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Macroeconomics as the Basis of Commercial Banks Stability in Nepal

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Abstract

Background: Maintaining financial stability is vital for all financial institutions, as it fosters public trust and confidence in the entire system contributing to a healthy and well-operating economy in a country. Therefore, banks and other financial institutions must uphold their financial soundness and stability, given their crucial economic role.

Objective: The study examines the influence of macroeconomic factors such as Inflation (INF), Gross Domestic Product (GDP) growth, Inflation Rate (INF), the Exchange rate (ER), Money Supply (M2), and NEPSE Index on bank stability of commercial banks in Nepal.

Methods: The study obtained data from the Nepal Rastra Bank, which published a quarterly economic bulletin and database on the Nepalese economy from 2001 to 2022, and applied the Autoregressive Distributed Lag (ARDL) technique for evaluation and interpretation.

Results: The findings from this study indicate that the interest rate and money supply (M2) have a positive and significant impact on bank stability. Similarly, the NEPSE index has a positive but insignificant impact on bank stability. However, bank stability is negatively and statistically significantly impacted by both the exchange and inflation rates.

Conclusion: The primary findings of the research indicate the presence of a sustained and stable association between bank stability and macroeconomic variables. The ARDL techniques analysis demonstrates that GDP growth, inflation, effective exchange rate, and NEPSE index are statistically significant factors, implying that they have a robust capacity to clarify the evolution of bank stability in Nepal.

Implications: Therefore, the study suggests that policymakers and regulators need to pay close attention to macroeconomic indicators such as inflation, interest rates, money supply (M2), and exchange rates to ensure the stability and soundness of the banking system. The research also highlights the need for commercial banks to closely monitor macroeconomic developments and adjust their strategies accordingly to mitigate risks and maintain stability.

Paper Types: Research Paper

Keywords: Bank stability; Commercial banks; Macroeconomic variables; ARDL approach.

JEL Classification: E63, G21, G28

Introduction

Financial resources are the elixir to establish new enterprises by offering growth possibilities, hiring employees, and supporting other firms as well as local, state, and federal government organizations (Yakuba and Bunyaminu, 2023). Individuals, businesses, organizations, and even government agencies need financial resources to meet various needs. Ordinary people have greater challenges in obtaining financial loans than corporations, organizations, or governmental agencies (Ngalawa and Derera, 2023). It is essential for promoting economic growth at the business, industry, and macroeconomic levels (Mittal and Garg, 2021). The banking history has shown that this industry is susceptible to several risks and instabilities, and it may be the only one in which many risks are managed simultaneously (Cebenoyan and Strahan, 2004). There have been significant changes in this industry over the past several decades in terms of deregulation, inventions, diversification, competitiveness, and financial globalization. The banking industry's influence has spread globally, making it more inclusive, lively, and dynamic. The financial market prospects have multiplied due to greater financial globalization, creating dangers and instability worries (Kanapiyanova et al., 2023). Macro-prudential standards are receiving more attention from regulatory bodies throughout the world in an effort to keep financial systems stable. Furthermore, given the extensive global interconnection of financial systems today, volatility in the financial systems can potentially harm the global economy (Alshubiri, 2017).

It is a state in which the economic process for deciding prices, distributing funds, and managing risk operate properly and fosters economic growth; financial system stability is crucial to a nation's economy (Wang and Luo, 2022). The distribution of money will not operate properly if the financial system is unstable and inefficient, which might impede the nation's economic progress. Investigating the variables contributing to instability will help one better understand financial system stability (Gwachha, 2022). Instability in the financial system may be brought on by a wide range of variables and changes, typically a mix of market failures brought on by structural or behavioral issues. Pressures from both domestic and foreign sources might contribute to market failure. Based on the circumstances as mentioned above, actions to prevent or minimize the danger of potential financial system instability are required, especially to prevent another enormous loss (Beck et al., 2013). Theoretically, a number of variables, including capital flows, currency rates, interest rates, inflation, the proportion of bad loans (non-performing loans), and others, might affect the stability of the financial system.

