Factors Affecting Credit Risk in Nepalese Commercial Banks

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Abstract

This study analyzes the factors affecting credit risk in Nepalese commercial banks. The study comprises data from 27 commercial banks from 2002 to 2020 A.D. For analysis, the Least Square Dummy Variable (LSDV) Regression for model I and Random Effect (RE) Regression Analysis for model II were performed. The effect of the independent variables on credit risk, using loan loss provision and non-performing loans, as proxies of it was examined. While comparing both models, the loan loss provisioning was found to better explain the credit risk. The growth rate of GDP, a macroeconomic variable, had a significant and positive effect on credit risk, which was unexpected whereas the control variable, the interbank interest rate, had a negative and significant effect on credit risk. Furthermore, the year dummy showed a relatively high requirement for loan loss provision, especially in the years 2019 and 2020, which may be due to COVID-19. The bank-specific variables like size, and government banks had significant and positive effects on credit risk. This implied that the merging of banks was not fruitful as it caused an increase in the total assets of banks, which would lead to an increase in the size of commercial banks. That increase in the size of commercial banks was found to increase credit risk. In addition, government-owned banks were found to have higher credit risk than other banks. The government should think about reforms through private sector participation in government-owned banks as another alternative to reduce credit risk.

Keywords: *commercial banks, loan loss provision, non-performing loans, COVID-19.*
JEL Classification: G21 Banks, E51 Credit.

1. INTRODUCTION

Banks have a vital role in the country's economic development. The contribution of banking sector to the GDP of Nepal was 18% in FY 2075/76 (Regmi, 2020; Bhattarai, 2020). In other words, economic development of country is highly dependent on the development of country's banking sector (Kasana & Naveed, 2016). Loans are the sources of earnings for all types of banks and financial institutions (Daniel & Wandera, 2013). If these loans (assets) do not generate any revenue, non-performing assets become higher. Here, the banks will not be able to pay interest to depositors and pay back their deposits. In this case, the customers will not have faith and confidence on such banks (Diamond & Dybvig, 1983).

Risk can be termed as probability of loss (Horcher, 2005). It arises because of exposure. The exposure to financial markets directly or indirectly affects the financial institutions as there is a possibility of loss (Bansal et al., 1992). Financial risk is the risk associated with financial institutions. Financial risk arises through financial transactions (IMF Financial Operations, 2016). The examples of such transactions are sales and purchases, investments and loans, and various other business activities like legal transactions, new projects, mergers and acquisitions, debt financing, etc. In condition when financial prices change unexpectedly and dramatically, the costs increase, revenues reduces, and profitability declines (Horcher, 2005). This is called the financial risk. There are various types of financial risk like credit risk, liquidity risk, interest rate risk, exchange rate risk, income risk, and operational risk (IMF Financial Operations, 2016). This study is concerned with credit risk. Credit creation is an important product of commercial bank; the risk applicable to bank is credit risk. It is defined as the risk of loss which arises because of non-payment of principal amount or interest amount or both amounts on time by debtor. Credit risk can be called a systematic risk. An evidence of systematic credit risk is when banking crisis and bank defaults occurred in 2007-2009 in the world-wide scenario due to non-performing loan (Li & Zinna, 2014). This event damaged the economy of the USA and many other countries of the world like Portugal, Italy, Ireland, Greece, and Spain (Richard, 2011, as cited in Bhattarai, 2015).

The credit risk mainly arises due to asymmetric information of loan customer. So, to mitigate credit risk, proper credit risk assessment of borrower should be done with the help of 5 C's of the potential borrowers like 'Character', 'Capacity', 'Capital', 'Collateral', and 'Conditions' (Premier Farm Credit, 2017-2018). Character indicates credit history of borrower, capacity is represented by debt-to-income ratio of debtor, capital is the amount of money the loan applicant has, and collateral is asset that can act as security of loan, whereas conditions are represented by the purpose, amount and interest rate of loan.

The indicators to measure credit risk are non-performing loan and loan loss provisioning. Non–performing are bad loan which are not paid on due date. It includes substandard, doubtful and loss loan (NRB, 2019). The banks have to keep certain provisioning based on the type of non-performing loan (i.e. substandard, doubtful and loss loan). According to Nepal Rastra Bank, the banks have to keep 100% for loss loan provisioning, 25% for sub-standard loan, 1% for pass loan and 50% for doubtful loan provisioning (NRB, 2019). The sum total of these provisioning forms loan loss provisioning. Hence, at the present scenario, banks are very conscious of the loan distribution because of loss from bad loans (Sontakke & Tiwari, 2013). The increment of credit risk means an increase in sub-standard loan and doubtful loan, as well the

increase in loan loss provisioning. So, credit risk is represented by non-performing loan and loan loss provisioning.

