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Loan growth drivers in state-owned banks: A fixed effects model approach

[a,] * Probir Kumar Bhowmik, [b] Gopal Karmakar

[a,] Department of Accounting & Information Systems; University of Barishal; Bangladesh, [b] Department of Business Administration; Varendra University; Bangladesh Bangladesh

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ABSTRACT

Loan growth is a critical driver for economic development, and comprehending the determinants affecting lending in state-owned banks is vital for enhancing financial sector stability and performance. This paper examines the factors that affect loan growth in state-owned banks in Bangladesh. We collected data over a 11-year period from 2012 to 2022. We applied ordinary least square method primarily followed by fixed effect estimation. To check the validity of the regression models of the study, we have considered several diagnostic tests. Our findings indicate that loan growth in state-owned banks is influenced by several industry-dependent variables i.e. size, liquidity, efficiency, non-performing loans, etc. The influence of bank size, income, liquidity, non-performing loan ratio, and cost-to-income ratio is the main emphasis of this study's investigation into the factors influencing bank lending. According to the statistics, there is a significant positive correlation between size and lending. Bank liquidity and lending show a strong negative correlation. The study also found higher lending is associated with higher non-performing loans significantly. The efficiency ratio shows a substantial negative impact on lending. To improve bank performance and stability, policymakers and bank management may benefit greatly from these results. Policymakers need to integrate various macroeconomic and qualitative elements into regulatory frameworks to bolster financial stability while facilitating sustainable loan expansion. Bank management can enhance efficiency by decreasing the cost-to-income ratio and strengthening credit risk management, while utilizing bank size for strategic expansions to increase lending capacity.

1. Introduction

Loan growth serves as a crucial indicator of the economic strength and financial stability of the banking industry, especially in developing economies. State-owned banks play a crucial part in the economic growth of numerous countries, including Bangladesh, where they function not only as financial entities but also as tools for government policies focused on socio-economic development. In contrast to private banks, state-owned banks typically function with a dual mandate: to achieve financial stability while promoting wider socio-economic goals. The dual duty complicates their loan growth dynamics, necessitating an examination of the unique issues affecting their lending practices.

State-owned banks in Bangladesh function within a distinct regulatory and political framework. These banks, as the main facilitators of government projects, frequently function as instruments for implementing governmental policies, thereby profoundly influencing their lending practices. The increase in loans among these institutions signifies their operational efficiency and financial stability, as well as the government's overarching economic policies. Consequently, comprehending the determinants of loan expansion in state-owned banks is essential for evaluating their contribution to economic stability and growth.

Despite the significance of state-owned banks in Bangladesh, a considerable research gap exists about the determinants of loan growth inside these entities. Most current research concentrates on private banks or regards the banking sector as a uniform entity, neglecting the distinct attributes of state-owned banks. This neglect has resulted in a deficiency in the literature, leaving significant inquiries unresolved regarding the particular elements influencing loan expansion in these government-owned entities. Tan and Anggraeni (2017) emphasize that

* Corresponding author. E-mail address: *gopal@vu.edu.bd* (G. Karmakar).
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credit constitutes the principal asset for banks in Indonesia, simultaneously presenting risks to the associated institutions. They suggest that the majority of loans are allocated for investment and working capital, critical sectors where bank credit bolsters economic activity. Baoko et al. (2017) underscore the crucial function of banks in preserving financial system stability by serving as intermediaries between surplus fund holders and borrowers, which is vital for economic advancement.

This study seeks to address the research gap by identifying and assessing the particular factors that influence loan growth in Bangladeshi state-owned banks. The study examines internal factors including bank size, gross loan-to-total asset ratio, total income, cost-to-income ratio, non-performing loan ratio, profitability, and liquidity. The study aims to elucidate how these factors affect lending behavior in state-owned banks. The results will augment the current research and provide actionable insights for policymakers and regulators seeking to improve the efficiency and stability of these institutions.

Understanding these factors is essential for multiple reasons. This research provides policymakers with essential insights on utilizing state-owned banks to foster economic growth and enhance financial inclusion in Bangladesh. The findings assist authorities in pinpointing vulnerabilities and opportunities for enhancement within the financial system. This study ultimately fills a significant gap in the academic literature and establishes a foundation for future research into the specific conditions of Bangladesh's state-owned banks. To the best of our knowledge there is hardly any study relating to lending behavior of government banks solely in Bangladesh. The main aim of this study is to clarify the unique elements influencing loan growth in state-owned banks in Bangladesh. This research seeks to improve our comprehension of how these organizations might reconcile their dual obligations of financial performance and socio-economic growth. This will facilitate more steady and inclusive economic growth in Bangladesh.