The financial sector of Nepal, a developing economy, is dominated by banks, just like that of other emerging nations. As such, the stability of commercial banks in Nepal is crucial for the overall development of the economy (Gwachha, 2022). The study can help policymakers and commercial banks in Nepal to understand the importance of macroeconomic stability in ensuring the stability of commercial banks. The study can provide insights into the relationship between macroeconomic factors such as inflation, economic growth, the NEPSE index, remittance, exchange rates, and interest rates, and the stability of commercial banks in Nepal. Similarly, the research can help commercial banks in Nepal improve their risk management practices. By understanding the impact of macroeconomic factors on their stability, banks can develop better risk management policies to mitigate risks and ensure their stability. This, in turn, can lead to more efficient and effective lending practices, which can benefit borrowers and the overall economy. In addition, the study can contribute to the overall development of Nepal's financial sector by promoting the stability of commercial banks. The study can attract foreign investment and promote economic growth. As a result, Nepal's banking industry is crucial to financial intermediation. Commercial banks are expanding rapidly in Nepal and greatly impact the country's financial sector (Singh, 2021). The empirical studies may suggest that macroeconomic stability is crucial for commercial bank stability in Nepal, but there may be a lack of empirical evidence to support this claim. How do macroeconomic factors such as inflation, exchange rates, GDP growth, NEPSE index, and interest rates impact the stability of commercial banks in Nepal? Therefore, the study can focus on analyzing the impact of macroeconomic factors on the stability of commercial banks in Nepal.

The second section of the study focuses on the empirical literature review and examines macroeconomic factors that contribute to bank stability. I have discussed the methodology in detail in the third section, outlining the data and variable description, descriptive statistics, and model specification. The fourth section discusses the results obtained through the ARDL approach, providing an interpretation and discussion of these findings. Finally, the study concludes by summarizing the research and highlighting the main contributions and implications of the study.

Review of literature

The literature on the relationship between macroeconomics and commercial bank stability suggests that macroeconomic stability is a critical factor in maintaining the banking sector's stability. Studies have shown that macroeconomic factors such as inflation, interest rates, exchange rates, and economic growth can have a significant impact on the stability of commercial banks (Ngalawa & Derera, 2023; Hakimi et al., 2022; Danisman & Tarazi, 2020). Alshubiri (2017) evaluates the factors affecting banks' financial stability. The Z-score method was used in the study to assess bank stability. The study found that bank-specific characteristics have a substantial influence on the financial stability of the banks, but macroeconomic variables have little bearing on the financial stability of Oman. Diaconu & Oanea (2015) examines the factors influencing bank stability in Africa utilizing the Z-score as a proxy of financial stability. The study also found that institutional factors that affect banking stability in Africa include government efficiency, political stability, institutional quality, macroeconomic policy, and unemployment rates.

Chand et al. (2021) investigate the structural, microfinance, and bank-specific factors influencing bank stability in Fiji. The study discovered that inflation rate and economic expansion favourably affected bank stability. According to Shrestha (2020), the financial performance of Nepalese commercial banks is examined concerning the influence of bank-specific variables. The study reveals that asset quality, management effectiveness, and operating efficiency all have a favourable effect on the financial success of banks. Using bank-level data, Chiaramonte and Casu (2017) examined the impact of structural liquidity on bank financial stability in the European Union. The study discovers that larger liquidity holdings reduce the risk of bank collapse and hardship, whereas capital ratios only matter for large banks. Diaconu and Oanea (2015) investigate how macroeconomic and bank-specific variables affect the stability and profitability of cooperative credit banks across 34 countries from 2008 to 2013. The study found that advances and loans considerably influence profitability and stability, but the link is not in the same way.

Laeven and Tong (2016) use three key indicators—tier 1 capital, the loan-to-asset ratio, and the deposit-to-asset ratio—to examine the financial stability status of banks operating in 32 countries. The study discovered a conflict between bank stability and size. Swamy (2014) investigates the connection between numerous banking stability indicators. The study's findings show that liquidity is inversely correlated with capital sufficiency, asset quality, and profitability in financial systems dominated by banks. Fielding and Rewilak (2015) examine the relationship between financial instability in the United States from 2012 to 2015. The study found that political instability can negatively impact the performance and stability of banks in developing countries. Ahmad and Mazlan (2015) build bank stability for Malaysian banks using several economic risks such as credit, liquidity, and market risk. The study discovered that the return on assets had a detrimental effect on operational effectiveness.

