Commercial Bank Net Interest Margins, Default Risk, Interest Rate Risk and off-balance sheet banking: A Case of Nepalese Commercial Banks

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Abstract

This study examines the impact of default risk, interest rate risk and off balance-sheet activities on the profitability of Nepalese commercial banks. Return on assets and net interest margin are the selected dependent variables. The selected independent variables are spread rate, capital adequacy ratio, non-performing loan, loan loss provision, liquidity and off balance-sheet activities. The study is based on secondary data of 13 commercial banks with 104 observations for the study period from 2015/16 to 2022/23. The data were collected from Banking and Financial Statistics published by Nepal Rastra Bank and annual report of respective commercial banks. The correlation coefficients and regression models are estimated to test the significance and importance of spread rate, capital adequacy ratio, non-performing loan, loan loss provision, liquidity and off balance-sheet activities on the profitability of Nepalese commercial banks.

The study showed that spread rate has a positive effect on return on assets and net interest margin. It means that increase in spread rate leads to increase in return on assets and net interest margin. Similarly, capital adequacy ratio has a positive effect on return on assets and net interest margin. It indicates that increase in capital adequacy ratio leads to increase in return on assets and net interest margin. Moreover, loan loss provision has a negative effect on return on assets. It shows that higher the loan loss provision, lower would be the return on assets. In contrast, off balance-sheet activities have a negative effect on return on assets and net interest margin. It means that increase in off balance-sheet activities lead to decrease in return on assets and net interest margin. Similarly, liquidity has also a negative effect on return on assets and net interest margin. It means that increase in liquidity leads to decrease in return on assets and net interest margin.

Keywords: return on assets, net interest margin, spread rate, capital adequacy ratio, non-performing loan, loan loss provision, liquidity, off balance-sheet activities

1. Introduction

Financial institutions play an important role in the management and circulation of capital in the economy. In doing so, financial institutions

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contribute to a country's economic growth and performance through the optimal allocation of resources. For financial institutions to play their intended role, a well-functioning financial system is essential, because weak financial systems are one of the reasons why many countries remain poor (Saad and El-Moussawi, 2012). In less developed economies such as Nepal, where the financial sector is largely dominated by banks, the efficiency and effectiveness of the banking sector plays an important role in driving growth economy. To achieve the goal of efficient resource allocation, the bank's intermediary role must be performed at the lowest possible cost. Banks largely depends on competitive marketing strategy that determines their success and growth (Sukmadewi, 2020). Therefore, strong banking sector enables money circulation and distribution, security and ease in money transactions, and also helps the execution of monetary policies leading to a dynamism in the economy.

Akinlo and Owoyemi (2012) argued that high interest rate differentials may discourage potential savers and thereby limit the steady availability of funds to potential investors. Higher net interest margins typically imply lower banking sector efficiency and have a negative impact on financial development, leading to lower investment and slower economic activity. Net profit margin is considered an important indicator to evaluate the efficiency of intermediary activities. Similarly, Ben Naceur and Goaied (2008) argued that this net interest margin will decrease as the banking industry matures and competition increases. The interest rate spread or net interest margin of banks represents an essential element of profitability. Interest rate margins are of significant importance in effectively mobilizing resources for economic and productive activities. Large differentials between interest rates make borrowing expensive, which limits economic activity and reduces the return on savings. Likewise, Drakos (2003) found that the decline in interest rate margins demonstrates the success of market-oriented reforms implemented in transition countries. Furthermore, Allen (1988) argued that credit risk is important in determining interest rate margins. Moreover, Maudos and Guevara (2004) identified several determinants of profit margins and showed that the level of competition and operating costs are both important for-profit margins. Silaban (2017) analyzed the effect of capital adequacy ratio, net interest margin and non-performing loans on bank profitability in Indonesia. The results indicated that capital adequacy ratio (CAR) does not have a significant effect on bank profitability. However, net interest margin (NIM) improves the growth of bank profitability. Similarly, Chishty (2011)

argued that capital adequacy is important for a bank to maintain depositor's confidence and presenting bank from going bankrupt. Capital is seen as a strong support to protect depositors and promote the stability and efficiency of financial system around the world. Likewise, Dodi *et al.* (2018) concluded that capital adequacy ratio has a negative relationship with return on assets and return on equity.

