect loan growth significantly indicating that banks had no lending bias i.e., regardless of their profit levels, they would not lend more. These results presented in this two-way fixed-effects model are the main, most reliable estimates of our study as they control for both time-invariant bank heterogeneity and common shocks at the macro level. The key implication is that it is scale expansion, intermediation intensity, and asset quality within the same bank over time rather than short-run movements in capital or profitability that determine these lending decisions. In principle, better-capitalized banks are expected to lend more freely (Van den Heuvel, 2007), but the insignificance of CAR in this model likely reflects the fact that Nepalese commercial banks have historically maintained CAR well above the regulatory minimum and therefore leaving little within-bank variation in capital adequacy to explain loan growth. Likewise, the insignificance of ROA in the two-way FE model contrasts with its potential significance in cross-sectional comparisons and indicates that any profitability differences across banks are captured by bank fixed effects, that is, more profitable banks may also be larger, and when size is controlled for, profitability adds no incremental explanatory power within banks over time.

Table 6. *Two-way Fixed Effects Model*

Variables	Coefficient	Std_Error	t_value	p_value
SIZE	22.31***	2.61	8.54	0.00
LDR	0.28*	0.16	1.73	0.08
NPL	-10.98***	3.78	-2.90	0.00
CAR	0.14	1.87	0.07	0.94
ROA	5.24	5.37	0.98	0.33
R_Squared	0.2096			
nobs	197.00			

Note. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively

Robustness Checks

To test the sensitivity of the baseline results, various robustness checks are carried out on alternative specifications and variable definitions. Policy and macro variables that only vary at the year level and are same across banks (e.g., CRR, LTV, policy rate, macro controls) have little independent identifying variation once we include year fixed effects. Accordingly, we re-estimate the model using bank fixed effects only to facilitate identification of macroeconomic and policy variables. As shown in Table 7, the estimated coefficients are robust to alternative specifications. Bank size, the loan-to-deposit ratio, the cash reserve ratio, and the loan-to-value cap are positively associated with loan growth, while non-performing loans are negatively associated. GDP growth and inflation show positive coefficients, whereas the policy rate remains negatively associated. Capital adequacy and profitability are not statistically significant. We use this specification without year fixed effects to identify macroeconomic and policy coefficients that are collinear with two-way model year dummies. So, the positive GDP growth coefficient and negative policy rate coefficient in Table 7 are consistent with the OLS results providing support to credit-demand and bank-lending channel mechanisms. The positive coefficient of CRR is, however, unexpected from a regulatory perspective as larger reserve requirements should inhibit lending by lowering loanable funds. The most plausible interpretation for this, in line with Lim et al. (2011), is that NRB has been using CRR counter-cyclically, raising it at credit booms and lowering it at downturns so that the CRR moves together with credit, and not against it. This endogeneity of the regulatory instrument to the credit cycle implies that the OLS and bank-FE estimates are observing a policy-reaction function rather than a structural supply constraint, and therefore there is no causal inference regarding this coefficient. Similarly, the positive and significant LTV coefficient in the bank-FE specification. Looser collateral requirements should make borrowing easier, which means that higher LTV caps are the expected trajectory. But during the study period, NRB's LTV adjustments were equally counter-cyclical (tightening pre-2019 and loosening post during COVID recovery), creating a reverse-causality issue here as well. Since this model does not entirely absorb average shocks that vary over time, these coefficients are best viewed as descriptive associations rather than estimates of causal effects (Angrist & Pischke, 2008). More importantly, similar

bank-level results, especially for size, LDR and NPL, across both the bank-FE-only and with two-way FE specifications indicate that these are robust within-country effects, regardless of the time controls applied.

Table 7. *Robustness Test*

Variable	Coefficient	Std_Error	t_value	p_value
GDP	2.014**	0.574	3.510	0.001
INF	5.301**	1.705	3.110	0.002
PR	-6.783*	3.290	-2.062	0.041
CRR	35.811***	4.909	7.294	0.000
LTV	3.286**	0.938	3.504	0.001
SIZE	71.142***	6.823	10.427	0.000
LDR	0.957***	0.209	4.590	0.000
NPL	-15.828***	4.134	-3.828	0.000
CAR	1.263	0.856	1.475	0.142
ROA	-3.510	5.454	-0.644	0.521

Note. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively

Loan growth is likely to persist due to adjustment costs, credit relationships, and gradual balance-sheet re-optimization. Therefore, a dynamic panel model is also estimated by Arellano-Bond GMM specification to control for persistence and potential endogeneity. The lagged loan growth is statistically significant as reported in Table 8, which implies that loan growth is dynamically adjusting. The signs and magnitude of the cash reserve ratio, loan-to-value cap and non-performing loans are in line with the baseline results. Diagnostic tests do not reveal serial second-order correlation and do not reject the validity of the instruments. The GMM results are reported for robustness, rather than as the preferred estimator discussed in the methodology section. The value of this GMM specification is two-fold. The lagged loan growth is statistically significant but negative, suggesting short-run mean reversion rather than simple persistence. This finding would not be revealed by other static models and indicates that dynamic adjustment should be considered when interpreting loan growth behaviour. Secondly, the signs on the NPL, CRR and LTV are consistent across both models (FE and GMM), providing evidence that those results are not necessarily an artefact of dynamic misspecification. Differences in the magnitudes of the estimates between GMM and FE are more likely due to simultaneity correction, especially for NPL and LDR, which are mechanically linked to loan growth through balance-sheet accounting.