The regulatory environment also plays a critical role in ensuring the stability of commercial banks. The central bank, government policies, and banking regulations are all crucial factors that affect the stability of commercial banks in Nepal. The banking sector in Nepal has undergone significant changes in recent years, and studies have explored its history, structure, and challenges (Gwachha, 2022; Sing, 2021). Political instability is another factor that can impact the stability of commercial banks, particularly in developing countries such as Nepal. Human capital is also crucial in ensuring

the stability of commercial banks, with studies emphasizing the importance of training, experience, and leadership in promoting stability (Sing 2021). The impact of digitalization on commercial bank stability in Nepal has not been widely studied, although there is growing recognition of the challenges and opportunities presented by fintech. Finally, lessons learned from past financial crises in Nepal and other countries can provide valuable insights into the role of macroeconomics in commercial bank stability (Gwachha, 2022).

The literature analysis shows that the researchers have put a lot of work into their research to gauge bank financial stability. The study has tried to evaluate bank stability using metrics such as Z-score, ROA, and NPAs. Some studies have employed a camel-based methodology. In Nepal, research has looked at efficiency and profitability that evaluated the banking industry's stability. The study adds to the body of knowledge by evaluating the stability of Nepalese commercial banks. Bank stability is crucial for ensuring the safety and credibility of the banking system. It also supports international trade by predicting financial crises, especially in countries experiencing rapid economic growth. This study examines the macroeconomic factors that impact commercial bank stability in Nepal.

Research Methods

Construction of Bank Stability

Several central banks and monetary authorities are worried about sustaining financial system safety and financial stability in the present trend of the global financial system. Global social and economic growth now depends on financial stability and sustainable development (Ali & Puah, 2018). Many theoretical and empirical studies have shown the factors that affect a bank's stability. Bank stability is the indicator signalling bank stability for the identity of bank soundness, as proposed in the prior empirical research of Adusei (2015), Ali & Puah (2018), and Klingelhofer and Sun (2019). The scholars use the following indicators to calculate bank stability: ROA (return on assets), Total Equity / Total Assets ratio, and ROA standard deviation. We calculate the bank stability (BS) as follows:

$$\text{Bank Stability (BS)} = \frac{\text{ROA} + {}^{\text{TE}}/_{\text{TA}}}{\sigma(\text{ROA})} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots .. (1)$$

Data description and variables

We gathered information on macroeconomic and financial factors from Nepal Rastra Bank releases, including quarterly economic bulletin and database on the Nepalese economy from 2001 to 2022. Based on theoretical and empirical perspectives, the literature has identified several factors that impact the stability of commercial banks in Nepal. GDP growth, inflation (INF), interest rate (INT), exchange rate (ER), money supply (M2), and NEPSE index were employed in the study as explanatory variables.

Table 1 Summaries of research variable

Symbols	Variables	Proxies	Expected Sign
BS	Bank Stability	$BS = \frac{ROA + TE/TA}{\sigma(ROA)}$	
Explanatory variables			
INF	Inflation Rate	Consumer Price Index	-
GDP	GDP Growth Rate	Growth =ΔGDP/GDP	±
INT	Interest Rate	Average Interest rate	±
ER	Exchange Rate	USD: NR	±

Symbols	Variables	Proxies	Expected Sign
M2	Money Supply	Per cent of GDP	+
NEPSE	Nepal Stock Exchange	NEPSE Index	+

Source: From the literature review

Bank stability: The ability of a bank to maintain its financial position and withstand financial shocks or disruptions without jeopardizing its ability to continue its normal operations. It is a critical aspect of the overall health of the financial system and is essential for maintaining public confidence in the banking system. It is essential for maintaining financial stability, promoting economic growth, and safeguarding the interests of bank customers and other stakeholders.

Inflation: It refers to the sustained increase in the general price level of goods and services in an economy over a period. Inflation is often expressed as a percentage increase in the Consumer Price Index (CPI), which measures the average change in prices of a basket of household goods and services.

GDP growth: It refers to the increase in the value of goods and services produced within a country's borders over a specific period, usually a year. GDP stands for Gross Domestic Product and measures an economy's size and health. It is an important measure of the health and performance of an economy.

Interest rate: The amount of money a borrower must pay a lender is usually expressed as a percentage of the principal amount borrowed. Interest rates are a key tool used by banks, central banks, and policymakers to manage the economy and promote economic growth while also ensuring the financial system's stability.

Exchange rate: The rate at which we exchange Nepalese currency for foreign currencies in the global exchange market—central banks and policymakers manage exchange rate fluctuations and promote economic stability by closely monitoring exchange rates.

Money Supply (M2): Broad money, also known as M2, is a measure of the total amount of money in an economy that is readily available for spending. It includes all physical currency, such as banknotes and coins, as well as all types of deposits in banks and other financial institutions that can be withdrawn on demand.