Musah *et al.* (2018) investigated the impact of interest rate spread on bank profitability in Ghana. The results of the study showed that there is a positive and statistically significant association between interest rate spread and bank profitability in Ghana. Likewise, Vodova (2016) found that the relation is not in accordance with standard finance theory which emphasizes negative link between liquidity and profitability. Similarly, Samad (2015) stated that loan-deposit ratio (bank liquidity), loan loss provision to total assets ratio (credit risk), equity capital to total assets (capital risk) and operating expenses (bank efficiency) have been found statistically significant with bank profitability. Meanwhile, Parvin *et al.* (2019) analyzed the effect of liquidity and bank size on the profitability of commercial banks in Bangladesh. The results stated that loan to asset ratio and bank size have a positive relation with return on asset (ROA) which was the indicator of profitability. The results also showed that deposit to asset ratio has a negative impact on the ROA of the selected banks. Furthermore, Alshatti (2015) stated that it is essential to assured proper liquidity management for increasing the profitability of the banks. However, Larty *et al.* (2013) found that the relationship between profitability and liquidity was positive but insignificant during that period. In addition, Qin and Pastory (2012) found that liquidity and asset quality have a positive effect but level of nonperforming loans and capital adequacy have a negative effect on the profitability of the banks.

Ramadhanti *et al*. (2019) assessed the effect of capital adequacy, liquidity and credit risk on profitability of commercial banks. The study revealed that capital adequacy ratio (CAR) has a significant positive effect on profitability. However, non-performing loan (NPL) has a negative and significant effect on profitability. Similarly, Amenawo *et al.* (2016) examined the effect of currency fluctuation on commercial banks profitability. The study revealed that capital adequacy ratio has a positive relationship with return on assets. Likewise, Setiawan and Nupus (2021) analyzed the effect of capital adequacy ratio and loan-to-deposit ratio on banking profitability. The result found that capital adequacy ratio (CAR) and loan-to-deposit ratio (LDR) have a positive and significant influence on the profitability in State Owned Banks.

However, only asset size has positive and significant effect on profitability in foreign bank. Moreover, Brastama and Yadnya (2020) analyzed the effect of capital adequacy ratio and non-performing loan on banking stock prices with profitability as intervening variable. The results found that capital adequacy ratio has a positive effect on return on assets. Furthermore, Solihati (2020) ascertained the factors affecting banking profitability. The results revealed that non-performing loan and capital adequacy ratio have significant effect on ROA. Meanwhile, capital adequacy ratio is not significantly affected by return on assets (ROA). However, Sinha and Chatterjee (2008) compared Indian public and private commercial banks' ability to generate income out of off-balance-sheet activities by using the data envelopment approach. The results showed that public sector commercial banks are lagging behind the private sector commercial banks in OBS activities. The results indicated that OBS activities are positively related to operating profit ratio and negatively related to NPA ratios.

Nachane and Ghosh (2007) traced the determinants of off-balance sheet activities in the Indian banking sector using data for the period 1996 to 2004. The study found out that there is a significantly positive relationship between OBS activities and profitability. Likewise, Khasawneh *et al*. (2012) found that there is a significantly positive relationship exists between OBS activities usage and net income (profitability). Moreover, Sukmadewi (2020) examined the effect of capital adequacy ratio, loan-to deposit ratio, operating-income ratio, non-performing loans, and net interest margin on banking financial performance. The results revealed that capital adequacy ratio, nonperforming loan, and loan-to-deposit ratio has a positive and significant effect on return on assets. Brock and Suarez (2000) argued that high interest rate margins are actually unfavorable because they lead to "disintermediation. Further, the study argued that low deposit interest rates represent unattractive returns for maintaining deposit accounts, which discourages saving. Similarly, Tarus *et al.* (2012) analyzed the determinants of net profit margins of commercial banks in Kenya using pooled and fixed effects regressions on a panel of 44 Kenyan commercial banks over the period (2000-2009). The estimation results showed that operating costs and credit risk have a positive and significant impact on the net interest margin of commercial banks in Kenya. The study also found that higher the inflation, wider would be the net interest margin, while growth and market concentration have a negative impact on net interest margin. In contrast, Williams (2007) found that a negative and significant relationship between net interest margin and banking risks. The results stated

that deregulatory environment contributed to the acceptance of banks with lower interest margins and lower credit quality. Moreover, Martynez Peria and Mody (2004) demonstrated an insignificant impact of the NPL ratio on interest rate spreads but a significant impact of centralization measures and administrative costs.