Table 8. *Dynamic panel Generalized Method of Moments (GMM) Estimation*

Variable	Coefficient	Std_Error	z_value	p_value
lag(LG, 1)	-0.216**	0.081	-2.679	0.007
GDP	0.025	0.815	0.031	0.975
INF	3.244	2.753	1.179	0.239
PR	2.209	3.774	0.585	0.558
CRR	16.631*	6.751	2.464	0.014
LTV	2.143**	0.829	2.584	0.010
SIZE	32.879	19.674	1.671	0.095
LDR	0.932	0.953	0.978	0.328
NPL	-18.628*	9.293	-2.004	0.045
CAR	1.346	2.426	0.555	0.579
ROA	-2.890	15.496	-0.187	0.852
Number of observations	198			
AR(1) test (p-value)	0.117			
AR(2) test (p-value)	0.158			
Sargan test (p-value)	1			

Note. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively

Further, robustness checks are performed with real loan growth in place of nominal loan growth and by excluding the years under COVID i.e. 2020-21. The results are presented in Table 9. The qualitative results are unchanged in these alternatives. The sign and statistical significance of the important bank-

level control variables remain same, but the macroeconomic variables are more significant in explaining loan growth when we do not include the COVID years. We also include a term where the policy rate is interacted with size of bank to account for heterogeneity in transmission channels which is found to be statistically insignificant. The policy rate-size interaction term is insignificant which suggests that bank size does not drive heterogeneity in monetary policy transmission to the Nepalese lending channel, pointing against hypotheses of a bank-lending channel theory for economies with large disparities between small and large banks (Kashyap & Stein, 2000). This could be indicative of relatively uniform liquidity and regulatory environments that Nepalese commercial banks may have been operating in after a period of consolidation, where all banks, regardless of size, have had similar funding constraints at times when policy was tight. In addition, the relative significance of macroeconomic variables in the non-COVID specification is important as it signals that the COVID-years represent a structural break from normal conditions because this shock was unprecedented and led to emergency policy responses which may have obscured the demand-driven and supply-driven mechanisms that are more clearly identified in normal economic conditions.

Table 9. *Robustness Checks of the Baseline Results Using Alternative Specifications*

Variable	Baseline	Baseline_p	Real_LG	Real_LG_p	No_COVID	No_COVID_p	PRxSIZE	PRxSIZE_p
GDP	2.014**	0.047	2.014**	0.047	8.622***	0	1.565	0.156
INF	5.301**	0.039	4.301*	0.094	15.952***	0	4.008	0.16
PR	-6.783**	0.024	-6.783**	0.024	-6.872**	0.035	-124.227	0.277
PR_SIZE							4.558	0.304
CRR	35.811***	0	35.811***	0	47.077***	0	36.582***	0
LTV	3.286***	0.001	3.286***	0.001	2.932***	0.007	3.747***	0.001
SIZE	71.142***	0	71.142***	0	93.897***	0	44.153	0.114
LDR	0.957***	0.004	0.957***	0.004	1.188***	0.004	0.919***	0.007
NPL	-15.838***	0	-15.828***	0	-17.524***	0	-16.512***	0
CAR	1.263	0.433	1.263	0.433	1.85	0.324	1.192	0.46
ROA	-3.51	0.575	-3.51	0.575	-4.218	0.562	-2.44	0.7

Note. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively

5 Conclusion and Implications

This study examines the determinants of loan growth in Nepalese commercial banks over the period of 2013 to 2023. Macroeconomic conditions (credit demand side) emerged as important correlates of loan growth. Loan growth tends to increase during periods of higher GDP growth and to slow when the policy interest rate is higher, which is consistent with the presence of both a strong credit-demand effect and a bank-lending channel of monetary policy. Macroprudential variables (policy rate, CRR, LTV) are correlated with loan growth, but their interpretation is sensitive to time controls; therefore, we present them mainly as associations and rely on bank-specific results from the two-way FE model for inference. We found that looser borrower-based constraints (a higher LTV cap) are associated with higher lending levels, as expected. Meanwhile, the positive coefficient on the CRR (observed in specifications without year fixed effects) likely reflects the central bank's countercyclical use of reserve requirements as CRR was low during economic slumps and high during recoveries rather than a direct stimulative effect of a higher CRR on lending. Bank fundamentals (supply-side factors) are also important. Our results show that larger banks tend to experience faster loan growth, and banks with a higher loan-to-deposit ratio (more aggressive intermediation) also exhibit relatively higher loan growth rates. However, banks with higher NPL ratios are associated with significantly slower loan growth, indicating that poor asset quality coincides with restrained lending. The preferred two-way fixed-effects results confirm that, for a given bank, increases in scale and better asset quality are correlated with higher loan growth over time, whereas short-term fluctuations in capital adequacy or profitability do not show any independent association with loan growth once size, intermediation, and risk are accounted for. In other words, after controlling for bank-specific attributes and common shocks, variations in CAR and ROA within a bank do not

significantly explain its loan growth, suggesting that most banks maintain sufficient capital buffers and that profitability effects are subsumed by other factors.