In the context of Nepal, the non-performing loans (NPLs) of commercial banks have increased from Rs. 46.16 billion to Rs. 55.97 billion in a year from 2019 to 2020 (NRB, 2020, 2019). The situation was similar in the past, where NPLs was Rs. 23.77 billion in 2016, which increased to Rs. 28.86 billion in 2017 (NRB, 2016, 2017). As well, the Loan Loss Provisioning (LLPs) amount in mid Feb 2020 was Rs. 7.11 trillion (NRB, 2020a). This increase of impaired loan is an indicator of negative performance of banks. So, there is a need to control NPLs and LLPs, for which the identification of their root causes is a must. In this regard, the general objective of this research is to analyze the effect of bank specific variables, policy specific variables on credit risk while controlling macroeconomic variables in the present context in Nepalese banking sector. The specific objective is to analyze the effect of bank specific variables like real interest rate, size, ownership and lagged liquidity ratio; policy variable like interest spread rate and macroeconomic variables like growth rate of GDP, inflation rate and interbank interest rate on NPLs, and LLPs and, proxies of the credit risk.

2. LITERATURE REVIEW

On the basis of financial intermediation theory conceived in the 20th century by Gurley and Shaw (1960) as in Mayowa (2020), the informational asymmetry theory and the agency theory were used for the development of theoretical framework of this study. In this study, financial intermediaries include commercial banks of Nepal. Generally, the financial intermediaries' development is positive for economic growth (Mayowa, 2020). As the financial intermediation activities of the nation increases, it causes the bank deposits and credits to accelerate, and vice-versa (Dash & Kabra, 2010). The risk associated to it is credit risk. The impact on credit risk can be described by the factors: bank–specific, policy specific, year specific and macroeconomic variables. According to Mankiw (2011), the financial intermediaries may have high credit risk when there is a decline in the GDP growth rate and higher rate of inflation due to the inability of the customers to repay loan amount on time. Moreover, during increment in the rate of GDP and lower rate of inflation, the financial intermediaries may find low credit risk as the ability of customers to repay loan increases. In addition, increase in inflation rate may also increase the profit of the producers as they can use cheaper inputs but sell at higher prices. Therefore, inflation rate might have negative effect on credit risk (Ghosh, 2015; Bofondi & Ropele, 2011). The bankers may have herd behavior and agency behavior, which may lead to lenient policy terms to lend excessively. The lenient credit terms could be high real interest rate, and policy of government owned banks, which may cause high non-performing loans or loan loss provisioning (Reddy, 2004). With regard to this, when the real lending rate of a financial intermediary increases,

the cost of borrowing increases, thereby causing decline in financial activities. Here, the ability of borrowers to repay loan on time decreases, causing increase in credit risk. This is due to the information asymmetry where the customer is not aware of low lending rate in other financial intermediaries (Bhattarai, 2015).

With respect to ownership dummy, few years back, most of the joint venture banks established in collaboration with foreign banks are now privatized to Nepalese nationals. However, the number of fully government banks has remained constant at two. With regard to this, government banks may have agency problem due to which, there is evidence of high non-performing loan in comparison to private banks (Bhattarai, 2015). On the contrary, the evidence of China showed that the banks with government ownership have low credit risk, which may be due to proper loan management (Hu et al., 2004). Hence, the effect of government ownership, private Nepalese citizen's ownership and foreign national's ownership of financial intermediary on credit risk is an issue (Bhattarai, 2015).

Furthermore, when there is increase in financial intermediation activities, the asset of banks increases, causing increase in size and liquidity ratio of banks. The big sized bank may be neglectful, leading to increase in credit risk (Ghosh, 2015). However, the big sized banks may have good credit management strategies, thereby causing decline in credit risk too (Bardhan & Mukherjee, 2016). This increase in the liquidity ratio as well as lagged liquidity ratio of banks makes it able to fulfill its financial obligation on time, causing decline in credit risk (Onyango & Olando, 2020).