In the context of Nepal, Maskay and Pandit (2010) argued that there is a significant long run elasticity between the policy rate (bank rate) and the interest rate margin. Similarly, Panta (2019) concluded that default rate and cost per loan asset were the significant variables explaining the banks' performance. However, capital adequacy ratio was insignificant for the banks' performance. Similarly, Neupane (2013) revealed that the decline in efficiency volatility is due to a decline in both pure efficiency variability and scale efficiency variability, as well as a positive relationship between the debt-to-equity ratio ownership and efficiency as well as between capital adequacy and efficiency. Furthermore, profitable banks with lower leverage and higher capital adequacy ratios are found to be more efficient and bank loans appear to be more valuable than alternative banking products.

The above discussion shows that empirical evidences vary greatly across the studies on the impact of default risk, interest rate risk and off balance-sheet activities on the profitability of commercial banks. Though there are above-mentioned empirical evidence in the context of other countries and in Nepal, no such findings using more recent data exist in the context of Nepal. Therefore, in order to support one view or the other, this study has been conducted.

The main purpose of the study is to analyze the impact of default risk, interest rate risk and off balance-sheet activities on the profitability of commercial banks. Specifically, it examines the relationship of spread rate, capital adequacy ratio, non-performing loan, loan loss provision, liquidity, off balance-sheet activities with return on assets and net interest margin Nepalese commercial banks.

The remainder of this study is organized as follows. Section two describes the sample, data and methodology. Section three presents the empirical results and the final sections draws conclusion.

2. Methodological aspects

The study is based on the secondary data which were gathered from 13 Nepalese commercial banks from 2015/16 to 2022/23, leading to a total of 104 observations. The study employed convenience sampling method. The main

sources of data include Banking and Financial Statistics published by Nepal Rastra Bank and annual report of respective commercial banks. This study is based on descriptive as well as causal comparative research designs. Table 1 shows the list of commercial banks selected for the study along with the study period and number of observations.

Table 1

List of commercial banks selected for the study along with study period and number of observations

S.N.	Name of the banks	Study period	Observations
1.	Nepal Bank Limited	2015/16-2022/23	8
2.	Rastriya Banijya Bank Limited	2015/16-2022/23	8
3.	Agricultural Development bank Limited	2015/16-2022/23	8
4.	Everest Bank Limited	2015/16-2022/23	8
5.	NMB Bank Limited	2015/16-2022/23	8
6.	Machhapuchchhre Bank Limited	2015/16-2022/23	8
7.	Sanima Bank Limited	2015/16-2022/23	8
8.	Citizens International Bank Limited	2015/16-2022/23	8
9.	Prime Commercial Bank Limited	2015/16-2022/23	8
10.	Siddhartha Bank Limited	2015/16-2022/23	8
11.	NIC Asia Bank Limited	2015/16-2022/23	8
12	Nepal SBI Bank Limited	2015/16-2022/23	8
13.	Standard Chartered Bank Nepal Limited	2015/16-2022/23	8
Total number of observations			**104**

Thus, the study is based on the 104 observations.

The model

The model used in this study assumes that bank profitability depends on default risk, interest rate risk and off balance-sheet activities. The dependent variables selected for the study are return on assets and net interest margin. Similarly, the selected independent variables in this study are spread rate, capital adequacy ratio, non-performing loan, loan loss provision, liquidity and off balance-sheet activities. Therefore, the models take the following forms:

$$ROA = \beta_0 + \beta_1 SR + \beta_2 CAR + \beta_3 NPL + \beta_4 LLP + \beta_5 LIQ + \beta_6 OBSA + e$$

$$NIM = \beta_0 + \beta_1 SR + \beta_2 CAR + \beta_3 NPL + \beta_4 LLP + \beta_5 LIQ + \beta_6 OBSA + e$$

Where,

ROA = Return on assets as measured by the ratio of net income to total assets,

in percentage.

NIM= Net interest margin as measured by the ratio of net interest income to total assets, in percentage.

SR= Spread rate as measured by the weighted average interest rate spread, in percentage.

CAR= Capital adequacy ratio as measured by the ratio of total capital to total risk weighted exposure, in percentage.

NPL= Non-performing loan as measured by the ratio of non-performing loans to total loans, in percentage.

LLP = Loan loss provision as measured by the total loan loss provision, Rs. in billions.

LIQ= Liquidity as measured by sum of cash and cash equivalent and due from Nepal rastra bank, Rs. in billions.

