Research article

Loan growth and bank risk: empirical evidence from SAARC countries

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ABSTRACT

During the last few decades, the world financial crisis sheds on the bank risk, which creates a direct threat to the existence of banks. This paper investigates the relationship between bank risk and loan growth in the South Asian economies. The study has collected data from BankFocus of 118 commercial banks from 2011 to 2019. This study explores three hypotheses explaining the relation between (i) Bank Risk and Loan Growth; (ii) Loan growth and Bank Profitability; and (iii) Loan growth and bank solvency. Results show that loan growth can induce bank risk in the South Asian economic region. At the same time, Banks’ solvency and profitability are correlated to bank risk with statistical significance. Primarily OLS has been applied, followed by GMM estimation. Non-Performing Loan (NPL) has been used as the proxy of bank risk. Further, to check the robustness of the investigation, we have used ZSCORE as a replacement to NPL. The results derived from regressions can put light on banks’ poor performance in the South Asian counties and, simultaneously, may set guidance for policymakers of emerging economies.

1. Introduction

Banks’ principal operations are deposit mobilization and then lending to borrowers, which produces interest income. Increasing lending activities can benefit banks boost market shares, boost earnings, and improve overall business results. Banks, in almost all sorts of economies, play a crucial role in development. Banks help to grow agriculture, infrastructure, industry, and overall living standard through healthy lending practices. At the same time, bad lending can negatively impact the overall economy. Vast quantities of capital rolling through state-controlled banks into the economy contribute to a substantial credit growth rate that is considered the main national predictor (Vo, 2018).

Rapid credit growth results in higher risks for banks in subsequent years, implying that hasty credit growth policies cause banks to have worse outcomes (Foos et al., 2010). Is this true for developing nations? This question is raised because banks in Asia have worked in more stringent controls and restricted risk management policies since the 1997 financial crisis (Mongkonkittichai, 2012). It is also noted that banks are inclined to reduce lending when local administrations in developing countries have significant impacts on banks’ actions (Qian and Yeung, 2015).

South Asian economy has been growing at a good pace during the last decade. SAARC has eight countries that can broadly be categorized into two types of economies. On one side, India, Bangladesh, and Nepal are emerging and developing economies with upward trends in all economic indicators. Simultaneously, Sri Lanka, Maldives, Pakistan, Afghanistan, and Bhutan can be treated as struggling economies concerning GDP and other indicators. Simultaneously, Sri Lanka, Maldives, Pakistan, Afghanistan, and Bhutan can be treated as struggling economies concerning GDP and per capita income, its economy is mainly concentrated in tourism.

There is significant evidence that emerging countries’ economic development is based on banks’ proper functioning and good lending practices. However, high loan growth appears to follow poor loan decisions and thus adversely affect banks’ profitability. Similarly, Foos et al. (2010) describes credit growth in their analysis as the most critical driver of bank profitability and finds a negative correlation with credit growth between interest income and risk-adjusted interest income.

There is some proof at the individual bank level of the connection between credit growth and risk (Berger and Udell, 2004; Laeven and Majnoni, 2003). In addition to the macroeconomic conditions and systemic changes where all banks have a collective impact, there are various significant causes why banks raise lending. For example, banks may expect to benefit from new credit prospects, extend to new regional markets, or acquire market shares of established markets. The diversification of the loan/cross-selling portfolio (Lepetit et al., 2008; Rossi et al., 2009) may be potential explanations relevant to creating the loan.

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Besides, a decrease in interest rates or a reduction in collateral conditions, loosening credit criteria, or a mixture of both are potential strategies for improving financing (Dell'Ariccia et al., 2008; Ogura, 2006). Moreover, few banks focus on internal expansion; others follow an external growth policy through mergers and acquisitions (M&A). Given that fresh lending is given to previously rejected investors, historically unknown or non-existent, or whether they need too low rates of credit or too little collateral compared to their credit rating, the increase of borrowing will adversely influence the risk of banks.

Our current study investigates the lending growth in SAARC countries. Researchers have repeatedly been asking some questions like: Can banks expand without being riskier? Is the development of loans related to higher or lower-risk-adjusted profitability? What may be the correlation between credit growth and bank solvency? We inspect the relationship between credit growth and three essential dimensions: the loan portfolio’s riskiness, the return from loans, and the equity structure. We rely on numerous analytical metrics for each of the dimensions to identify the credit risk related to bank lending, risk-taking reward, and banks’ overall fragility. We test the following hypotheses:

Firstly, we discuss whether and how past growth of loans (LG1_t) influences individual banks’ non-performing loans. We anticipate loan growth to have a positive relationship with loan default (Berger and Udell, 2004). Secondly, we examine how the individual bank’s profitability is affected by loan growth. We have considered the return on asset (ROA) as a proxy of profitability that will show the relationship with increasing credit in the individual bank. Lastly, we are evaluating the effect on bank solvency with loan growth. The equity-to-total assets ratio decreases if banks mostly finance their loan with new debt. While it is more difficult to issue new equity and thus occurs less often, credit growth can also be backed by mounting equity by retained earnings. We assume loan growth to cause a decline in the ratio of equity-to-total-assets (EQUA).

To the best of our information, very few studies have been conducted to investigate the impact of past loan growth at the bank level in South Asian countries.

There have been studies on factors affecting credit risk and their effects on bank efficiency, but there has not been a comprehensive study attempting to answer the three questions posed in this study. The outcome of this study may help give the regulatory authority and banks’ decision-makers control unusual credit expansion to prevent adverse consequences.