The bank's lending interest rate also has vital impact on bad loan and loan loss provisioning. The high interest spread rate and interbank lending rate may also lead to high cost of repayment of loan, which result in the increment of credit risk (Poudel, 2018). This is because, if the interest spread rate and interbank lending rate increases, the cost of borrowing also goes up, this decreases the economic activities of a nation, leading to increase in credit risk. In addition, if interest spread rate and inter banking rate rise, the cost of borrowing will rise, which leads to the borrowers borrowing less amount of loan, causing low credit risk.

Similarly, with the passage of time, the Nepalese financial intermediaries have faced credit risk due to earthquakes and covid-19. This is because, due to earthquakes destructions of different properties have occurred, causing the loan customers to be unable to repay principal or interest or both on due time (Bhattarai, 2020). Similarly, covid-19 has also disrupted the financial intermediation activities causing loan borrowers to be unable to repay loan's principal or interest amount or both on due date causing high credit risk.

Ghosh (2015) examined the bank specific determinants and macro-economic determinants of non-performing loans. Here, the study focused on the commercial and saving institutions of 50 US states and District of Columbia over a period of 1984 to 2013. The methodology used for the study was fixed effect and dynamic generalized methods of moments estimations. The findings showed the more the capitalization, liquidity risk, cost inefficiency, banking industry size, the lower was the credit quality, and the more was the NPLs. In addition, the increase in bank profitability caused the decline in the NPLs. With regard to the economic determinants, the higher the GDP, the lower was the NPLs. Furthermore, the higher the inflation, state unemployment rates, and US public debt, the NPLs were found to increase significantly.

Hu, Li and Chiu (2004) aimed to identify the relation of ownership with non-performing loans. The researchers derived models to estimate the above-mentioned relation. Here, the researchers predicted that the relations could be downward sloping, upward sloping, and U- shaped. With this regard, an increment of government's shareholding was facilitated by political lobbying, while the private shareholding increased the NPLs because of manipulation of corrupt private owners. The research was conducted on 40 Taiwanese commercial banks for 1996-1999 A.D. Here, the findings of the study showed that NPLs rate declined till there was 63.51% of government shareholding, however, after 63.51% of government shareholding, NPLs rate increased. Similarly, banks size had negative relation with NPLs rate. Moreover, on average, the Taiwanese banks established after deregulation had lower rate of NPLs than those established beforehand.

Kasana and Naveed (2016) studied the causes of credit risk in Pakistani commercial banks. With regard to causes, the paper focused on bank specific as well as macro variables. The bank specific variables were capital adequacy ratio, growth in advances, operation inefficiency, loan to deposit ratio, and size of the bank and the macroeconomic variables were GDP growth, and growth in interest rates. The study focused on 26 commercial banks over a period of 2007-2013 A.D. The methodologies used for the analysis were fixed effects and random effects regression models. Finally, the robustness test was measured by Hausman test. The findings of the study showed that capital adequacy ratio was positively correlated with credit risk whereas the operating inefficiency, return on asset, growth in GDP, and growth in advances were significantly and negatively related with credit risk. While using fixed effects and random effects model, operating inefficiency, loan to deposit ratio and size had insignificant relation with credit risk.

Onyango and Olando (2020) aimed to analyze the impact of bank specific factors on credit risk over a period of 2012- 2016 in 43 Kenyian commercial banks. The

methodology for the research was quantitative analysis to produce descriptive statistics and inferential analysis. The findings of the study indicated that average level of bad loan (NPL) in Kenyian bank was above 5% (threshold level). So, at 5% level of significance, interest spread rate had significant and positive impact on non-performing loan. Similarly, operating efficiency had significant and positive effect on non-performing loan. Furthermore, liquidity ratio, and ROA had negative and significant influence on non-performing loan.

Farhan, Sattar, Chaudhary and Khalil (2012) studied the perception of bankers on the causes of credit risk in Pakistani banks. The study was performed using structured questionnaire. Sampling strategy used was multistage sampling. The first stage of this sampling included selection of top 10 banks having 72 % share of banking business and 56.54 % of NPL of total Banking Financial Institutions. Then the second stage included selection of 201 bankers of these 10 banks working in corporate offices and dealing with lending decision and analyzing credit risk or NPL portfolio. The five point likert scale was used to identify the determinants of NPL. The descriptive statistics, regression analysis and correlation analysis were performed for the study. The bank specific variable like interest rate and macroeconomic variables like energy crisis, unemployment, inflation, and exchange rate were perceived to have positive impact on credit risk whereas GDP growth was perceived to have negative influence on credit risk.