OBSA= Off-balance sheet activities as measured by the total contingent liabilities and commitments, Rs. in billions.

The following section describes the independent variables used in this study along with hypothesis formulation.

Non-performing loans

Non-performing loan (NPL) is a major problem in the banking industry. A nonperforming loan (NPL) is a loan in which the borrower is in default and hasn't made any scheduled payments of principal or interest for a certain period of time. Athanasoglou *et al.* (2008) showed that the poor quality of loans reduces interest revenue, thus confirming that NPLs has a negative effect on bank profitability. According to Akter and Roy (2017), non-performing loan was the major factor influencing banks profitability and it has statistically significant negative impact on return on assets. Likewise, Marius (2011) examined the relationship between NPL and efficiency for the Central and Eastern European banking sector between 2004 and 2009. The findings showed that this relationship is statistically significant and negative, which suggested that banks should limit NPLs as a solution to enhance bank's efficiency. Similarly, Brastama and Yadnya (2020) concluded that non-performing loan is negatively related to profitability. Moreover, Altunbas *et al.* (2000) confirmed that there exists a negative relationship between NPLs ratio and bank profitability. Based on it, this study develops the following hypothesis:

H_1: There is a negative relationship between non-performing loans and bank profitability.

Spread rate

Interest rate spread is the interest rate charged by banks on loans to private sector customers minus the interest rate paid by commercial or similar banks for demand, time, or savings deposits. The difference between the borrowed rate and the lending rate is called the spread. Spread is different from the rates because they are determined by the individual financial institution. Khan and Sattar (2014) examined the effect of interest spread on profitability of four major banks in Pakistan. The results of the correlation analysis revealed a positive and statistically significant relationship between interest spread and profitability. Similarly, Siddiqui (2012) found that rate spread has a positive impact on ROA whereas bank liquidity has a negative impact on interest rate spread. Likewise, Musah et al. (2018) showed a positive and significant association between IRS and bank profitability in Ghana. Furthermore, Owusu-Antwi et al. (2017) found that there is weak positive correlation between interest rate spread and performance of Ghanaian banks. Moreover, Jui *et al.* (2020) found that there is positive correlation between interest rate spread and NIM and ROA. Based on it, this study develops the following hypothesis:

H_2: There is a positive relationship between spread rate and bank profitability.

Capital adequacy ratio

Capital adequacy ratio is the ratio that set standards for banks by looking at a bank's ability to pay liabilities, and respond to credit risks and operational risks. Putri *et al.* (2018) stated that CAR has a significant positive effect on profitability (ROA). A bank that has a good CAR has enough capital to absorb potential losses. Similarly, Nahar *et al.* (2020) identified a positive relationship between capital adequacy ratio and profitability. Capital is a factor that needs to be considered by banks. Likewise, Olalekan and Adeyinka (2013) found a positive relationship between capital adequacy ratio and profitability of Nigerian banks. Furthermore, Kumar *et al.* (2020) investigated the relationship between monetary policy and bank profitability in New Zealand. The study revealed that capital adequacy ratio is positively related to return on assets. Moreover, Ariwidanta and Wiksuana (2018) determined the relationship between credit and liquidity risk to profitability through the capital adequacy ratio as a mediating variable. The study concluded that capital adequacy ratio is positively related to return on assets. Furthermore, Farkasdi *et al.*

(2021) determined the determinants of profitability in commercial banks in Germany. The study showed a positive relationship between capital adequacy ratio and profitability measured by return on equity. Based on it, this study develops the following hypothesis:

H_3: There is a positive relationship between capital adequacy ratio and bank profitability.

Loan loss provisions

Loan-loss provisioning policy is critical in assessing financial system stability, in that it is a key contributor for fluctuations in banks' profitability and capital positions, which has a bearing on banks' supply of credit to the economy. Loan loss provision is provisioning for credit losses on the loan portfolio and its funding which occurred impairment in economic value (Budiarti, 2012). Iloska (2014) indicated that operating expenses and loan-loss provisions exhibit negative relationship with bank profitability. Similarly, Alhadab and Alsahawneh (2016) examined loan loss provision and the profitability of commercial banks in Jordan. The study showed that loan loss provision has a negative impact on the profitability of Jordanian commercial banks. Loan loss provision is found to have a negative and significant relationship with profitability (Ramlall, 2009). Likewise, Sufian and Habibullah (2009) also found that loan loss provision and profitability are negatively associated. Moreover, Pelealu and Worang (2017) found that loan loss provision has negative and insignificant effect on bank profitability. Based on it, this study develops the following hypothesis:

H_4: There is a negative relationship between loan loss provisions and bank profitability.