We have arranged the remaining parts of this paper as follows: In Section 2, we review the allied literature, and in Section 3, we define the data, variable, and methodology. In Section 4, we report the estimation method and descriptive statistics, and in Section 5, we demonstrate regression results & findings. Section 6 contains the conclusion.

2. Review of literature

This research is relatively linked to current literature on whether bank loans’ expansion indicates banks’ riskiness and poor performance. Several recent studies (Baron and Xiong, 2017; Jorda et al., 2013; Reinhart and Rogoff, 2009; Schularick and Taylor, 2012) have shown that credit growth typically ends badly and follows weak financial performance. High credit spread intervals accompany credit booms and low credit spread intervals (Bordalo et al., 2018). A study with 20 developed countries between 1920 and 2012 found that massive growth in bank lending results in low credit quality (Baron and Xiong, 2017). During boom times, (Greenwood and Hanson, 2013) provide evidence of deteriorating credit quality. When credit risk is overpriced, it tends to be followed by a subsequent widening of credit spreads and a slowdown in economic activity (López-Salido et al., 2017). Authors also focus on the role of credit-market sentiment and evaluate aggregate results. While investigating 31 Kenyan commercial banks from 2011 to 2015 (Paul Kiama Thingo, 2016) found bank loan growth and financial performance to be positively related with statistical significance in the short-run with both primary and secondary data. At the same time, in the long run, these variables are negatively associated.

A study from 1973 to 2014 on the US banking system shows that banks that have high credit growth in a particular year during this time would be ineffective in the third year after that, witnessed by a decrease in ROA (Fahlenbrach et al., 2018). In contrast to rapidly growing banks, the authors (Fahlenbrach et al., 2018) also argue that slow lending growth leads to better results. Some literature focuses on the effect of rapid growth on income, indicating that more rising businesses will have lower returns in the future. The study by (Hou et al., 2015) shows that overgrowing banks end up with lower earnings than banks growing slowly. Earlier, (Cooper et al., 2008) found that the asset’s growth is the prime cause of exceptional potential incomes. A behavioural study on Pakistani banks was conducted from 2006 to 2014, revealing that a repaid growth in the loan may create more bad loans and reduce banks’ long-term solvency (Kashif et al., 2016a). They also find that failure to supervise the banking sector during the heavy competition will create potential credit boom risks.

Few systematic studies on this subject, such as those of Hess et al. (2009), Foos et al. (2010), and Amador et al. (2013), use the abnormal measure of loan growth to indicate the expansion of bank lending. Therefore, Foos et al. (2010) describes irregular loan growth as “the difference between the growth of loans by an individual bank and the median growth of loans by banks from the same country and year.” However, other researchers also have similar opinions. Laidroo and Männasoo (2014) claimed that this determination has some weaknesses that make it challenging to identify the connection between irregular loan growth and loan loss clauses, missing the bank-specific variations in loan growth issues and long-term growth patterns in the banking industry.

A comprehensive examination (Foos et al., 2010) inspected the riskiness of bank and loan expansion. The study used a broad dataset of 16, 000 banks from 1997 to 2007, advocating that credit growth is a crucial measure of bank riskiness. The study found an opposite correlation between loan growth and lagged loan loss provisions, provided that this outcome reverses over 2–3 years. They also revealed that a quick increase in the loan might make bank solvency weaken shortly. They beforehand proved to defend their opinion and investigation outcomes that the growth of loans does not help decrease the ratio of bank capital (solvency) by default, which everybody assumes. As they claim, the benefits generated would be added to bank equity if banks expand loans accordingly, not declining bank resources.

Exploring evidence from Central and Eastern European countries that have undergone a significant transformation in their economic regimes, Cottarelli et al. (2005) and Kraft and Jankov (2005) both deliver evidence that supports fast credit growth is allied to more significant non-performing loans and bank risk.

Other studies concentrating primarily on credit growth (Laidroo and Männasoo, 2014) explore the connotation between the credit supply growth measured by unutilized committed credit lines and the ratio of loan loss provisions. With a one-year lagged in credit supply expansion on credit risk, the authors find a strong positive impact calculated by different approaches using a dataset in Central and Eastern Europe from 2004 to 2010.

Prior research (Saunders et al., 1990) found that bank managers may have a short-term interest and may propose risky strategies at the moment of credit growth. As criteria for performance measurement, loan growth volume is one of the main issues considered at organizations. However, a quick growth trend in lending may seem to create benefits in the short run but contains long-term hidden risks for shareholders and successors. A study with the US banking sector (Keeton, 1999) explored that loan growth is one of the key reasons for loan loss provisions. The author used a dataset of US banks from 1982 to 1996 for this research; catalysts the researchers found are the availability of bank loans, reduced lending interest rates, and relaxing lending standards.
Using data from Spanish savings and commercial banks from 1985 to 1997 (Salas and Saurina, 2002) found that credit growth is substantially related to credit loss provisions over the next three to four years. The study suggests a positive correlation between credit growth and credit risk delays for Spanish banks. Another research by Hess et al. (2009) in Australia applies bank data from 1980 to 2005 to identify that rapid loan growth turns into losses for banks within two to four years after the rise. The authors also identified that the effect intensifies if macroeconomic instability exists or if the banks are large.

Unlike most of the other studies, research conducted by Laeven and Majnoni (2003) finds that banks show less loan loss provisions during good times of the business cycle, while in bad times, loan loss provisions increase. A negative relationship between loan growth and non-performing loans is reported evaluating 1,000 banks from 45 different countries on a time horizon from 1988 to 1999. Similar findings were obtained in evaluating 1,176 commercial banks from developing countries (Majnoni and Cavallo, 2001).