NEPSE Index: The Nepal Stock Exchange (NEPSE) index is a benchmark index that reflects the performance of the Nepalese stock market. It is a weighted index that tracks the performance of the stocks listed on the Nepal Stock Exchange based on their market capitalization.

Econometric methods

The study employs the Autoregressive Distributed Lag (ARDL) approach to examine the co-integrating connection between macroeconomic factors and bank stability from 2001 to 2022. The Nepal Rastra Bank provided the yearly time series data, which was subjected to a stationarity pre-test before the estimation procedure. The use of the ARDL model relies on the co-integration test result, as it considers all variables in both dynamic and static models as a priori endogenous and adjusts for interactions between endogenous and exogenous components. Occasionally, exogenous variables may include in the ARDL model. The ARDL model is frequently used to investigate the long-term and short-term equilibrium linkages and co-integration variables. Assuming that the variables in this study are co-integrated, the RDL equation is as follows.

$$\begin{aligned}\Delta lnBS_t = \alpha_0 &+ \sum_{i=0}^{q} b_i \Delta lnBS_{t-i} + \sum_{i=0}^{q} c_i \Delta lnINF_{t-i} + \sum_{i=0}^{q} d_i \Delta lnGDP_{t-i} + \sum_{i=0}^{q} e_i \Delta lnINT_{t-i} \\ &+ \sum_{i=0}^{q} f_i \Delta lnER_{t-i} + \sum_{i=0}^{q} g_i \Delta lnM2_{t-i} + \sum_{i=0}^{q} h_i \Delta lnNEPSE_{t-i} + \mu_1 lnBS_{t-1} \\ &+ \mu_2 lnINF_{t-1} + \mu_3 lnGDP_{t-1} + \mu_4 lnINT_{t-1} + \mu_5 lnER_{t-1} + \mu_6 lnM2_{t-1} \\ &+ + \mu_7 lnNEPSE_{t-1} + \varepsilon_t \dots\dots\dots (1)\end{aligned}$$

Here, the dependent variable in this study is bank stability (BS). In contrast, explanatory variables are inflation rate (INF), GDP growth (GDP), interest rate (INT), exchange rate (ER), money supply (M2), and NEPSE index (NEPSE). All variables are also specified as before: the long-run coefficients are μ1, μ2, μ3, μ4, μ5, μ6, and μ7 the short-run coefficient dynamics are bj, cj, dj, ej, fj, gj, and hj and ε represented by the random disturbance term.

The study utilizes a co-integration test and an error correction model (ECM) to investigate both the long-term equilibrium and short-term causal links between these variables. In addition, the study also evaluates the speed of adjustment and the short-run relationship between the macroeconomic variables and the bank stability using the ECM of Equation 3.

$$\Delta lnBSI_t = \alpha_0 + \sum_{i=0}^{q} \delta_1 \Delta lnBSI_{t-i} + \sum_{i=0}^{q} \delta_2 \Delta lnINF_{t-i} + \sum_{i=0}^{q} \delta_3 \Delta lnGDP_{t-i} + \sum_{i=0}^{q} \delta_4 \Delta lnINT_{t-i} + \sum_{i=0}^{q} \delta_5 \Delta lnER_{t-i} + \sum_{i=0}^{q} \delta_6 \Delta lnM2_{t-i} + \sum_{i=0}^{q} \delta_7 \Delta lnNEPSE_{t-i} + \delta_8 ECM_{vt} \dots\dots\dots (3)$$

Equations (3) will be used for estimating the dynamic ARDL model, which represents the model's long-run and short-run dynamics through coefficients δ1, δ2, δ3, δ4, δ5, δ6, and δ7. The divergence or convergence towards long-run equilibrium is represented by coefficient δ8. A positive coefficient indicates divergence, while a negative coefficient indicates convergence.

Descriptive statistics for pre-estimation diagnostics

We used descriptive statistics to define the stability characteristics of financial banks and macroeconomic conditions over the research period. Mean, median, minimum, maximum, standard deviation, skewness, and kurtosis were used as descriptive statistics to explain the values of the variables investigated. Table 2 provides an overview of the descriptive statistics and economic time series data for the macroeconomic factors examined in this study from 2001 to 2022.