The research is segmented into multiple sections: Section 2 presents a thorough literature review, providing an in-depth understanding of previous research in the topic. Section 3 detailed Data, variable definition and methodology. Section 4 reveals the analysis, research findings, offering the results and insights obtained from the data analysis. Section 5 constitutes the study's conclusion along with the policy implications derived from the analysis of the findings, providing significant recommendations for policymakers and need for the further research.

2. Literature Review

Credit refers to the act of providing funds or similar assets based on a contractual arrangement or loan agreement between a bank and another party. The borrower is obligated to repay the debt, together with interest, within a specified period of time (Mushinski, 1999). To establish an effective credit management system, it is necessary to implement policies while extending credit to customers. Banks frequently implement the practice of extending credit as a means to augment the amount of loans, hence boosting earnings (Stiglitz and Weiss, 1981). Tan and Anggraeni (2017) found that financial performance growth varied among state-owned banks in Indonesia. Using semi-log panel data with REM, the study revealed that the non-performing loan (NPL) variable and loan-to-deposit ratio (LDR) variable had a significant positive impact on the credit of state-owned banks. However, the Return on Assets (ROA) variable does not have a substantial impact. Warjiyo (2009) states that the credit offering behavior of banks is influenced not only by the amount of third-party funds, but also by the bank's perception of the debtor's business prospects and the bank's own condition, including Return on Assets, non-performing loan, and loan to deposit ratio. Tan and Anggraeni (2017).

Sobarsyah et al. (2020) in their study found higher loan growth exacerbates credit risk one year ahead regardless of the measure of loan growth and credit risk. The study also found to have higher capitalization exacerbates moral hazard due to loan growth in Islamic banks. Bank size, measured by total assets, significantly affects the magnitude of loan growth, where bigger banks have more resources and diversified portfolios. Large commercial banks have been the primary drivers of loan growth due to their extensive branch networks and financial capabilities (Bhowmik and Sarker 2021). While higher liquidity ensures banks meet loan demand without compromising financial stability (Ahamed and Research 2021). According to a 1973–2014 research on the US banking system, banks that have rapid loan expansion in a given year will become inefficient in the third year thereafter, as shown by a decline in return on assets (ROA) (Fahlenbrach, Prilmeier, and Stulz, 2016). The authors (Fahlenbrach et al., 2016) contend that slower loan expansion yields superior outcomes in comparison to banks that are expanding quickly. Certain scholarly works concentrate on the impact of fast expansion on earnings, suggesting that increasing numbers of growing enterprises will eventually have reduced profits. According to a research by Hou, Xue, and Zhang (2015), banks that develop too quickly end up with worse profitability than banks that grow more slowly. According to earlier research, the asset's growth is the main factor contributing to extraordinary prospective earnings (Cooper, Gulen, and Schill, 2008). A repaid loan increase may result in more problematic loans and lower banks' long-term solvency, according to a behavioral research done on Pakistani banks between 2006 and 2014 (Kashif, Zafar, and Arzoo, 2016). They also discover that there might be credit boom dangers if the banking industry is not closely supervised during times of intense competition. Researchers discovered a strong positive correlation between bank risk and loan growth in a study of SAARC nations (Bhowmik and Sarker, 2021). According to the research, banks' quickly growing lending practices seem to be increasing non-performing loans and decreasing bank solvency. The findings do not support the notion that rapid loan growth will lower bank profitability by decreasing return on investment. A small number of systematic studies on this topic, including those by Foos (2010), Amador (2013), and Hess, Grimes, and Holmes (2009), employ the anomalous measure of loan growth to show that bank lending has expanded. As such, irregular loan growth is defined by (Foos, 2010) 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." Still, there are other scholars who share similar views. According to (Laidroo and Männasoo, 2014), this assessment has some flaws that make it difficult to determine the relationship between irregular loan growth and loan loss clauses. It also fails to take into account bank-specific variances in loan growth difficulties and long-term trends in the banking sector.