Off-balance sheet activities

Off-balance sheet activities include items such as loan commitments, letters of credit, and revolving underwriting facilities. These off-balance sheet (ODS) activities are contingent claims or contracts that generate fee income for a bank. However, these ODS activities also create balance sheet or portfolio risk. Saad and El-Moussawi (2012) found that there is positive and significant relationship between off balance-sheet activities and net interest margin. Similarly, Misni *et al.* (2015) argued that Bank's profitability has a positively significant relationship with off-balance sheet activities. Moreover, Swain and Panda (2017) revealed that there is positive and significant relationship between off-balance sheet activities and profitability. Furthermore, Aktan *et al.* (2013) examined the effect of the off -balance sheet provisions on the

performance of the commercial banks listed on the Istanbul Stock Exchange (ISE). The study found that the off-balance sheet activities have a positive impact on improving the revenue the shares of the bank. Based on it, this study develops the following hypothesis:

H_5: There is a positive relationship between off balance sheet activities and bank profitability.

Liquidity

Liquidity is the degree to which a security can be quickly purchased or sold in the market at a price reflecting its current value. Liquidity in finance refers to the ease with which a security or an asset can be converted into cash at market price. Oluwasegun and Samuel (2015) found a positive relationship between liquidity and bank performance for a panel of 13 banks for the period of 2004 to 2012. Similarly, Ismail (2016) revealed that liquidity (current ratio and the cash conversion cycle) have significant positive impact on profitability (ROA) of the 64 Pakistani non-financial firms for the period of 2006-2011. Likewise, Ahmad (2016) showed that there is a positive relationship between liquidity and profitability. Furthermore, Olagunju *et al*. (2012) observed that liquidity has a positive influence on profitability of a commercial banks in Nigeria. Moreover, Umobong (2015) demonstrated that there is a positive relationship between liquidity and profitability for a Pharmaceutical firms in Nigeria. Meanwhile, Ajanthan (2013) suggested that liquidity is positively associated with profitability. Likewise, Ibrahim (2017) found that there is positive relationship between liquidity ratio and return on assets. Similarly, Lukorito *et al*. (2014) argued that liquidity has statistically significant and positive relationship with banks' profitability. Furthermore, Lartey *et al.* (2013) showed that there is a very weak positive relationship between the liquidity and the profitability. Based on it, this study develops the following hypothesis:

H_6: There is a positive relationship between liquidity and bank profitability.

3. Results and discussion

Descriptive statistics

Table 2 presents the descriptive statistics of the selected dependent and independent variables during the period 2015/16 to 2022/23.

Table 2

Descriptive statistics

This table shows the descriptive statistics of dependent and independent variables of 13

Nepalese commercial banks for the study period of 2015/16 to 2022/23. The dependent variables are ROA (Return on assets as measured by the ratio of net profit to total asset, in percentage) and NIM (Net Interest Margin as measured by the ratio of net income to total assets, in percentage). The independent variables are SR (Spread rate as measured by the Weighted Average Interest Rate Spread, in percentage), CAR (Capital adequacy ratio as measured by the ratio of total capital to total risk weighted exposure, in percentage), NPL (Non-performing loan as measured by the ratio of non-performing loans to total loans, in percentage), LLP (Loan loss provision as measured by the total loan loss provision, Rs. in billions), LIQ (Liquidity as measured by sum of cash and cash equivalent and due from Nepal rastra bank, Rs. in billions), and OBSAs (Off balance sheet activities as measured by the total contingent liabilities and commitments, Rs. in billions).

Variables	Minimum	Maximum	Mean	Std. Deviation
NIM	1.82	5.6	3.15	0.71
ROA	0.47	2.79	1.55	0.49
SR	3.09	7.15	4.18	0.60
CAR	10.2	22.99	14.20	2.40
LLP	0.07	10.39	2.63	2.02
NPL	0.01	4.85	1.46	1.31
OBSA	8.17	179.74	46.16	33.52
LIQ	2.31	236.54	20.18	23.17

Source: SPSS output

Correlation analysis

Having indicated the descriptive statistics, Pearson's correlation coefficients are computed and results are presented in Table 3.