This research is important for many stakeholders. For banks' management and shareholders, knowing that loan growth depends on the macroeconomic cycle, policy approach, and current balance-sheet position would yield better lending decisions, more effective risk management, and better long-term strategic decisions for capital adequacy and asset-liability management. Furthermore, knowing that firm-specific variables would allow banks to project credit growth (bank size, LDR, NPL) and subsequently adjust underwriting or next-best actions. For regulators and policymakers, the findings are informative about how lending co-moves with monetary stance and prudential settings in Nepal, while recognizing that these instruments may partly reflect policy reactions to the credit cycle.

Overall, this study brings together the macroeconomic, macro-prudential and bank-specific determinants of loan growth in one integrated empirical framework and examines them in the context of Nepalese commercial banks using a single panel model with estimation strategies that explicitly allow for unobserved bank heterogeneity, common time effects, and dynamic adjustment. The results show that although macroeconomic and policy variables influence general credit conditions, only bank-level characteristics, particularly size, intensity of intermediation and asset quality, explain within-bank variation in loan growth over time in the preferred specification. This distinction between aggregate credit-cycle associations and within-bank lending dynamics of this nature has not been clearly established in the previous Nepalese literature, but has direct implications for how regulators and bank managers should view cyclical dynamics in credit i.e., while aggregate macro conditions set the stage, a bank's own balance-sheet position ultimately determines its lending trajectory. In sum, this study mainly contributes by providing empirical evidence for credit policy and bank management of Nepal in terms of its unique focus on establishing the respective effectiveness and predominance of bank-level characteristics, particularly the scales as defined in our framework, intermediation intensity and asset quality, as dominant within-bank drivers of loan growth in Nepal's commercial banking sector.

This study has certain limitations. Bank specific regressors such as NPL, LDR and SIZE are potentially endogenous to loan growth i.e., rapid growth in credit may itself increase future NPLs, the balance sheet grows with lending activity and there may be contemporaneous adjustment of the LDR in response to credit expansion (reverse causality/simultaneity). Policy variables such as CRR and LTV may also respond to credit conditions. Therefore, the estimated coefficients are interpreted as associations consistent with demand, supply, and regulatory channels, rather than definitive causal effects. Likewise, the use of annual bank-year data does not allow for intra-year evaluation or specific timing of policies implemented, and the analysis does not disaggregate by loan type, or borrower segment limiting the granularity of interpretation. Future studies should utilize either more frequent observations or loan-based data, apply quasi-experimental policies such as difference-in-differences or event studies, use instruments or dynamic panel methods to strengthen causal identification, and test for non-linear and state-dependent relationships of LTV/CRR as well as differences across banks by size and ownership type as well as categories of loans.

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Appendix 1. *List of Sample Banks*

S.N.	Name of Banks	Study Period	No. of Observations
1.	Agriculture Development Bank Limited	2013-2023	11
2.	Citizens Bank International Limited	2013-2023	11
3.	Everest Bank Limited	2013-2023	11
4.	Global IME Bank Limited	2013-2023	11
5.	Himalayan Bank Limited	2013-2023	11
6.	Kumari Bank Limited	2013-2023	11
7.	Machhapuchchhre Bank Limited	2013-2023	11
8.	Nabil Bank Limited	2013-2023	11
9.	Nepal Bank Limited	2013-2023	11
10.	Nepal SBI Bank Limited	2013-2023	11
11.	NIC Asia Bank Limited	2013-2023	11
12.	NMB Bank Limited	2013-2023	11
13.	Prabhu Bank Limited	2013-2023	11
14.	Prime Commercial Bank Limited	2013-2023	11
15.	Rastriya Banijya Bank Limited	2013-2023	11
16.	Sanima Bank Limited	2013-2023	11
17.	Siddhartha Bank Limited	2013-2023	11
18.	Standard Chartered Bank Limited	2013-2023	11
	Total		198

Appendix 2. *Random Effects Regression*

Variable	Coefficient	Std_Error	t_value	p_value	R_Squared
(Intercept)	-481.84***	63.01	-7.65	0.00	0.14
SIZE	18.34***	1.74	10.54	0.00	
LDR	0.34	0.21	1.62	0.11	
NPL	-5.39***	1.48	-3.65	0.00	
CAR	0.33	0.94	0.35	0.73	
ROA	1.38	4.15	0.33	0.74	

Note. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix 3. *Multicollinearity Test*

Variable	VIF	Tolerance
GDP	1.759	0.568
INF	3.95	0.253
PR	2.529	0.395
LTV	3.135	0.319
CRR	6.969	0.144
SIZE	4.033	0.248
LDR	1.321	0.757
NPL	1.429	0.7
CAR	1.417	0.706
ROA	1.521	0.658