Some researchers have explored the Chinese banking industry to examine rapid credit expansion and its consequences in the Chinese banking sector. Of these studies concentrate on the banking sector's financial performance and productivity, emphasizing the Chinese banking system's efficiency, which has improved steadily (Ariff and Luc, 2008; Berger and Udell, 2004; Xiaoqing Maggie and Heffernan, 2007; Zhou, 2009). A study of 28 commercial banks from 1995 to 2004 found that joint-stock banks are more profitable and cost-effective than public-sector banks (Ariff and Luc, 2008). It is also identified that the levels of Chinese bank profit efficiency are significantly lower than those of cost efficiency, perhaps because of the lack of proper asset quality monitoring and control of Chinese banks. Salvatore (2010) identified the necessity for financial market developments to examine the Financial Development Index established by the World Economic Forum 2009. This study indirectly highlights the value of developing a better understanding of the elements that define risks in Chinese banks.

Managers may indulge themselves with poor credit quality to get more incentives as fees from higher profitability. A study by Dell'Ariccia and Marquez (2006) found that screening becomes less critical with a high demand for loans resulting decrease in credit standards. Berger and Udell (2004) find that bank personnel forget recent credit distress and lose the loan restructuring skills learned throughout the period and loosen the lending standards and criteria to expand lending. They call it the 'institutional memory' hypothesis, which they gathered exploratory commercial lending made by banks from 1980 to 2000. These latent clarifications for rapid loan growth connected to reducing credit standards can help comprehend some banks' reckless loan growth. A way for banks to expand rapidly is to buy other banks. Empirical evidence shows that negative, but not universally acknowledged, unusual long-run profits after merger and acquisition (Loughran and Vittet, 1997; Moeller et al., 2005; Rau and Vermaelen, 1998). As a result of mergers, rising banks combine more and hence have lower returns.

Some recent developments in this area of literature (Adesina, 2019; Aysan and Dishi, 2019; Bustamante et al., 2019; Dang, 2019; Jiang et al., 2020; Nguyen & Dang, 2020; Sobarsyah et al., 2020; Wei et al., 2019) discuss the relationship of loan growth, bank risk and profitability.

Adesina (2019) suggests that asset portfolios' poor performance hampers banks' capacity to make loans. This study is supported by Dang (2019) who found similar results and argued that loan growth affects banks' performance in the form of credit risk, bank profitability, and bank solvency. Growth in lending increases loan loss provisions from 2 to 3 subsequent years, lowers bank capital ratio the following year, while bank profitability gains positive effects from loan growth both in the short term and long term. While Aysan and Dishi (2019) found a different result and argued that a rise in non-performing loans did not modify bank lending activities in Turkey, and diversified funding helped banks survive the reduced returns from deteriorated investments.

Well-capitalized, high-liquidity, low-risk, and more lucrative banks appear to give more credit, especially in local currency (Bustamante et al., 2019). Furthermore, reserve requirement in both local and foreign currency is successful in curbing domestic credit in Peru, bolstering the central bank's aggressive use of reserve requirements as a macro-prudential mechanism to smooth the credit cycle.

A study with Vietnamese banks from 2007 to 2019, Nguyen & Dang (2020) discovered that having a large capital buffer allows them to expand lending quickly. Asset quality is positively related to high credit growth, less effective banks are more aggressive in credit expansion, profitability helps banks boost lending, liquidity is positively related to loan growth, and interest rate risk suppresses credit expansion, according to the study. This study is supported by Jiang et al. (2020), who used a quantile regression technique on a data set of 135 Chinese banks between 2004 and 2017 to discover that bank capital buffer has a strong U shaped association with bank risk-taking, demonstrating the nonlinearity and heterogeneity of the relationship between the capital buffer and risk-taking for the Chinese banking system. For banks at the top of the risk-taking distribution, this effect is more pronounced. Furthermore, the researchers have shown that the capital buffer turning point decreases as risk tolerance increases.

An investigation by Wei et al. (2019) on a panel dataset of 507 banks from four central euro area countries (France, Germany, Italy, and Spain) from 2005 to 2017 reveals that Economic policy uncertainty (EPU) has a positive effect on NPLs. However, this effect is considerably moderated by greater bank concentration. Another study on a sample of Islamic banks from 29 countries examined the impact of loan growth and capitalization on credit risk (Sobarsyah et al., 2020). The findings show that higher loan growth increases credit risk one year ahead, especially for Islamic banks with greater capitalization. However, a closer examination reveals that such evidence became more pronounced following the global financial crisis (GFC) of 2008. In Islamic banking, boosting capital requirements is not enough to guarantee prudent lending behaviour.

3. Data, variable definition and methodology

3.1. The data

We have used balanced panel data for eight Asian countries grouped as SAARC according to an economic zone. First, we have developed an econometric model to describe the relationship of Bank Risk (NPLi,j,t) with Bank loan growth (LGi,j,t) from 2011 to 2019. The reason for taking nine years as time length is the availability of data. Data before this are not available in BankFocus. It is to be mentioned here that countries with a low economic base, underdeveloped financial sectors, and little access to information have led to some missing data.

For countries like Afghanistan, Bhutan, Maldives, and Nepal, we used the exponential growth method to find a few missing values. Examining the trend of each indicator, we have used the exponential growth rate formula to find some approximate data for previous periods. In other words, \( P_t = P_{n+1} (1+r)^n \) where \( P_n \) is the starting (missing) value, \( r \) is the rate of increase or decrease (exponential decay), and \( t \) stands for time in equal intervals expressed as an integer. Amounts in this paper are all in USD as already converted by BankFocus.