The riskiness of bank and loan expansion is examined in one of the most thorough studies on loan growth and riskiness ever conducted (Foos, 2010). The research has been handled rather thoroughly. Using a large dataset spanning 16,000 institutions from 1997 to 2007, they argued that credit growth is an important indicator of bank riskiness. More specifically, they discovered that, as long as this result reverses over a period of two to three years, there is an inverse relationship between loan growth and lag loan loss provisions. They also disclosed that a rapid rise in loans might lead to a shortfall in bank solvency. They have previously provided evidence to support their claims and study findings, which show that contrary to popular belief, the expansion of loans does not contribute to a decline in bank capital (solvency) by default. As they assert, if banks grow loans in line with demand rather of cutting down on resources, the advantages would be added to bank equity. In a study (Norawati, Zulher, Kasmawati, and Ratnasih, 2022) found substantial findings when testing the simultaneous premise of the impact of controlling third-party funds and operational costs on credit growth. The credit expansion is influenced by both the third-party funding and the operating costs. Third-party funds have a minor influence on credit growth. According to Hasan et al. (2017), third-party funds, commonly referred to as public funds, are monies acquired by banks from the general community, encompassing both individual communities and business enterprises. Their analysis reveals that bureaucratic variables have a substantial impact on both individual banks and bank groups, while economic variables have relatively minimal influence. This finding aligns with the notion that the state retains a major level of control. (Chen and Wohlfarth, 2019). Liberalization in the financial sector, aimed at enhancing the depth of the financial industry, can lead to a significant increase in credit growth. Another element that contributed to the rise in credit was the influx of capital, which augmented the availability of cash for banks and subsequently boosted credit expansion. On the other hand, loan growth can also happen as a result of financial actors overreacting to changes in risk periodically (Baoko et al., 2017).

Regardless of the cause, rapid credit expansion will have a significant influence on increasing credit losses and diminishing bank profitability, perhaps leading to problems for banks (Duican and Pop, 2015). The perspective that rapid credit expansion leads to an increase in credit non-performing loans cannot be disregarded. In the event of a significant increase in credit, banks may seek to direct credit by relaxing their lending criteria and increasing the number of non-performing loans. Nevertheless, if there is a surge in credit growth due to a shift in the mindset of successful entrepreneurs who opt to borrow from banks rather than seek additional money from the capital market, it should not lead to an increase in non-performing loans. The cautious motive may account for the ability of highly liquid banks to stimulate their lending. Martin, and Rossi (2014) present a model that demonstrates how banks make the most efficient choice to retain liquidity by acquiring liquid assets to fund future investments. In addition, banks may face challenges in distributing funds immediately after receiving them from depositors. As a result, they may choose to temporarily invest in easily convertible assets, which can later be replaced by loans (Broner, Erce, Martin, and Ventura, 2014).

According to Cornett, McNutt, Strahan, and Tehranian (2011), banks have bolstered their liquidity balances to safeguard themselves against liquidity risk during challenging periods. As a result, they have reduced their investments in new loans. Prior empirical research commonly employs assets and liabilities ratios to investigate the correlation between liquidity positions and the expansion of bank loans (Berrospide and Edge, 2010; Roulet, 2018). The findings underscore that increasing liquidity reserves serves as a strong incentive for banks to later increase lending. According to Everaert et al. (2015), having more liquid assets in the previous period is anticipated to enable a larger increase in credit. High liquidity indicates that the bank has a strong capacity to settle its obligations. Nevertheless, having a greater amount of liquid assets does not necessarily result in more benefits for a bank. Banks aim to increase their profits by expanding their lending portfolio and making investments. Meanwhile, banks must maintain sufficient liquid assets to meet their loans and prevent the accumulation of liquidity shortfall. A lack of liquidity can potentially initiate operational issues for banks and perhaps pose threats to the overall financial system. In theory, the impact of bank profitability on lending is uncertain. According to certain theoretical models, banks may be able to reduce the issue of asymmetric information by increasing their profits (Holmstrom and Tirole, 1997; Mankiw, 1986). These banks could effectively leverage their competitive advantages to obtain funding from depositors and stockholders. Consequently, this results in a significant increase in lending operations of highly profitable banks, which consistently have a variety of cash available for loans. Dell'Ariccia and Marquez (2006) argue that banks may loosen their lending criteria or reduce lending rates due to improved comparative advantages, to expand their lending portfolios. Conversely, the profitability of banks can significantly influence their willingness to take on risk and their approach to conducting business. Rajan (2006) argues that as banks experience higher returns, they are less motivated to engage in "searching for yield" and so become more hesitant to provide loans. In addition, a highly competitive banking sector may lead to increased loan growth due to reduced interest margins (Laidroo, 2010).