Bhattarai (2015) tried to identify the determinants of macro and micro economic variables on non-performing loan, a proxy of credit risk. The quantitative analysis was performed on 26 Nepalese commercial banks over 11 years (2002 to 2012 A.D.). With regard to micro (bank specific) variables, higher the real lending rate of interest, higher was the non-performing loan or credit risk. While the macroeconomic variable, Real Effective Exchange Rate (REER) had negative and significant impact on non-performing loan. However, growth rate of GDP, size, inflation rate had insignificant influence on credit risk.

Similarly, Makri (2015) aimed to find out the factors influencing loan loss provisions in Greek financial sectors. The researcher found out that capital adequacy, liquidity, profitability, unemployment, public debt, economic growth and inflation have impact on credit risk.

Poudel (2018) aimed to recognize the main indicators of credit risk in Nepalese commercial banks. The study was conducted in the sample of 15 commercial banks. The major tool of analysis was one way Fixed Effect Model (FEM) of panel data. Secondary data was used for the study over the period of 2002/03 to 2014/15. The bank specific

variables such as liquidity, capital adequacy ratio, bank size, and interest spread, and the macro-economic variables such as GDP growth, rate of inflation and interbank interest rate were also used in identifying credit risk The study showed that liquidity has the significant positive effect on credit risk, however, capital adequacy ratio and interest spread have the significant negative effect on credit risk. Furthermore, the study identified that bank size and interest spread both have no clear effect on credit risk. Similarly, credit risk in Nepalese commercial banks negatively fluctuated with GDP growth, but insignificantly at 5% level of significance. In contrast, inter-bank interest rate had negative but insignificant effect on credit risk in the concerned banks.

Bhattarai (2018) focused on the causes of loan loss provisions (LLPs) of Nepalese commercial banks over the period of 2012/13 - 2016/17A.D. The major finding of the study was that non-performing loan and loan to deposit ratio are the major determinants of loan loss provisions, a proxy of credit risk, in Nepal.

Furthermore, Golitsis, Fassas and Lyutakova (2019) studied the determinants of credit risk in Bulgarian banking system. They used NPL and LLP both as proxies of credit risk. The findings revealed that both bank-specific and macroeconomic variables have significant impact on credit risk of Bulgarain banking system.

While studying the previous literatures, the results of these literatures could not be generalized at present context in Nepal because of the several issues such as variations in macroeconomic characteristics, new practices being introduced in the banking sectors and inclusion of a diverse variables in the study. This study tries to fulfill the gaps in the previous researches and contribute to knowledge in this area.

3. DATA AND METHODS

The study was based on the secondary information of twenty-seven commercial banks for the period of 2002 to 2020 A.D. The time period for the study was from 2002 A.D. since there was substantial amount of non-performing loans and loan loss provisions in commercial banks from 2002 A.D. for the analysis of credit risk. The sample size was 432 observations of different variables, which included 27 commercial banks with the time period from 2002 A.D to 2020. A.D. Since there are 27 commercial banks as different cross-sectional units and the data was collected on different time periods, this research was based on unbalanced panel data. Here, the sample included all 27 banks which comprised of private, joint venture and government banks. The table I in the annex showed the list of banks and the sample size.

The Stata programming software was used to run regression analysis of the data. The mean values, and standard deviations of variables were also obtained and analyzed.

Since, the natural logarithm of LLP and NPL were used as dependent variables and some of the values for LLP and NPL were zero and some are missing, so, Ln(0) treatment was done using the following equations for regression:

$$Ln(NPL+1)_{i,t} = = \beta_{0i} + \beta_1 RIR_{i,t} + \beta_2 LnSIZE_{i,t} + \beta_3 Ownership\ dummy1 + \beta_4 Ownership\ dummy2 + \beta_5 Liquidity_{i,t-1,} + \beta_6 IS_{i,t} + \beta_7 GGDP_t + \beta_8 INF_t + \beta_9 IBIR_t + \beta_{10} year_t + \varepsilon_{i,t} \ldots\ldots\ldots\ldots..(i)$$