3.2. Variable definition

LGij,t is measured as a customer's bank loan growth rate. NPLij,t is the impaired loans customers unable or unwilling to pay within the credit period. EQTAij,t, calculated by total bank equity divided by total assets, is a metric for bank solvency. ROAij,t is bank profitability measurements, measured as the net profits on assets. SIZEij,t reflects the size of the bank measured as the total assets' natural logarithm.

LGij,t signifies the loan growth determined by the average growth for each nation of the overall loans in the banking system. LGij,t denotes bank-level loan growth calculated by either LOANG or DLOAN as the real change in the ratio of new loans to total assets after (Bouvatier and
Lepetit, 2008), while LOANG is essentially the bank’s annual total loan growth rate. In specific, LOANG and DLOAN is determined as follows:

\[
LOANG = \frac{(\text{Loan}_{i,t} - \text{Loan}_{i,t-1})}{\text{Loan}_{i,t-1}}
\]

\[
DLOAN = \frac{(\text{Loan}_{i,t} - \text{Loan}_{i,t-1})}{0.50 \times (\text{Total Assets}_{i,t} + \text{Total Assets}_{i,t-1})}
\]

Cost to income (CIR_{i,j,t}) ratio is the dimension used in the banking sector to assess efficiency. It is usually used in banks and financial institutions to measure its operating cost paralleled to its income. The lower the cost to income ratio is the better it is for the banks’ performance. Similarly, the lower the ratio is, the more efficiency the bank can achieve in the period. To lessen the cost to income, the company desires to either upscale its operating income or decrease its operating costs.

The ZSCORE_{i,j,t} ratio delivers evidence on a bank’s financial steadiness and bankruptcy risk. ZSCORE_{i,j,t} specifies the number of standard deviations taking place below the expected return on assets ratio at which the institution is considered to be insolvent. It is a proxy to NPL_{i,t} that evaluates the overall performance of individual banks. We take into account a well-recognized substitute method of bank risk: 

\[
\text{Z-score} = \frac{\text{Mean of } (\text{EQT A-ROA})}{\text{Std Dev of } (\text{ROA})}
\]

(Boyd et al., 1992; Roy, 1952). This ratio reflects the average capitalization (EQT A) return on assets (ROA) for the previous three years over the 3-year standard deviation of the return on assets and is an index of bank steadiness, signifying non-performing loans. Banks that have lower z-scores can be considered to be more unstable.

3.3. Methodology

Based on (Keeton, 1999) context hypothesis, the research model was established to evaluate loan growth’s general effect on credit risk, bank solvency, and bank profitability in compliance with applicable research strands.

3.3.1. Loan growth and bank risk

We examine the influence of credit growth on non-performing loans. As indicated in H1, we will measure if credit growth is related to a continuing deterioration in a bank’s loan portfolio quality. The following model is used to find the relationship:

\[
\ln\text{NPL}_{i,t} = \beta_0 + \beta_1 \ln\text{NPL}_{i,t-1} + \beta_2 \text{LG}_{i,j,t} + \beta_3 \ln\text{SIZE}_{i,t} + \beta_4 \text{LIQD}_{i,t} + \beta_5 \text{ROA}_{i,t} + \epsilon_{i,t}
\]

(1)

Here regression factors of explanatory variables are resented by \(\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5\) and, \(\epsilon_{i,t}\) represents unobservable properties. The dependent variable is \(\text{NPL}_{i,t}\), which means the banks’ credit risk and is obtained by the impaired or bad loan to customer credits (Hess et al., 2009; Laidroo and Männasoo, 2014; Majnoni and Cavaiolo, 2001). As nearly all values of NPL_{i,t} are larger than zero (NPL_{i,t}>0); we perform for the log-normal distribution of non-performing loans by considering the natural logarithm (lnNPL_i,t), to obtain a \((\alpha, + \alpha)\) range of possible values.

3.3.2. Loan growth and return on investment

To characterize the shift in each bank’s relative return on assets (ROA_{i,t}) through contemporaneous loan growth (LG_{i,j,t}) and a series of control variables, we have developed the following model in line with our hypothesis H2:

\[
\text{ROA}_{i,t} = \beta_0 + \beta_1 \text{LG}_{i,j,t} + \beta_2 \text{LIQD}_{i,j,t} + \beta_3 \ln\text{SIZE}_{i,t} + \beta_4 \text{EQT A}_{i,t} + \beta_5 \text{CIR}_{i,t} + \epsilon_{i,t}
\]

(2)

Where bank profitability reflects ROA_{i,t}. In assessing bank profitability, these metrics are commonly used, but unlike (Foos et al., 2010) in selecting interest income for their analysis as a dependent variable.

3.3.3. Loan growth and bank solvency

EQT A_{i,t} is also a metric for solvency, determined by the overall equity bank divided by total assets. LG_{i,t} which reflects the increase of consumer loans by banks, is the explanatory variable (Gambacorta and Marques-Ibanez, 2011; Kashif et al., 2016a; Keeton, 1999). It’s a vital index for bank lending behaviour, particularly in developing markets such as SAARC countries where the economies are rapidly growing, and bank loans are critical for economic development.

Previous researches indicate that the rise in loans contributes to an improvement in new non-performing loans and a decline in relative interest income. Both results suggest that the increase in loans raises banks’ riskiness. As reported in Hypothesis H3, we now investigate whether loan growth contributes to an overall decrease in bank solvency. For each bank-year observation, bank solvency is calculated employing the equity-to-total-assets ratio.

Theoretically, one might assume that loans’ growth often implies a decrease in equity ratio to total assets (as mentioned in Hypothesis H3). Still, a bank’s equity can be raised, for example, by an experienced new problem or by retained earnings. This not only encourages more capital to be accumulated into new credit, but it also moderates more debt-financed credit growth while decreasing the equity to total assets ratio relative to the previous year.