Table 3

Pearson's correlation coefficients matrix

This table shows the bivariate Pearson's correlation coefficients of13 Nepalese commercial banks for the study period of 2015/16 to 2022/23. The dependent variables are ROA (Return on assets as measured by the ratio of net profit to total asset, in percentage) and NIM (Net Interest Margin as measured by the ratio of net income to total assets, in percentage). The independent variables are SR (Spread rate as measured by the Weighted Average Interest Rate Spread, in percentage), CAR (Capital adequacy ratio as measured by the ratio of total capital to total risk weighted exposure, in percentage), NPL (Non-performing loan as measured by the ratio of non-performing loans to total loans, in percentage), LLP (Loan loss provision as measured by the total loan loss provision, Rs. in billions), LIQ (Liquidity as measured by sum of cash and cash equivalent and due from Nepal rastra bank, Rs. in billions), and OBSAs (Off balance sheet activities as measured by the total contingent liabilities and commitments, Rs. in billions).

Variables	NIM	ROA	SR	CAR	LLP	NPL	OBSAs	LIQ
NIM	1							
ROA	0.598**	1						
SR	0.719**	0.458**	1					
CAR	0.329**	0.372**	0.265**	1				
LLP	0.133	-0.376**	0.042	-0.091	1			
NPL	0.439**	0.035	0.337**	-0.016	0.654**	1		
OBSAs	-0.212*	-0.331**	-0.201*	0.148	0.429**	0.148	1	
LIQ	-0.037	-0.217*	-0.068	-0.051	0.516**	0.192	0.167	1

Note: The asterisk signs (**) and (*) indicate that the results are significant at one percent and five percent levels respectively.

Table 3 shows that spread rate has a positive relationship with net interest margin. It means that increase in spread rate leads to increase in net interest margin. Furthermore, there is a positive relationship between capital adequacy ratio and net interest margin. It indicates that increase in capital adequacy ratio leads to increase in net interest margin. However, loan loss provision has a positive relationship with net interest margin. It shows that higher the loan loss provision, higher would be the net interest margin. In contrast, off balance-sheet activities have a negative relationship with net interest margin. It means that increase in off balance-sheet activities lead to decrease in net interest margin. Similarly, liquidity has also a negative relationship with net interest margin. It means that increase in liquidity leads to decrease in net interest margin. In addition, non-performing loan has a positive relationship with net interest margin. It indicates that increase in non-performing loan leads to increase in net interest margin.

Similarly, there is also a positive relationship between spread rate and return on assets. It means that increase in spread rate leads to increase in return on assets. Likewise, there is a positive relationship between capital adequacy ratio and return on assets. It indicates that increase in capital adequacy ratio leads to increase in return on assets. In addition, loan loss provision has a negative relationship with return on assets. It indicates that higher the loan loss provision lower would be the return on assets. However, non-performing loan has a positive relationship with return on assets. It indicates that increase in non-performing loan leads to increase in return on assets. Moreover, off balance-sheet activities have a negative relationship with return on assets. It means that increase in off balance-sheet activities lead to decrease in return on assets. Furthermore, liquidity has a negative relationship with return on assets. It indicates that higher the liquidity, lower would be the return on assets.

Regression analysis

Having indicated the Pearson's correlation coefficients, the regression analysis has been carried out and results are presented in Table 4 and Table 5. More specifically, Table 4 shows the regression results of spread rate, capital adequacy ratio, non-performing loan, loan loss provisions, liquidity, and off balance-sheet activities with return on assets of Nepalese commercial banks.

Table 4

Estimated regression results of spread rate, capital adequacy ratio, non-performing loans, loan loss provision, liquidity, and off balance sheet activities on return on assets

The results are based on panel data of 15 commercial banks with 104 observations for the period of 2015/16-2022/23 by using the linear regression model and the model is ROA = β_0 + β_1 SR+ β_2 CAR + β_3 NPL + β_4 LLP + β_5 LIQ + β_6 OBSA+ e where, the dependent variable is ROA (Return on assets as measured by the ratio of net profit to total asset, in percentage). The independent variables are SR (Spread rate as measured by the Weighted Average Interest Rate Spread, in percentage), CAR (Capital adequacy ratio as measured by the ratio of total capital to total risk weighted exposure, in percentage), NPL (Non-performing loan as measured by the ratio of non-performing loans to total loans, in percentage), LLP (Loan loss provision as measured by the total loan loss provision, Rs. in billions), LIQ (Liquidity as measured by sum of cash and cash equivalent and due from Nepal rastra bank, Rs. in billions), and OBSAs (Off balance sheet activities as measured by the total contingent liabilities and commitments, Rs. in billions).