$i = 1,\ldots N,\ t = 1,\ldots T$

$$Ln(LLP+1)_{i,t} = \beta_{0i} + \beta_1 RIR_{i,t} + \beta_2 LnSIZE_{i,t} + \beta_3 Ownership\ dummy1 + \beta_4 Ownership\ dummy2 + \beta_5 Liquidity_{i,t-1} + \beta_6 IS_{i,t} + \beta_7 GGDP_t + \beta_8 INF_t + \beta_9 IBIR_t + \beta_{10} year_t + \varepsilon_{i,t} \ldots\ldots\ldots\ldots\ldots..(ii)$$

$i = 1,\ldots N,\ t = 1,\ldots T$

Then the data was set in the panel format in STATA and the regression was run one by one: Least Square Dummy variable (LSDV), Random Effect (RE), and Fixed Effect (FE) regressions. Based on test results, the best fitted model was achieved. While using dependent variable, Ln(NPL+1), the LSDV and random effects (RE) regression were run. Then the p-value of Breusch and Pagan Lagrangian multiplier test for random effects (RE) was less than 1% level of significance, which shows that random effects (RE) regression was better than LSDV regression.

Then fixed effect regression of model I was run. After which, the Hausman test was run. The p-value of Hausman test was less than 1% level of significance; this shows that fixed effect (FE) regression was better than random effects (RE) regression. Since dummies od1 and od2 were omitted by Stata in fixed effects regression, LSDV regression was run instead of Fixed effect (FE) regression. So, the regression model for model I was Panel -LSDV regression.

Using dependent variable, Ln(LLP+1), the LSDV and random effects (RE) regression were run. Then the p-value of Breusch Pagan Lagrangian test was less than 1% level of significance, which shows that random effects (RE) regression was better than LSDV regression. Then fixed effect regression of model II was run followed by Hausman test. The p-value of Hausman test was greater than 10% level of significance; this shows that random effects (RE) regression was better than fixed effect (FE) regression. So, the ideal regression for model II was random effects (RE) regression.

3.1. Specification of Model

Model I

$LnNPL_{i,t} = \beta_{0i}+\beta_1 RIR_{i,t}+\beta_2 LnSIZE_{i,t} +\beta_3 Ownership\ dummy1 + \beta_4 Ownership\ dummy2+\beta_5 Liquidity_{i,t-1,}+\beta_6 IS_{i,t}+\beta_7 GGDP_t+ \beta_8 INF+ \beta_9 IBIR_t+\beta_{10} Year_t + +\varepsilon_{i,t}$ ……..(i)

i = 1,…N, t= 1,…T

Model II

$LnLLP_{i,t} = = \beta_{0i}+ \beta_1 RIR_{i,t}+ \beta_2 LnSIZE_{i,t} +\beta_3 Ownership\ dummy1 + \beta_4 Ownership\ dummy2 +\beta_5 Liquidity_{i,t,-1}+\beta_6 IS_{i,t}+ \beta_7 GGDP_t+ \beta_8 INF_t+ \beta_9 IBIR_t+\beta_{10} Year_t + +\varepsilon_{i,t}$……..(ii)

i = 1,…N, t= 1,…T

where: $LnNPL_{i,t}$ represents the natural log of Non-Performing Loan (NPL) for bank *i* in year *t; LnLLP*$_{i,t}$ represents the natural logarithm of loan loss provision (LLP) for bank *i* in the year *t. RIR*$_{i,t}$ denotes the real interest rates calculated by the difference between the average lending rate of bank *i* at time *t* and the annual inflation rate at time *t.* Ln*SIZE*$_{i,t}$ is the natural log of the absolute market share of each bank's assets that indicates the size of the bank *i* at time *t;;* Ownership dummy1 is a dummy variable that is given value 1 if it is a government bank and 0 otherwise. Ownership dummy 2 is a dummy variable that is given value 1 if it is a joint venture bank and 0 otherwise. $Liquidity_{i,t-1}$ is a variable for liquidity ratio bank *i* at time *t-1*. $IS_{i,t}$ is the interest spread rate of bank *i* at time *t*. $GGDP_t$ is the growth rate of GDP (Gross Domestic Product) of the country (Nepal) at time *t*. INF_t is the rate of inflation of Nepal at time *t*. $IBIR_t$ is the interbank interest rate at time *t*. Year is a time variable.

4. RESULTS

The results of the regression models I and II are in this section with their interpretations and explanations, along with the descriptive statistics.