According to Karmakar and Paul (2024) total assets exert a significant negative impact on PAT in both POLS and 2SLS models. In contrast, building loans exert a beneficial effect on PAT in these models. The total revenue consistently exerts a positive influence on profit after tax (PAT) across all models. In the GMM model, transport loans and textile loans exert a significant negative impact on PAT, but pharmaceutical loans have a marginal positive effect. The existence of non-performing loans, total loans, agricultural loans, and food procurement loans does not significantly affect profitability after tax (PAT) in any of the models. Moreover, Environmental, Social, and Governance (ESG) considerations play a pivotal role in fostering loan growth (Qian et al., 2023) and overall economic development in countries, which, in turn, helps achieve the Sustainable Development Goals (SDGs) (Işık et al., 2024a; 2024b; 2024c; 2024d). A robust ESG framework can enhance the credibility and attractiveness of financial institutions, ultimately leading to increased lending activity. Moreover, Işık et al. (2024g) have introduced a concept known as the ECON-ESG factor, which underscores its significance in improving the performance of banks in developing countries. This factor is essential not only for bolstering banking performance but also for driving economic growth and enhancing energy efficiency. By integrating ESG principles into financial practices, countries can create a more sustainable and resilient economic landscape, benefiting both financial institutions and the broader community. Additionally, sustainability can be an influential

factor in achieving the SDGs, with technological advancement and green innovation serving as moderators (Islam, 2024c).

There is a lack of comprehensive research on the financial performance of banks and their lending activities, and it is necessary to expand this analysis. Nier and Zicchino (2006) conducted a study using a substantial sample size of 600 listed banks from around the world. They discovered that there is a positive relationship between bank return, as measured by return on equity, and loan growth. The subsequent research conducted by Bustamante, Cuba, and Nivin (2019) validates this finding for the banking sector in Peru. Adesina (2019) uses return on assets as a measure of bank profits and discovers a trend that contradicts earlier findings. Specifically, the author demonstrates the adverse correlation between bank profits and loan growth and explains this phenomenon by suggesting that banks may reduce the availability of loans to pursue a greater rate of return. However, it is important to acknowledge that the focus of these previous studies is not on bank earnings.

Increased profitability serves as an indicator of overall economic improvement. A higher return on equity signifies that a bank is efficiently utilizing its capital to produce profits and distribute them to investors at an appealing rate. Attracting more equity through a greater return on equity can lead to a bank having a higher capital adequacy, which is anticipated to positively impact loan growth. Insufficient profitability in insurance firms can indicate underlying issues and serve as an early warning sign for potential solvency difficulties (Heath, 2013). They believe this concept applies to banks as well. Logically, banks are likely to lend more money as their profitability rises. Zumaidah, L. N., & Soelistyo, A. (2018) demonstrate that total assets exert a strong positive impact on economic growth. The Third-Party Fund Value has a positive and strong impact on economic growth and Credit has a substantial positive impact on economic growth. Yıldırım (2022) observed a negative relation between the profitability indicators of banks and their foreign exchange positions and asset quality indicators in the long term. However, there was a positive correlation between loan growth and profitability. According to Demid (2021), the decline in credit quality is influenced by both macroeconomic conditions and elements specific to banks. There is significant variation in the extent and timing of this decline, depending on the kind of loans in different business sectors and the characteristics of the banks. Specifically, they discovered compelling evidence of the cyclical susceptibility of loan quality. Approximately 25% of banks see a more pronounced increase in non-performing loans (NPLs) in reaction to shocks in economic growth, currency rates, interest rates, and profitability. Highly profitable banks are less likely to engage in excessive risk-taking, which leads to smaller non-performing loans (NPLs). In their study, Cahyo, Harjanto and Sulastri (2023) demonstrate that Non-Performing Loans (NPL) substantially adversely impact credit development. The capital structure has a notable and favorable impact on the growth of credit. Credit expansion has a beneficial impact on profitability, albeit it is not statistically significant. Non-performing loans (NPL) have a substantial adverse impact on profitability. The capital structure has a substantial and favorable impact on profitability.