Model	Intercepts	Regression coefficients of						Adj. R_bar^2	SEE	F-value
		SR	CAR	LLP	NPL	OBSAs	LIQ			
1	-0.014 (0.046)	0.374 (5.197)**						0.202	0.439	27.011
2	0.464 (1.708)		0.076 (4.053)**					0.130	0.458	16.426
3	1.789 (24.222)**			-0.092 (4.097)**				0.133	0.458	16.785
4	1.53 (21.033)**				0.013 (0.351)			0.009	0.494	0.123
5	1.773 (22.716)**					-0.005 (3.542)**		0.101	0.466	12.542
6	1.642 (26.133)**						-0.005 (2.249)*	0.038	0.482	5.061
7	-0.556 (1.631)	0.315 (4.398)**	0.055 (3.077)**					0.263	0.422	19.361
8	-0.289 (0.924)	0.337 (5.185)**	0.047 (2.867)**	-0.091 (4.835)**				0.397	0.382	23.559
9	-0.039 (0.123)	0.258 (3.741)**	0.050 (3.127)**	-0.138 (5.579)**	0.113 (2.806)**			0.435	0.369	20.852
10	0.037 (0.117)	0.226 (3.201)**	0.058 (3.525)**	-0.118 (4.356)**	0.107 (2.659)**	-0.002 (1.733)		0.447	0.366	17.621
11	0.025 (0.08)	0.228 (3.217)**	0.057 (3.478)**	-0.127 (4.025)**	0.112 (2.715)**	-0.002 (1.633)	0.001 (0.590)	0.443	0.367	14.644

Notes:

i. Figures in parenthesis are t-values.
ii. The asterisk signs (**) and (*) indicate that the results are significant at one percent and five percent level respectively.
iii. Return on assets is the dependent variable.

Table 4 shows that the beta coefficients for spread rate are positive with return on assets. It indicates that spread rate has a positive impact on return on

assets. This finding is similar to the findings of Jui *et al.* (2020). Likewise, the beta coefficients for capital adequacy ratio are positive with return on assets. It indicates that capital adequacy ratio has a positive impact on return on assets. This finding is consistent with the findings of Olalekan and Adeyinka (2013). Similarly, the beta coefficients for loan loss provision are negative with return on assets. It indicates that loan loss provision has a negative impact on return on assets. This finding is similar to the findings of Iloska (2014). Likewise, the beta coefficients for non-performing loan are positive with return on assets. It indicates that non performing loan has a positive impact on return on assets. This finding contradicts with the findings of Brastama and Yadnya (2020). Moreover, the beta coefficients for off balance sheet activity are negative with return on assets. It indicates that off balance sheet activity has a negative impact on return on assets. This finding is similar to the findings of Misni *et al.* (2015). Furthermore, the beta coefficients for liquidity are negative with return on assets. It indicates that liquidity has a negative impact on return on assets. This finding is consistent with the findings of Lukorito *et al*. (2014).

Table 5 shows the regression results of spread rate, capital adequacy ratio, non-performing loan, loan loss provisions, liquidity, and off balance-sheet activities with net interest margin of Nepalese commercial banks.

Table 5

Estimated regression results of spread rate, capital adequacy ratio, non-performing loans, loan loss provision, liquidity, and off balance sheet activities on net interest margin

The results are based on panel data of 15 commercial banks with 104 observations for the period of 2015/16-2022/23 by using the linear regression model and the model is $NIM = \beta_0 + \beta_1 SR + \beta_2 CAR + \beta_3 NPL + \beta_4 LLP + \beta_5 LIQ + \beta_6 OBSA + eit$ where, the dependent variable is ROA (Return on assets as measured by the ratio of net profit to total asset, in percentage). The independent variables are SR (Spread rate as measured by the Weighted Average Interest Rate Spread, in percentage), CAR (Capital adequacy ratio as measured by the ratio of total capital to total risk weighted exposure, in percentage), NPL (Non-performing loan as measured by the ratio of non-performing loans to total loans, in percentage), LLP (Loan loss provision as measured by the total loan loss provision, Rs. in billions), LIQ (Liquidity as measured by sum of cash and cash equivalent and due from Nepal rastra bank, Rs. in billions), and OBSAs (Off balance sheet activities as measured by the total contingent liabilities and commitments, Rs. in billions).