Shifts in the equity-to-total asset (EQT A_{i,t}) is regressured on loan growth and multiple control variables by the model as follows:

\[
\text{EQT A}_{i,t} = \beta_0 + \beta_1 \text{LG}_{i,j,t} + \beta_2 \text{LIQD}_{i,j,t} + \beta_3 \ln\text{SIZE}_{i,t} + \beta_4 \text{ROA}_{i,t} + \beta_5 \text{CIR}_{i,t} + \epsilon_{i,t}
\]

(3)

3.3.4. Loan growth and Z-score

The Z-score ratio has been commonly used to express financial institutions’ aggregate efficiency or assess bank stability (Delis et al., 2014; Houston et al., 2010; Khan et al., 2017). Banks that attain strong profitability (ROA_{i,t}) and good solvency (EQT A_{i,t}) often have a better Z-score ratio, indicating these banks often have healthier average efficiency and increased steadiness. We have designed the robustness of the model as:

\[
\text{ZSCORE}_{i,t} = \beta_0 + \beta_1 \text{ZSCORE}_{i,t-1} + \beta_2 \text{LG}_{i,j,t} + \beta_3 \ln\text{SIZE}_{i,t} + \beta_4 \text{LIQD}_{i,j,t} + \beta_5 \text{ROA}_{i,t} + \epsilon_{i,t}
\]

(4)

4. Estimation method

We have used Generalized Moment Methods (GMM) to estimate coefficients of correlations. GMM is widely used for complex panel data models as it addresses endogeneity issue using instrumental variables (Arellano and Bond, 1991; Arellano and Bover, 1995). GMM models’ suitability is validated by the Hansen and Sargan over-identification test and the Arellano-Bond test for the absence of error-term second-order autocorrelation. Before applying GMM, we have tested our models through ordinary least squares (Pooled OLS), the fixed effect (FEM), and the model of random effect (REM) models. The Hausman test and F-test help choose a suitable regression model to overcome the research dilemma. Heteroskedasticity and autocorrelation concerns can be defined and addressed by cluster-robust standard errors (Hoechle, 2007). For variables such as non-performing loans (NPL_{i,t}), overall assets (SIZE_{i,t}), we have taken the logarithm because the numbers are all in thousands of US dollars. To decrease the influence of outliers in our analyses, we utilize variables included in this analysis and analyst estimation errors and revisions at 1 percent and 99 percent. With wide outliers, the distribution of analyst prediction failures and updates tends to demonstrate substantial skewness. Some increasing economies, such as Afghanistan, Bangladesh, and Nepal, etc. are the cause of extreme values.
4.1. Summary statistics

Table 1 displays the study variables’ summary statistics that contain the mean value, minimum value, maximum value, standard deviation value, and the number of observations of the sample variables. The minimum values of NPL_{i,j,t} and SIZE_{i,j,t} are in thousand USD due to small amounts.

4.2. Correlation structure

Table 2 displays the form of the correlation of all variables. No significant association between the variables used in this analysis can be found except NPL_{i,j,t} to SIZE_{i,j,t}, which is around 92%. We perform the variance inflation test (VIF) in this respect to verify if multicollinearity is a concern or not. When the VIF regression coefficient is greater than 10, multicollinearity problems begin to arise (Gujarati, 2003). The VIF coefficients of regressions demonstrate in this paper that the VIF is less than 5, and thus, the existence of multicollinearity problems is not a concern.

5. Regression results and discussion

5.1. Bank risk and loan growth

To estimate the model, we apply two different techniques: ordinary least squares (OLS) regressions followed by a complex two-step system GMM panel estimator, as suggested by Blundell and Bond (1998), along with the finite sample correction for variance estimation (Windmeijer, 2005). Provided our balanced panel and auto-regressive model, we choose the alteration of instruments by orthogonal deviations, regulating potential fixed effects at the bank level. Standard errors are robust regarding likely constraints from heteroskedasticity and clustering of observations in banks applying the Huber–White correction in the OLS specification and using the Windmeijer correction in our GMM models. Model (1) is assessed using OLS, column (2) signifies fixed effect, while columns (3) and (4) yield the output from GMM evaluations. In model (3), we consider only the lagged dependent variable (\text{lnNPL}_{i,j,t}/C0) as endogenous so that ‘GMM-style’ instruments of deeper lags are created, and in model (4), we lengthen this set of predetermined variables by loan growth (\text{LG}_{i,j,t}) and the total assets (\text{SIZE}_{i,j,t}), which we hypothesize to

### Table 1. Summary statistics.

| Country | No. of banks (SAARC) |
|---------|----------------------|
| Afghanistan | 9 |
| Bangladesh | 20 |
| Bhutan | 4 |
| India | 20 |
| Maldives | 5 |
| Nepal | 20 |
| Pakistan | 20 |
| Sri Lanka | 20 |
| **Total** | **118** |

| Variable | Notation | No. of obs. | Mean | Std. dev. | Min. | Max. |
|----------|----------|-------------|------|-----------|------|------|
| Non-performing Loan (in bill USD) | NPL | 1062.00 | 0.05 | 0.15 | 0.461* | 1.37 |
| Total Assets (in bill. USD) | SIZE | 1062.00 | 1.21 | 2.80 | 77.4 | 20.97 |
| Loan growth (in %) | LG | 1062.00 | 13.76 | 20.56 | -28.21 | 101.47 |
| Loan to Total Asset Ratio (in %) | LIQD | 1062.00 | 60.53 | 19.75 | 6.18 | 112.22 |
| Return On Asset (in %) | ROA | 1062.00 | 1.23 | 1.74 | -5.2 | 8.45 |
| Overall Performance of Bank (in %) | ZSCORE | 1062.00 | 23.91 | 16.74 | 3.1 | 64.57 |
| Cost to Income Ratio (in %) | CIR | 1062.00 | 53.39 | 17.95 | 5.21 | 84.78 |
| Equity-to-total assets (in %) | EQTA | 1062.00 | 10.12 | 4.57 | 4.63 | 21.81 |

* figures are in thousand USD.