Table 2 Descriptive statistics of research variables, 2001-2022

	BS Index	INF (In %)	GDP growth	INT (In %)	EER (In %)	M2 (% of GDP)	NEPSE Index
Mean	10.508	6.702	11.616	89.142	9.889	91.251	902.104
Median	11.992	6.570	11.421	79.425	9.860	91.184	716.500
Maximum	15.109	11.090	21.162	126.510	12.470	120.517	2883.400
Minimum	1.528	2.690	0.772	65.020	6.540	60.700	204.860
Std. Dev.	3.701	2.620	4.956	19.034	1.708	17.694	691.721
Skewness	-0.755	-0.019	0.019	0.546	-0.195	-0.170	1.212
Kurtosis	2.720	1.727	3.051	1.873	2.271	1.864	4.101

Source: Authors' computations from EViews 12 output.

Table 2 reveals that there are outliers present in the data, as there is a considerable difference between the lowest and highest values for each variable analyzed. Except for banks' stability index, money supply, and inflation, the statistics have positive skewness. Additionally, all the variables have kurtosis values that are not equal to three and are not uniformly distributed. All datasets were transformed using natural logarithms and made stationary before being utilized for primary data analysis to address the issue of non-normality, extreme values, and anomalies,.

Empirical Results and Discussion

The stationarity tests

In time series analysis, checking the stationarity of variables before conducting any tests is crucial. Additionally, the variables should not have unit root problems, and only one of their integration orders must be I(0) or I(1) to use the ARDL technique. This study utilized unit root testing to determine the integration order of all variables. The research employed the PP and ADF tests to achieve this objective. Table 4 shows the results of these tests at both the level and first difference.

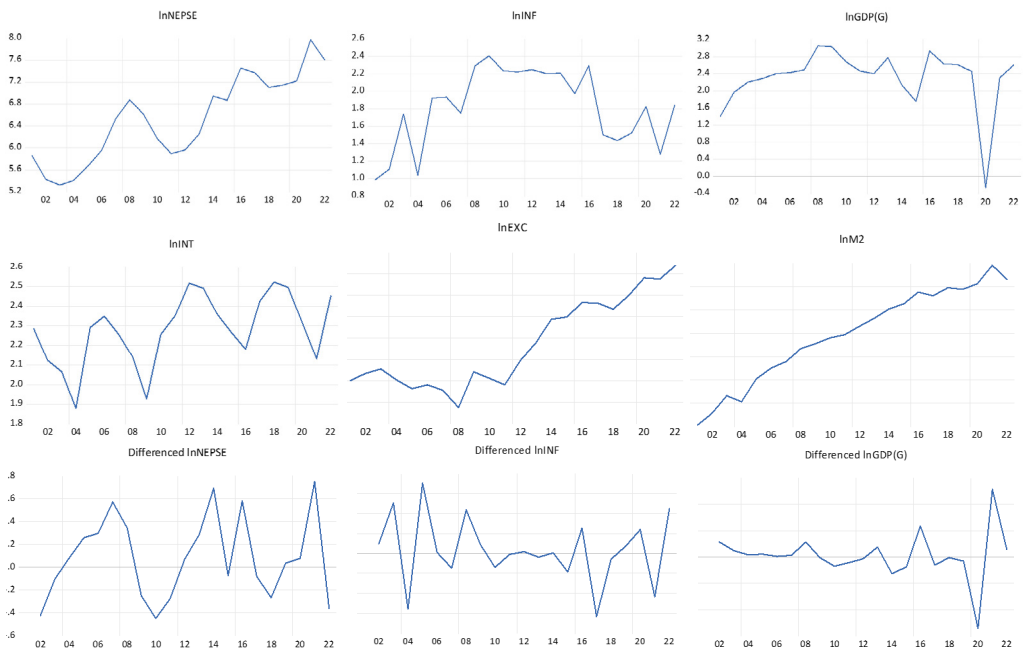
Table 3 Panel unit root test

Variables	Level		First difference		Order of integration
	Augmented Dickey-Fuller	Philips-Person	Augmented Dickey-Fuller	Philips-Person	
lnBS	-3.3109	-3.3066	-7.6035*	-9.0907*	I(1)
lnINF	-2.9307**	-2.8732	-73938*	-7.6121*	I(0)
lnGDP(G)	-2.0582	-2.0467*	--6.2234*	--6.2177*	I(1)
lnINR	-5.4908*	-3.1460	-7.0511*	-4.9054*	I(0)
lnEER	-1.8213	-1.4603	-4.6173*	-4.6180*	I(1)
lnM2	-1.4948	-2.0003	-6.4047*	-6.4957*	I(1)
lnNEPSE	-3.1437	-2.7860	-3.8408*	-3.8408*	I(1)

*Note: * indicates rejection of the null hypothesis of non-stationary at 1 per cent.*

Source: Based on Authors' computations from EViews 12 output.