Model	Intercepts	Regression coefficients of						Adj. R_bar^2	SEE	F-value
		SR	CAR	LLP	NPL	OBSAs	LIQ			
1	-0.411 (1.195)	0.85 (10.45)**						0.512	0.497	109.28
2	1.758 (4.39)**		0.098 (3.52)**					0.100	0.675	12.408
3	3.025 (26.429)**			0.047 (1.35)				0.008	0.709	1.826
4	2.799 (29.55)**				0.239 (4.94)**			0.185	0.64	24.389
5	3.356 (28.655)**					-0.004 (2.19)*		0.035	0.699	4.782
6	3.179 (34.027)**						-0.001 (0.374)	0.008	0.715	0.141
7	-0.844 (2.137)*	0.804 (9.687)**	0.044 (2.123)*					0.529	0.489	58.77
8	-0.967 (2.436)*	0.794 (9.642)**	0.048 (2.231)*	0.042 (1.764)				0.538	0.484	41.038
9	-0.618 (1.556)	0.683 (7.895)**	0.052 (2.063)*	-0.023 (0.755)	0.159 (3.119)**			0.575	0.464	35.898
10	-0.476 (1.222)	0.624 (7.169)**	0.067 (0.322)	0.014 (0.415)	0.146 (2.951)**	-0.004 (2.618)**		0.599	0.45	31.788
11	-0.462 (1.181)	0.622 (7.104)**	0.068 (3.334)**	0.025 (0.639)	0.14 (2.758)**	-0.004 (2.659)**	-0.001 (0.551)	0.596	0.453	26.353

Notes:

i. Figures in parenthesis are t-values.
ii. The asterisk signs (**) and (*) indicate that the results are significant at one percent and five percent level respectively.
iii. Net interest margin is the dependent variable.

Table 5 shows that the beta coefficients for spread rate are positive with net interest margin. It indicates that spread rate has a positive impact on net interest margin. This finding is similar to the findings of Owusu-Antwi et al. (2017). Likewise, the beta coefficients for capital adequacy ratio are positive with net interest margin. It indicates that capital adequacy ratio has a positive impact on net interest margin. This finding is consistent with the findings of Farkasdi *et al.* (2021). Similarly, the beta coefficients for loan loss provision are positive with net interest margin. It indicates that loan loss provision has a positive impact on net interest margin. This finding contradicts with the findings of Ramlall (2009). Likewise, the beta coefficients for non-performing loan are positive with net interest margin. It indicates that non performing loan has a positive impact on net interest margin. This finding is consistent with the findings of Sufian and Habibullah (2009). Moreover, the beta coefficients for off balance sheet activity are negative with net interest margin. It indicates that off balance sheet activity has a negative impact on net interest margin. This finding is similar to the findings of Saad and El-Moussawi (2012). Furthermore, the beta coefficients for liquidity are negative with net interest margin. It indicates that liquidity has a negative impact on net interest margin. This finding is inconsistent with the findings of Ibrahim (2017).

4. Summary and conclusion

Default risk, interest rate risk, and off-balance sheet activities significantly impact the profitability of a financial institution or any business that deals with financial instruments. Default risk, interest rate risk, and off-balance sheet activities all pose significant challenges to the profitability and stability of financial institutions. Effective risk management practices, including diversification, hedging, and stringent credit assessment, are crucial for mitigating these risks and ensuring sustainable profitability.

This study attempts to analyze the impact of default risk, interest rate risk and off-balance sheet activities on the profitability of Nepalese commercial banks. The study is based on secondary data of 13 commercial banks with 104 observations for the study period from 2015/16 to 2022/23.

The study showed that the spread rate, capital adequacy ratio, and non-performing loan have positive impact on return on assets. However, loan loss provision, liquidity and off-balance sheet activities have negative impact on return on assets. Furthermore, spread rate, capital adequacy ratio, non-performing loan and loan loss provision have positive impact on net interest margin. Likewise, liquidity and off-balance sheet activities have negative impact on net interest margin of Nepalese commercial banks. High default rates can erode profits, especially if the institution hasn't adequately diversified its loan portfolio or implemented effective risk management practices. The study concluded that presence of default risk, interest rate risk and off-balance sheet activities influence the profitability of Nepalese commercial banks by affecting their interest income and expenses. The study also concluded that spread rate is the most influencing factor that determines the profitability of Nepalese commercial banks.

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