3. Data, variable definition and methodology:

3.1.The data

This chapter presents the methods used to examine the factors influencing loan growth in state-owned banks. The study examines the correlation between loan growth (LEND) and several explanatory factors, such as total assets (SIZE), net interest margin (INCM), cost-to-income ratio (CIR), liquidity (LIQ), and non-performing loan ratio (NPLR). The investigation examines state-owned banks over 43 observations, using different econometric models and diagnostic tests to ensure the strength and dependability of the findings. The sample comprises state-owned banks in Bangladesh, chosen based on their significance and the availability of consistent financial data. The study period covers 11 years, from 2012 to 2022 offering a comprehensive dataset for examining long-term trends and patterns in the growth of loans.

3.2.Variable definition

The study collected data from the chosen banks' annual financial reports, pertinent financial databases, and regulatory filings. The variables under consideration encompass:

3.3.Methodology

Ordinary Least Squares (OLS) is often used as the initial phase in regression analysis due to its simplicity and the clarity of its output in elucidating correlations among variables. The model minimizes the sum of squared residuals, making it appropriate for an initial investigation of the association between independent variables (e.g., bank size, liquidity, efficiency) and loan growth. Ordinary Least Squares (OLS) proposes that the error terms are uncorrelated with the independent variables and that no unobserved factors affect both the independent and dependent variables. Nonetheless, when utilized with panel data, OLS may produce biased results as it fails to consider unobserved heterogeneity—the time-invariant elements unique to each bank that could affect loan growth. Empirical research indicates that neglecting this unobserved variability may result in omitted variable bias, as highlighted by Wooldridge (2010) and Greene (2012).

The Fixed Effects (FE) model is preferred for panel data analysis in the presence of unobservable features that remain constant across time yet may affect the result variable. The FE model successfully eliminates the influence of time-invariant traits by concentrating on within-unit (within-bank) variation. Analyzing state-owned banks is essential, as these institutions frequently possess distinctive characteristics (such as ownership structure or regulatory environment) that remain stable over time yet may skew results if not adequately controlled. The application of Fixed Effects (FE) mitigates omitted variable bias, yielding more precise and consistent estimations of the impact of factors such as liquidity or non-performing loans on loan growth. Baltagi (2008) and Hsiao (2003) underscore the significance of fixed effects (FE) in accounting for unobserved, time-invariant heterogeneity, rendering it especially advantageous for banking research where institutional disparities are crucial.

Table 1: Variable definition

Variable	Definition and Formula	Expected Sign	Explanations/Justifications
Lending (lend)	The total amount of loans extended by the bank to its customers. Formula: Natural logarithm of gross lending to customers	Dependent variable	Lending is a crucial function of banks, contributing to their profitability and economic growth. Increased lending indicates a bank's commitment to supporting economic activity and development (Berger and Udell, 2006; Ghosh, 2015).
SIZE (Total Assets)	The total assets indicates the bank's lending capacity. Formula: Natural logarithm of gross lending to customers	Positive	A higher LTA indicates a greater proportion of assets allocated to loans, which suggests a more aggressive lending strategy. This can lead to increased lending activity and profitability (Beck and Levine, 2004; Ghosh, 2015).
CIR (Cost-to-Income Ratio)	A measure of a bank's efficiency, representing the ratio of operating costs to operating income. Formula: CIR = Operating Costs / Operating Income	Negative	A lower CIR indicates better efficiency in managing costs relative to income. Higher efficiency typically leads to increased lending capacity as banks can operate with lower cost structures (Athanasoglou et al., 2006).
NPLR (Non-Performing Loan Ratio)	The non-performing loan ratio represents the percentage loans that are in default or close to default. Formula: NPLR = (Non-Performing Loans)/ Total Loans	Negative	Higher NPL ratios signal increased risk for banks, leading to tighter lending standards and reduced lending activity. Banks may focus on risk management when NPLs are high (Ghosh, 2015; Klein, 2013).
INCM (Net Interest Margin)	A profitability measure indicates how efficiently a bank uses its assets to generate earnings. Formula: NIM ROA = Natural logarithm of total NIM	Positive	A higher profitability suggests better utilization of assets, which can lead to more funds being available for lending. More profitable banks are often more willing to extend loans (Berger and Mester, 1997).
LIQ (Total Liquidity Assets)	The ratio of a bank's liquid assets (such as cash or cash equivalents) to its total assets. Formula: Natural logarithm of Total Liquid Assets	Positive	A higher LIQ indicates that a larger proportion of the bank's assets are liquid, which allows banks to extend more loans. Increased liquidity typically leads to greater lending capacity (Berger and Bouwman, 2009; Allen and Gale, 2004).