Table 3 displays the outcomes of the ADF and PP tests. Bank stability and the macroeconomic variables are not statistically consistent. However, at a 1% significance level, all variables are stationary in the first difference. Therefore, every variable has an integration order of I(1). Additionally, Figure 1 illustrates the trend lines for research variables.



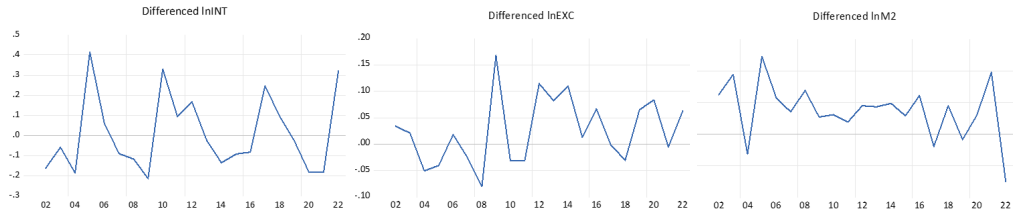


Figure 1 Trend line of research variables at both the level and first difference

Lags selection and determinations

The analysis follows Pesaran et al. (2001), which promoted the lowest Schwarz information criterion SC/HQ/AIC value as the primary concern for choosing the appropriate lag order selection criteria. The justification for selecting the optimal lag will greatly reduce the multicollinearity, heteroskedasticity, serial correlation, and normalcy issues.

Table 4 Optimal lag length test

Lag length	Akaike Information Criteria (AIC)	Schwarz Bayesian Criterion (SBC)	Hannan-Quinn information criterion (HQ)
0	0.020531	0.368705	0.096094
1	-5.751095*	-2.965702*	-5.146594*
2	-4.035771	-1.883217	-4.679333

Source: Based on Authors' computations from EViews 12 output.

Table 4 shows the results of the studies in terms of AIC, HQ, and SBC; to determine the optimal lag length, we must select the lag length with the lowest critical value for each criterion. According to the table, lag 1 has the smallest AIC, HQ, and BIC criteria for the macroeconomic variables. Bound tests for co-integration may be used to confirm if the variables are co-integrated.

Bound testing for co-integration analysis

Bank stability requires relevant macroeconomic parameters, which can be designed using a dynamic causality test after identifying the co-integration connection between variables. The ARDL approach is better suited for examining causality between variables integrated at I(0) and I(1) with few observations. The study found that the variables have a sustained relationship based on the co-integration test, with an F-statistics value of 5.813. This value is greater than the upper bound critical values from the table by Jahangard and Abdolshah (2017) (finite sample n □ 30), which are 3.515, 3.148, and 5.691 at 10%, 5%, and 1%, respectively. Thus, the study concludes that bank stability and macroeconomic factors are co-integrated. The study investigated the direction of causality between macroeconomic factors and bank stability. The study employed the ARDL model or bound testing techniques developed by Pesaran et al. (1999, 2001). This allowed the study to determine how changes in macroeconomic factors affect bank stability.

ARDL Long Run Form

After establishing the co-integration of the variables, the study determined the long-run coefficients of the ARDL model to assess the long-term impact of macroeconomic factors on bank stability. The variable's long-run coefficients were derived by using the ARDL method in this study. Table 7 displays the results of the long-term relationship between macroeconomic indicators and bank stability.

Table 5 Estimated Long- run coefficients by using the ARDL model

Levels Equation Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNINF	-0.771623	0.371975	-2.074398	0.0585
LNGDP_G	-0.502045	0.277143	-1.811501	0.0974
LNINT	0.733846	0.219118	3.349085	0.0051
LNER	-0.781752	0.230972	-3.384623	0.0048
LNM2	0.338509	0.115359	2.934374	0.0136
LNNEPSE	0.730877	0.489611	1.492773	0.1594
C	1.626524	0.685656	2.372216	0.0370

Note: Based on the Authors' computations from EViews 12 output

Table 5 displays the findings from the ARDL approach on the long-term causality of macroeconomic factors on bank stability. The results reveal that interest rate, money supply (M2), and NEPSE index positively and significantly impact bank stability. However, GDP growth, inflation rate, and exchange rate have a negative impact on bank stability in Nepal. The study also shows that a 1-period lag has advantageous and significant long-term effects of macroeconomic factors on bank stability. The long-term analysis shows a 1 per cent increase in interest rate leads to bank stability by 0.7338 per cent. Furthermore, the study reveals that a 1 per cent increase in money supply (M2) causes a 0.3385 per cent increase in bank stability. Additionally, the findings demonstrate that a 1 per cent decrease in exchange rate leads to a 0.7817 per cent increase in bank stability, while a 1 per cent decrease in inflation results in a 0.7716 per cent increase in bank stability.