Table I: Descriptive Statistics of Variables

Variables	Mean	Std. Deviation	N
Ln (Non –performing loan+1)	18.89	4.54	432
Ln(Loan loss provision+1)	19.99	2.04	432
Real Interest Rate	23.04	324.7	432
Ln(Size of bank)	24.35	1.10	432
Ownership dummy1	.13	.33	432
Ownership Dummy 2	.29	.46	432

Liquidity ratio	19.28	24.79	432
Interest Spread	11.02	325.11	432
Growth rate of GDP	4.40	2.02	432
Inflation rate	7.10	2.59	432
Inter Bank Interest Rate	2.67	2.20	432
Lagged Liquidity ratio	18.41	25.15	432

Descriptive Statistics

The mean, standard deviation and number of observations for each of the variables are shown above. The mean values of Ln(NPL+1) and Ln (LLP +1) were 18.89% and 19.99 %. The mean value of lagged liquidity ratio was 18.41% whereas the standard deviation of the variable was 25.15%. Remittance had the mean value of Rs. 423273.33 million with a standard deviation of Rs. 288361.86million.The number of observation was 432 for all variables.

Table II: Regression Results of Model I

Variables	LSDV Coefficients	RE Coefficients	FE Coefficients
Constant	-67.36***	-77.7155***	-88.85***
Ln(size)	3.77***	4.15***	4.76***
Real Interest Rate	-0.0018	-0.0096	-0.020**
Ownership Dummy1	-0.43	-0.76	0
Ownership Dummy 2	0.16	0.11	0
Lagged Liquidity ratio	0.0025	0.0032	0.0037
Interest Spread rate	-0.0021	-0.010	-0.021
Growth rate of GDP	-0.51***	-0.80***	-0.73***
Inflation rate	-0.597***	-1.97***	-0.87***
Inter Bank Interest Rate	0.15	2.16***	0.31**
Year 2003	2.24*	3.28***	2.69**
Year 2004	2.90***	5.88***	3.44***
Year 2005	4.74***	11.31***	5.58***
Year 2006	3.13***	10.07***	3.55***
Year 2007	1.35	8.11***	2.01**
Year 2008	3.94**	17.05***	6.40***
Year 2009	1.03	9.25**	1.86*
Year 2010	1.51	4.03	2.05**
Year 2011	0	-2.63	0
Year 2012	2.86**	17.35***	4.43***
Year 2013	3.32***	16.99***	4.68***
Year 2014	-0.15	11.55***	0.14

Year 2015	0	12.79***	0
Year 2016	0	8.05***	0
Year 2017	-2.21**	4.71***	-2.88***
Year 2018	-2.70***	0	-3.52***
Year 2019	-2.22**	0	-2.92***
Year 2020	-5.78***	0	-7.57****
R square	42.12	41.96	41.29
F value/Wald chi value	12.34***	296.42***	13.01***

Dependent variable: Ln(NPL+1), * 10% level of significance, ** 5 % level of significance, *** 1% level of significance

The output of the three regression models are given above. As the LSDV model is ideal for model I, the interpretation of LSDV Regression Results of Model I is given below.

Lnsize had significant and positive effect on non-performing loan whereas Growth rate of GDP, inflation rate had significant and negative influence on non-performing loan at 1% level of significance, respectively. In addition, year dummies on year 2003, 2004, 2005, 2006, 2008, 2012 and 2013 had significant and positive effect on non-performing loan. While year dummies 2017, 2018, 2019 and 2020 had significant and negative effect on non-performing loan. While comparing the coefficients of these time dummies, in the year 2020, the non-performing loan had sharply declined. This implied that the financial activities might have reduced due to Covid_19, causing low loan disbursement, finally leading to decline in credit risk.

The R squared value was 42.12, which says 42.12% of variation in non- performing loan (dependent variable) was explained by different explanatory variables. The value of F statistic was 12.34. As well, it was found to be significant at 1% level of significance. So, as a whole, this indicates that the model was also significant.

With regard to non-performing loan as a proxy of credit risk, the size of bank had positive and significant effect on credit risk. According to the financial intermediation theory, the reason behind positive effect of size on credit risk could be that the larger the bank, the more the unsecured lending, and higher the credit risk. This finding is in line with the findings of other researchers (Ghosh, 2015; Stern & Feldman, 2004; Kasana & Naveed, 2016).