### Table 2. Correlation coefficient matrix.

| Variables | (NPL) | (LG) | (LIQD) | (SIZE) | (ROA) | (ZSCORE) | (CIR) | (EQTA) |
|-----------|-------|------|--------|--------|-------|----------|-------|--------|
| NPL       | 1.00  |      |        |        |       |          |       |        |
| LG        | -0.326*** | 1.00 |        |        |       |          |       |        |
| LIQD      | -0.010 | 0.239*** | 1.00 |        |       |          |       |        |
| SIZE      | 0.917*** | -0.326*** | -0.129*** | 1.00 |       |          |       |        |
| ROA       | -0.417*** | 0.305*** | 0.139*** | -0.314*** | 1.00 |          |       |        |
| ZSCORE    | -0.094*** | 0.020 | 0.104*** | -0.02 | 0.266*** | 1.00 |          |       |
| CIR       | -0.098*** | -0.077** | -0.261*** | -0.189*** | -0.462*** | -0.176*** | 1.00 |        |
| EQTA      | -0.450*** | 0.135*** | 0.085*** | -0.447*** | 0.459*** | 0.266*** | -0.197*** | 1.00 |

Notes: Total number of observations 1,062.

*** The correlation at 1 percent level (two-tailed) is significant; ** The correlation at 5 percent level (two-tailed) is significant; * The correlation at 10 percent level (two-tailed) is significant.
The dependent variable is the regular logarithm of the non-performing loans (lnNPLt), defined as impaired or bad loans in year t over the total amount of customer loans. Explanatory variables are, besides the lagged dependent variable (lnNPLt-1), loan growth (LGt) as decimal numbers. We control for bank-specific effects using the loan to total asset ratio as liquidity (LIQDt), the logarithm of total assets (SIZEt), return on assets (ROAt), and the equity-to-total assets ratio (EQTA). Model (1) is estimated using OLS, (2) estimates Fixed Effect, whereas columns (3) and (4) report coefficients stemming from a dynamic two-step system GMM panel estimator proposed by Blundell and Bond (1998) with Windmeijer’s (2005) finite sample correction. In model (2), we treat only the lagged dependent variable (lnNPLt-1) as endogenous, so that ‘GMM-style’ instruments of deeper lags are created, and in model (3), we extend this set of predetermined variables by loan growth (LGt) and the bank size (SIZEt). All p-values are calculated from Huber–White robust standard errors, controlling for clustering at individual banks.

** The coefficients at 1 percent level are significant; ** The coefficients at 5 percent level are significant; * The coefficients at 10 percent level are significant. Number of instruments: 18.

Table 4. Regression results for Non-Performing Loans (NPLs).

| Dependent Variable: NPL | LG – LOANG | LG – SIZE*LOANG |
|------------------------|------------|-----------------|
|                        | (1)        | (2)             | (3)             | (4)             |
| Explanatory Variable   | Coeff.     | p-Val.          | Coeff.          | p-Val.          | Coeff.          | p-Val.          |
| lnNPLt-1               | 0.796***   | 0.0010          | 0.603***        | 0.0000          | 0.798***        | 0.0000          | 0.543***        | 0.0000          |
| LG                     | 0.006***   | 0.0000          | 0.012*          | 0.0700          | 0.0003***       | 0.0000          | 0.0004***       | 0.0040          |
| LIQD                   | 0.005***   | 0.0000          | 0.002           | 0.0800          | 0.005***        | 0.0000          | 0.005           | 0.4840          |
| SIZE                   | 0.230***   | 0.0000          | 0.444**         | 0.0100          | 0.225***        | 0.0000          | 0.588***        | 0.0010          |
| ROA                    | 0.004      | 0.5220          | 0.01            | 0.8430          | 0.003           | 0.5620          | 0.015           | 0.7620          |
| Constant               | -1.329***  | 0.0000          | -1.976          | 0.2610          | -1.315***       | 0.0000          | -3.586***       | 0.0430          |
| No. of Banks           | 118        | 118             | 118             | 118             | 118             | 118             | 118             | 118             |
| Observations           | 944        | 944             | 944             | 944             | 944             | 944             | 944             | 944             |
| Adjusted R squared     | 0.955      | 0.955           | 0.955           | 0.955           | 0.955           | 0.955           | 0.955           | 0.955           |
| AR(1)                  | 0.0000     |                 |                 |                 |                 |                 |                 |                 |
| AR(2)                  | 0.6880     |                 |                 |                 |                 |                 |                 |                 |
| Sargan test            | 0.0560     |                 |                 |                 |                 |                 |                 |                 |
| Hansen test            | 0.0850     |                 |                 |                 |                 |                 |                 |                 |
| Endogenous Variables   | NPLt-1, LG |                 | NPLt-1, LG      |                 | NPLt-1, LG      |                 | NPLt-1, LG      |                 |
| (’GMM-style instruments)| SIZE       |                 | SIZE            |                 | SIZE            |                 | SIZE            |                 |

*** The coefficients at 1 percent level are significant; ** The coefficients at 5 percent level are significant; * The coefficients at 10 percent level are significant. Number of instruments: 18.
as the formula mentioned above, we assume the logarithm of its total assets, and the equity to total assets ratio (EQTA) as well as control variables. Equations of the respective bank and year is used in our regressions to control the amount of capitalization. Also, liquidity (LIQD) and profitability (ROA) are treated as control variables.