The study reveals that interest rates show a positive and statistically significant influence on bank stability, which indicates improving a bank's profitability, which can strengthen its capital position and ability to absorb losses. Similarly, the money supply has a significant positive impact on bank stability. This finding reveals that it can increase the availability of funds for lending, which can help to stimulate economic growth and improve a bank's loan portfolio performance. This can enhance a bank's ability to withstand economic shocks and maintain stability over time. However, the exchange rate has a negative and significant impact on bank stability, which indicates that banks that hold assets or liabilities denominated in foreign currencies are exposed to exchange rate risk, which can cause their balance sheets to become more volatile. In addition, the study reveals that the inflation rate shows a negative and statistically significant influence on bank stability. This shows that the overall level of prices in the Nepalese economy significantly influences the stability of the banks and that greater levels of inflation are detrimental to bank stability. The stability of the banks appears to be negatively impacted by GDP growth. This seems to imply that banks accumulate greater NPAs as economic activity increases. This evidence supports our conclusion that a causal link between loan growth and bank stability exists.

ARDL Error Correction Regression

This study employs the dynamic causality test to examine the causal relationships between variables obtained through ARDL. The ARDL error correction regression results are presented in Table 6, which distinguish the short-run connections between bank stability and macroeconomic variables.

Table 6 Estimated short-run coefficients by using ARDL Error Correction Regression

ECM Regression Case 2: Restricted Constant and No Trend				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNINF)	-0.180021	0.192569	-0.934840	0.3699
D(LNGDP_G)	-1.699067	0.900920	-1.885924	0.0860
D(LNINT)	1.919132	0.787560	2.436808	0.0299
D(LNER)	-0.324497	0.076917	-4.218786	0.0010
D(LNM2)	0.771623	0.371975	2.074398	0.0585
D(LNNEPSE)	0.061639	0.044660	1.380186	0.1949
ECM(-1)	-0.497955	0.121251	-4.106795	0.0021
R-squared = 0.716557	Adjusted R-squared = 0.685064		Durbin-Watson stat = 2.015693	
	F-Statistic = 39.93336	Prob. (F-statistic) = 0.0000		

Note: Based on the Authors' computations from EViews 12 output

Table 6 presents the findings of the ARDL analysis on short-term causality. The error correction model (ECM) for time t-1 is -0.4979, statistically significant at a 1% level. This model indicates that any deviation from long-run bank stability in the short-run is corrected at a rate of 49.79% per year, with macroeconomic variables included in the analysis accounting for 49.79% of the previous year's deviation from long-run stability. The observed difference between short-term and long-term bank stability in Nepal may help explain the financial system's fragility, attributed to the inefficiency of the financial system's information flow in the short run. Moreover, the study discovered that GDP growth and exchange rate significantly impacted bank stability. However, the interest rate and money supply (M2) had positive and significant effects on the bank stability in Nepal.

Furthermore, the D/W value of 2.0156 suggests the absence of autocorrelation. The adjusted R2 value of 0.68506 and F-statistics of 39.9333 (with a p-value of 0.000) depicted in Table 4 indicate that the model of this study is the most suitable one, considering a significance level of 1%. Hence, the study concludes that the overall model of this study is the best fit. Finally, the ARDL model's dynamic causality demonstrates a significant relationship between bank stability and macroeconomic variables, including GDP growth, inflation, exchange rate, and the NEPSE index. These findings suggest that these variables have strong explanatory power in understanding the stability of banks in Nepal.

Diagnostic tests for ARDL Model

In this study, various diagnostic tests were employed to evaluate the dependability of the estimated ARDL approach. The study employed various tests to evaluate serial correlation, heteroscedasticity, normality, and model stability. Specifically, the BG serial correlation LM test, BPG heteroscedasticity test, Jarque-Bera normality test, and recursive CUSUM test were utilized. The results of the heteroscedasticity and serial correlation tests are presented in Table 7, while Figures 2 and 3 show the outcomes of the CUSUM test and model stability, respectively. These tests were conducted to ensure that the ARDL model was statistically robust and reliable.