The growth rate of GDP had significant and negative influence on credit risk, which is in line with the findings of the researchers (Bofondi & Ropele, 2011; Fainstein & Novikov, 2011; Saba, Kouser & Azeem, 2012).The reason behind the decrease in credit

risk due to increase in growth rate of GDP might be that the income of people had increased, causing them to be able to repay loan in time. This led to low credit risk. The inflation also had significant and negative effect on credit risk. This might be due to the increase in profit of borrowers, which caused them to be able to repay loan on time, causing low credit risk. This finding is consistent with the findings of other researchers (Ghosh, 2015; Bofondi & Ropele, 2011).

Table III: Regression Results of Model II

Variables	LSDV Coefficients	RE Coefficients	FE Coefficients
Constant	1.18	2.55	0.19
Ln(size)	0.63***	0.68***	0.68***
Real Interest Rate	0.007*	0.0046	0.0035
Ownership Dummy1	1.31***	1.30***	0
Ownership Dummy2	-0.043	-0.027	0
Lagged Liquidity ratio	-0.0029	-0.003	-0.0032
Interest Spread rate	0.0072*	0.005	0.0036
Growth rate of GDP	0.26***	0.26***	0.26***
Inflation rate	0.37***	0.15	0.37***
Inter Bank Interest Rate	-0.095*	-0.44**	-0.083
Year 2003	-1.21**	-1.59***	-1.20**
Year 2004	-0.88*	-1.36***	-0.87*
Year 2005	0.27	0.67	0.24
Year 2006	0.56	0.15	0.52
Year 2007	0.28	0.49	0.25
Year 2008	-2.54***	-1.03	-2.58***
Year 2009	-0.92**	-0.84	-0.97**
Year 2010	-0.62	1.21	-0.70
Year 2011	0	2.16***	0
Year 2012	-1.36**	-1.35	-1.28**
Year 2013	-1.26**	-1.44	-1.18**
Year 2014	0.13	-0.75	0.17
Year 2015	0	-0.0031	0
Year 2016	0	-1.34*	0
Year 2017	0.70	-0.78	0.69*
Year 2018	0.62	0	0.62
Year 2019	-0.33	0	-0.37
Year 2020	1.64***	0	1.69***
R square	45.90	45.82	41.37%
F value / Wald chi value	14.39***	323.17***	13.45***

Dependent variable: Ln(LLP+1), * 10% level of significance, ** 5 % level of significance, *** 1% level of significance

As the Random Effect (RE) regression model is ideal for model II, the interpretation of Regression Results of Model II are given below.

The above results showed that size of the bank, ownership dummy one, and growth rate of GDP, had significant and positive effect on loan loss provision of the banks. However, interbank interest rate had significant and negative effect on loan loss provision.

In addition, year dummies, year 2003, 2004, 2016, had significant and negative influence on loan loss provisioning, implying higher requirement of llp in year 2019-2020, which are Covid years. Coefficients of year dummies (years 2018, 2019 and 2019) are 0 because there are omitted due to collinearity with random effects.

The Wald Chi value was 323.17 at 1% level of significance. This denoted that the overall model was significant. The R^2 was 45.82 which mean 45.82% of the variation in explained variable (LLP) was explained by explanatory variables.

With regard to loan loss provision as a proxy of credit risk, the size of bank, ownership dummy1, GGDP were found to have positive and significant effect on credit risk. With regard to the financial intermediation theory, the reason behind positive effect of size on credit risk could be that larger the bank, the more unsecured loan, hence higher was the credit risk. This finding is in line with the findings of other researchers (Ghosh, 2015; Stern & Feldman, 2004; Kasana & Naveed, 2016). Similarly, due to the agency theory under financial intermediation theory, the government banks might have improper management of credit due to which they have larger credit risk than private banks. This result is consistent with the findings of some researchers (Bhattarai, 2015; Gajurel, 2010; Tehulu & Olana, 2014).

However, the interbank interest rate was found to have significant and negative effect on credit risk, which is unexpected. With regard to interbank interest rate, the significant and negative effect of interbank interest rate on credit risk, is not in line with the findings of (Poudel, 2018). This is a surprising result. According to the information asymmetry theory under financial intermediation theory, the reason might be that higher interbank interest rate caused loan customers to take low amount of loan causing low credit risk.

The growth rate of GDP had significant and positive effect on credit risk, which is unexpected. This result is inconsistent with the results of researchers (Bofondi & Ropele, 2011; Fainstein & Novikov, 2011; Saba, Kouser & Azeem, 2012).