Concerning the influence of control variables, the bank capital ratio (EQTA) has less substantial effects on Bank risk (NPL) as seen in Tables 3 and 4. Meanwhile, bank liquidity (LIQD) is positively associated with bank risk (NPL). Just the liquidity of banks in GMM model 3 has a negative relationship with NPLs. It is also seen in Tables 3 and 4 that the higher the bank size (SIZE), the greater the bank risk (NPL). This result is in line with the existence of “too-big-to-fail” effects associated with greater bank moral hazard linked with broader bank size (Beck and Laeven, 2006; Galloway et al., 1997).

Size (SIZE) and LIQD exhibit a reasonably strong positive association among other control variables, while ROA reflects a negative correlation with non-performing loans. In summary, we find strong evidence for discovering a significant association of credit growth with non-performing loans at the individual bank level in Hypothesis H1, which indicates that new loans show a greater risk of default. These results are supported by a time series analysis done on Bangladesh from 1979 to 2018. Researchers found liquidity is positively related to bank risk, while profit is negatively associated with statistical significance (Zheng et al., 2020).

Later, in Table 4, we reproduce the regression changing calculation for the dependent variable NPL. As the formula mentioned above, we have used DLOAN and LOANG SIZE to check whether the results of the regressions are in line with Table 3, which gives us conformity to our study’s robustness. The results presented in Table 4 resemble the results obtained in Table 3, meaning the results are robust.

### 5.2. Loan growth and return on asset

The loan growth (LG) signifies the chief explanatory variable and conferring to Hypothesis H2, we assume the return on assets to decline for banks with rapid growth, and therefore the negative effect of LG on ROA. Though there is enough empirical evidence that return is negatively associate with loan growth, in this study, we have found a strong positive correlation of ROA to NPL. The reason may be that the Asian economy is a growing emerging economy. Hence the banking sector is also growing at a quick speed. Due to industrialization, corporate and large financing are increasing, and at the same time, uplift in living standards has let people use more consumer loans and thus increasing the horizon of lending and increase in return on lending. However, there is enough evidence of a positive relationship between return and loan growth as well. Rapidly growing banks have a much greater ROA in the inception period (Fahlenbrach et al., 2018). Again (Amador et al., 2013) found that unusual loan growth for retail consumers is positively related to interest income, which a measure of profitability (see Table 5).

Regression coefficients illustrate continuity in analyzing the substantially positive effect of the loan growth variable on the ROA dependent variable of some consideration. Thus, this finding suggests that banks’ lending expansion would usually improve profitability as calculated by ROA. This result does not validate Hypothesis 2 and illustrates the reverse of other research (Fahlenbrach et al., 2018; Foos et al., 2010; Paul Kiama Thingo, 2016), though credit growth continues to boost non-performing loan levels, which also raises the expense of banks.

### Table 5. Regression results for Profitability.

| Dependent Variable: ROA | LG – LOANG (1) | LG – DLOAN (2) | LG – SIZE*LOANG (3) |
|-------------------------|---------------|---------------|---------------------|
| **Explanatory Variable**| **Coeff.** p-
| Val.**| **Coeff.** p-
| Val.**| **Coeff.** p-
| Val.**|
| LG | 0.015*** 0.0000 | 0.036*** 0.0000 | 0.001*** 0.0000 |
| LIQD | −0.007** 0.0150 | −0.009*** 0.0560 | −0.007** 0.0160 |
| SIZE | −0.182*** 0.0000 | −0.196*** 0.0000 | −0.202*** 0.0000 |
| EQTA | 0.091*** 0.0000 | 0.087*** 0.0000 | 0.089*** 0.0000 |
| CIR | −0.046*** 0.0000 | −0.045*** 0.0000 | −0.046*** 0.0000 |
| Constant | 5.547*** 0.0000 | 5.839*** 0.0000 | 5.866*** 0.0000 |
| Observations | 1,062 | 1,062 | 1,062 |
| R-squared | 0.447 | 0.462 | 0.445 |

** *** The correlation at 1 percent level is significant; ** The correlation at 5 percent level is significant; * The correlation at 10 percent level are significant.

### Table 6. Regression results for Solvency.

| Dependent Variable: EQTA | LG – LOANG (1) | LG – DLOAN (2) | LG – SIZE*LOANG (3) |
|-------------------------|---------------|---------------|---------------------|
| **Explanatory Variable**| **Coeff.** p-
| Val.**| **Coeff.** p-
| Val.**| **Coeff.** p-
| Val.**|
| LG | −0.021*** 0.0010 | −0.029*** 0.0190 | −0.001*** 0.0050 |
| LIQD | −0.006 0.3060 | −0.006 0.3190 | −0.007 0.2610 |
| SIZE | −0.803*** 0.0000 | −0.770*** 0.0000 | −0.776*** 0.0000 |
| ROA | 0.745*** 0.0000 | 0.742*** 0.0000 | 0.735*** 0.0000 |
| CIR | −0.041*** 0.0000 | −0.041*** 0.0000 | −0.041*** 0.0000 |
| Constant | 23.393*** 0.0000 | 22.825*** 0.0000 | 23.003*** 0.0000 |
| Observations | 1,062 | 1,062 | 1,062 |
| R-squared | 0.536 | 0.332 | 0.333 |

** *** The correlation at 1 percent level is significant; ** The correlation at 5 percent level is significant; * The correlation at 10 percent level are significant.
The analysis illustrates a significant and optimistic effect on bank profitability (ROA$_{ij,t}$) on the independent variable bank capital to asset ratio (EQTA$_{ij,t}$). Therefore, the greater the capital ratio suggests, the higher output of the bank. The study’s results are in line with (Bougatef and Mgdami, 2016; Casu et al., 2017; Lee and Hsieh, 2013; Psillaki and Mamatzakis, 2017; Zheng et al., 2017).