Table 7 Diagnostic tests for ARDL approach

	F-version		**Breusch-Godfrey LM-version**	
	Statistics	**P-Value**	**Statistics**	**P-Value.**
A: Serial Correlation	F (1,13) = 1.5976	0.2284	χ^2 (1) = 2.2984	0.1295

	F-version		**Breusch-Godfrey LM-version**	
	Statistics	**P-Value**	**Statistics**	**P-Value.**
D: Heteroscedasticity	F (4,16) = 1.7657	0.1784	χ^2 (4) = 9.0461	0.1710
C: Normality	Jarque-Bera	0.9837	0.61147	

Source: Authors' computations from EViews 10 output

The results presented in Table 9 indicate that the F-statistics and Chi-Square p-values for the LM test are greater than 0.05, indicating that the ARDL approach used in the study is not impacted by serial correlation and heteroscedasticity. Furthermore, the normality of the residual terms was evaluated using the Jarque-Bera statistics, with Table 9 displaying a JB test statistic of 0.9837 (with a p-value of 0.6114>0.05). This suggests that the residual series obtained from the model has a normal distribution. Consequently, the study concluded that the ARDL approach used in the analysis is statistically robust and reliable.

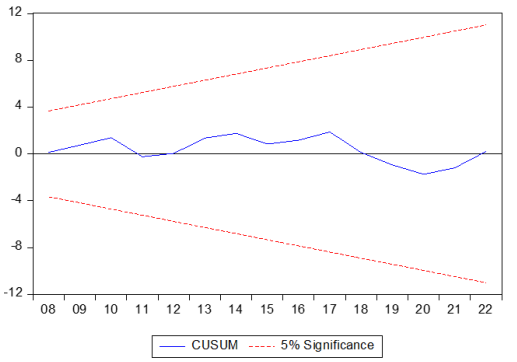


Figure 2 CUSUM test

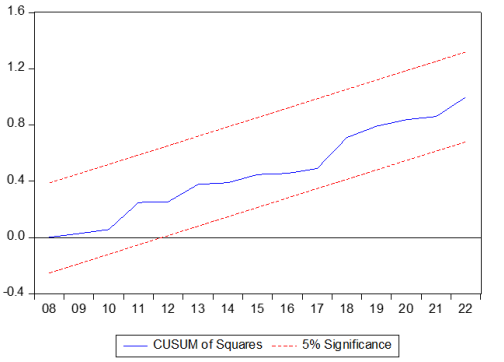


Figure 3 CUSUM square stability test

The CUSUM and CUSUM square stability tests confirmed the long-term stability of the model. Figures 2 and 3 demonstrate the results of these tests, showing the CUSUM and CUSUM of the square tests along with the critical boundary line at a 5% significance level. Both tests' plots fall within the critical boundaries, as depicted in Figures 2 and 3. Thus, the model's stability has been verified throughout the study period, allowing it to determine causality and long-term relationships.

Conclusions

The study examined macroeconomics as a basis of commercial banks' stability in Nepal by using time series data from 2001 to 2022. The study employed the ARDL model and finds the interest rate has a positive and significant impact on bank stability and that monetary policy decisions made by central banks to adjust interest rates can significantly impact the banking system's stability. Therefore, policymakers must carefully balance the trade-offs between the goals of price stability, economic growth, and financial stability when setting interest rate policy. In addition, banks must also manage their interest rate risk exposure and adapt to changes in interest rates to maintain stability over time. Similarly, money supply (M2) has a positive and significant impact on bank stability, which indicates that the availability of funds for lending can play a crucial role in maintaining the banking system's stability.

However, the study also reveals that the exchange rate negatively and significantly impacts bank stability. It implies that banks must carefully manage their foreign exchange risk exposure through hedging strategies and risk management practices to mitigate the impact of exchange rate fluctuations on their balance sheets. In addition, the inflation rate has a negative and significant impact on bank stability, which indicate that the banks manage their credit risk exposure and adjust their lending

practices to adapt to changes in inflation rates to maintain stability over time. Therefore, the study suggests that policymakers and regulators need to pay close attention to macroeconomic indicators such as inflation, interest rates, money supply (M2), and exchange rates to ensure the stability and soundness of the banking system. The research also highlights the need for commercial banks to closely monitor macroeconomic developments and adjust their strategies accordingly to mitigate risks and maintain stability.

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