In the data analysis, the non-performing loans and loan loss provisions were taken as the proxy for credit risk. As mentioned, LSDV model for model I and Random Effect regression model for model II were used for final analysis. While comparing the two models, the model with LnLLP (model II) as dependent variable, has the more numbers of significant independent variables, as well, the value of R square is relatively higher for the model II. Hence, it is found that loan loss provisioning explained the credit risk better. So, the output of regression of model II was used for the further discussions.

5. CONCLUSIONS

The bigger sized banks are observed to be higher credit risk banks. (Ghosh, 2015; Stern & Feldman, 2004; Kasana & Naveed, 2016). Similarly, the government banks are identified as higher credit risk banks. This finding was in line with the findings of earlier researchers (Bhattarai, 2015; Gajurel, 2010; Tehulu & Olana, 2014). Furthermore, there could be positive effect of COVID-19 on loan loss provisions in the year 2020. This result was in line with the finding of Altman (2020).

The growth rate of GDP had significant and positive effect on credit risk, which was unexpected. The reason could be these loan customers did not pay the loan on time, even though they had high income. The other reason could be that the banks might have over optimistic views during high growth period leading to over lending than optimal. Hence, the loan loss provisioning was higher. This finding was inconsistent with the finding of some earlier researchers (Bofondi & Ropele, 2011; Fainstein & Novikov, 2011; Saba, Kouser & Azeem, 2012).

The higher the interbank rate, lower was the credit risk. This was in line with the financial intermediation theory, where the increase in IBIR may lead to decrease in credit risk. In contrast, individual borrowers are observed paying loan amount on time for banks with high real interest rate as well as for banks with low real interest rate. This could be the reason behind having no influence of real interest rate on credit risk.

As we know, the interest spread rate is the difference between average lending rate and average deposit rate. So, even if the lending rate and deposit rate increases or decreases, there might have been no change in the loan repayment behavior of loan

customers. Hence, the influence of interest spread rate was not seen in the credit risk measurement.

The non-performing loan is the sum of total amount of substandard loan, doubtful loan and loss loan for a particular year whereas the loan loss provisioning is the sum of 1% of pass loan, 25% of substandard loan, 50% of doubtful loan, 100% of loss loan, as well, here the last year's loss loan is also added. In other words, LLP is the amount set aside to cover potential losses on bad debts. Hence, they (NPL and LLP) are different.

There are contradictory regression results of proxies of credit risk, i.e., LnNPL and LnLLP, on GGDP and year dummies (2003 and 2004). The increase in GGDP might have caused increase in the income of borrowers, causing decline in NPL but increase in the amount set aside for LLP as pass loan (which is not NPL but a part of LLP) was higher.

Similarly, in year 2003 and 2004, the non-performing loan was higher but loan loss provisioning was lower, because during those years, substandard, doubtful and loss loan were higher but pass loan was lower.

Thus, the regression results were different for GGDP and year dummies (2003 and 2004) and the above-mentioned reasons might have led to the difference in the results of the two dependent variables (LnLLP and LnNPL).

So, if the big sized banks used proper credit risk management policies in practice without negligence and regular monitoring, the credit risk would have been reduced. Similarly, the policies of merger and acquisition did not seem fruitful as the merging of banks caused increase in the total assets of banks. This would lead to the increase in size of commercial banks and the increase in size was found to increase credit risk. As well, government owned banks were found to have high credit risk than other banks. So, the government should think about privatization of government owned banks as another alternative to reduce credit risk.

Furthermore, the interbank interest rate is the rate determined by the market which was found to have negative influence on credit risk. So, if the NRB could stimulate the financial market to increase the demand of interbank loan, the interbank interest rate would be higher and the credit risk would be lower. So, to reduce credit risk, the concerned authority should pay attention on these variables and their effects for future.

Thus, the degree of credit risk can be reduced through its management by the commercial banks of Nepal by various means like privatization of government owned banks, reduction merger and acquisition activities of commercial banks, symmetric information of lender and borrower and stimulation of demand of interbank loan.

One of the major limitations of the study is that it has only focused on the financial intermediation theory for the research; other theories could also be used to analyze the effect of other different variables on credit risks. It covers the study of credit risk in commercial banks which forms the major part of financial institutions of Nepal.

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