Liquidity (LIQ$_{ij,t}$) presents a relatively weaker (at 5% level) positive relationship with loan growth (LG$_{ij,t}$). The reasons for having a negative relationship may be: excessive availability of liquid asset resembles less investment by the bank due to conservative nature or lack of investment opportunities resulting in less return. South Asian countries have a history of political instability that intensely impacts the banking industry and may create an unfavourable lending environment for banks to feel safe to invest.

The efficiency ratio, cost to income (CIR$_{ij,t}$), has a highly substantial negative connection with profitability (ROA$_{ij,t}$) at 1% level. The higher the cost in the direction of income, the inefficient the banks become. Hence, CIR$_{ij,t}$ is expected to have a negative relationship with profitability. Cost to income ratio acts as a proxy of management efficiency, which if increases harms profitability (Akbaş, 2012; Petria et al., 2015).

### 5.3. Loan growth and bank solvency

As expected, according to Hypothesis H3, there exists a negative relation in-between loan growth (LG$_{ij,t}$) and bank solvency (EQTA$_{ij,t}$) with a 1% significance level. This may happen due to banks’ inability to raise equity proportionately. We also control individual bank size (SIZE$_{ij,t}$), which is the proxy of the natural logarithm of total assets (see Table 6).

Profitability (ROA$_{ij,t}$) and Solvency (EQTA$_{ij,t}$) are positively related at a 1% level of significance as expected. As the profit increases, the retained earnings go up, and banks experience better solvency. The efficiency ratio, cost to income (CIR$_{ij,t}$) has a significant negative relationship with solvency and equity to total asset ratio (EQTA$_{ij,t}$) at the 1% level. As the cost increases in proportion to income, efficiency decreases with a negative impact on individual banks’ solvency. Results are in line with (Kashif et al., 2016b) who found a significant negative relationship of efficiency ratio to solvency. In summary, we see a statistically substantial negative connection between loan growth and bank capitalization, which represents an indication favoring Hypothesis H3.

### 5.4. Loan growth and ZSCORE

We use the ZSCORE$_{ij,t}$ as a proxy to non-performing loans to check our study’s robustness. As we know, the higher the Z score of an individual bank, the better it is considered. Hence, we expected all the independent variables to be associated with ZSCORE$_{ij,t}$ opposite to NPLs. As Table 7 shows the regression results, we find the explanatory variable LG$_{ij,t}$ is in a negative relationship with Z score and significant control variables SIZE$_{ij,t}$ has a negative relationship. In contrast, ROA$_{ij,t}$ has a positive relationship with ZSCORE$_{ij,t}$. These associations are in the same line with what we initially found with NPL$_{ij,t}$, indicating our study’s robustness. Regression results confirm the study of (Papadamou et al., 2018).

### 6. Conclusions

The empirical findings suggest that banks rapidly expanding lending practices appear to decrease bank solvency and increase non-performing loans. Concerning bank profitability, the results do not indicate that, as our initial expectation, fast loan growth will reduce banks’ return and increase profitability. In summary, on the theories that regard credit growth as a possible cause of weak performance, we have found some supportive confirmation. Therefore, banks need to be highly careful with their loan growth, which is perhaps a threat to future bank performance. Stringent loan endorsement processes, efficient bank risk management programs, and regulatory agency inspection and oversight may actively restrict bank risks associated with extending loan expansion. Moreover, banks should consider retaining the adequacy ratio of bank equity as actively growing lending to conform with guidelines and improve ability in the light of efforts by the SAARC banking system to implement Basel requirements. This research uses loan growth rates as predictive factors, comparable to most other studies.

As the number of non-performing loans rises dramatically, further regulation actions are needed to maintain a strong financial sector. Since abnormal loan growth cannot be identified at this time, an increase in the capital requirement policy for rapidly increasing banks is also needed. Simultaneously, strict oversight is needed to prevent the negative effects of borrower selection.

The financial sector’s role in the global economy cannot be overstated because it stimulates productivity, improves livelihood, and enhances infrastructure. Financial development is one of the motivating factors...
behind economic development, according to academic research. Financial companies and banks, like most firms, increase the size of their loans in order to increase their earnings or income. To put it another way, the existence of debt funding for enterprises and developers fosters new ventures’ growth. Local markets and local jobs will also benefit from lending capital to local businesses.

However, if the loan growth trend is aggressive, the risk of loan defaults increases as well. Furthermore, higher loan defaults may be caused by an uncertain environment or bank underpricing. According to many reports, excessive bank lending has been linked to higher credit defaults, negatively impacting financial markets and whole economies.

The scope of the study is limited due to the stringent time frame and straightforward research objectives. Research is a never-ending process impacting financial markets and whole economies. The existing literature and evidence will guide the potential researcher in concentrating their focus on the banking business line, precisely the problem and prospects of loan growth and its bitter experiences in loan defaults.

Declarations

Author contribution statement

Probir Kumar Bhowmik: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.
Niluthpaul Sarker: Contributed reagents, materials, analysis tools or data.

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Data associated with this study has been deposited online at Bank-Focus (https://banks.bvdinfo.com).

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The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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