This work leverages the simplicity and wide applicability of OLS, while the FE model enhances robustness by incorporating time-invariant, bank-specific components, so assuring that the analysis accurately represents authentic fluctuations in the data.

3.4. *Ordinary Least Squares (OLS) regression method*

The Ordinary Least Squares (OLS) model was initially employed to estimate the correlation between loan growth and the explanatory factors. The model is defined or described as:

$$LEND_{it} = \beta_0 + \beta_1 SIZE_{it} + \beta_2 INCM_{it} + \beta_3 CIR_{it} + \beta_4 LIQ_{it} + \beta_5 NPLR_{it} + \epsilon_{it}$$

where ϵ_{it} is the error term, i represents the bank, and t represents time.

4. Estimation Method

4.1.Summary statistics

The descriptive statistics provide a snapshot of the central tendency and dispersion for each variable. The variables are generally centered around their means with varying degrees of spread as indicated by their standard deviations. Notably, LEND, SIZE, INCM, and LIQ are logged variables, indicating that their original values span several orders of magnitude. The NPLR and CIR are ratios, with NPLR showing less variation compared to CIR.

Table 2: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
LEND	43	389.46	195.78	90.64	846.43
SIZE	43	794.49	422.58	172.99	1789.77
INCM	43	27.60	8.71	11.72	43.01
LIQ	43	89.07	51.47	23.497	225.35
NPLR	43	25.044	42.08	13.67	151.20
CIR	43	0.606	0.167	0.30	1.14

*Source: Authors' Calculations, * Figures are in billion Tk.*

4.2.Correlation structure

This correlation analysis provides insights into the relationships between key financial variables in the banking sector. The findings highlight significant associations that can guide future research and inform strategies for improving bank performance and stability. The high correlations among LEND, SIZE, and INCM suggest that these variables are closely related, likely reflecting the size and profitability of banks. These relationships can be further explored to understand their impact on bank performance. The moderate correlation between LIQ and SIZE indicates that liquidity management is crucial for larger banks. The weak correlation of CIR with other variables suggests that cost efficiency may not be directly related to size, liquidity, or asset quality, warranting further investigation into other factors affecting the cost-to-income ratio.

Table 3: Correlation matrix

Variables	(LEND)	(SIZE)	(INCM)	(LIQ)	(NPLR)	(CIR)
LEND	1.000					
SIZE	0.948***	1.000				
INCM	0.886***	0.866***	1.000			
LIQ	0.755***	0.851***	0.646***	1.000		
NPLR	0.225	0.295*	0.072	0.393***	1.000	
CIR	0.098	0.076	-0.203	0.226	0.260*	1.000

*Source: Authors' Calculations (Pairwise correlations), *** p<0.01, ** p<0.05, * p<0.1*

4.3. Regression results and discussion

We first went through OLS for the variables to find the relationships followed by a fixed effect model. A fixed effect model has more prudent results as the FE model controls for unobserved heterogeneity. We have discussed the results derived from the FE model here:

A fixed effects model is used to address the presence of unobserved differences among banks. This model accounts for time-invariant properties of each bank, enabling more precise estimations of the impacts of the explanatory variables. The fixed-effects regression model aims to analyze the impact of various economic factors on the dependent variable, LEND. The model accounts for unobserved heterogeneity by controlling for individual-specific effects within groups. A 1% increase in total assets is associated with a 1.256% increase in lending, holding other factors constant. This strong positive relationship is highly significant, indicating that larger asset bases contribute significantly to growth. Economically, this suggests that firms or entities with more assets have a higher capacity for generating or sustaining economic activities, profits, or other measures captured by more credit. The effect of interest margin on lending is positive but not statistically significant. This implies that variations in net interest margins do not have a consistent or significant impact on LEND within the context of this model. Economically, the net interest margin might be less critical for the outcome measured by lending compared to other variables.

A 1% increase in liquidity is associated with a 0.166% decrease in lending. This negative and significant relationship suggests that higher liquidity might be inversely related to the economic measure captured by an increase in loan disbursement. This indicates that holding too much liquidity might reduce investments or other activities that drive lending, possibly due to a preference for maintaining cash reserves rather than investing in growth opportunities. From 2019 to 2021 banks of Bangladesh faced excess liquidity and poor lending due to a lack of new investment. The effect of the non-performing loan ratio on lending is positive but not statistically significant. This implies a potential but uncertain relationship between non-performing loans and lending. While non-performing loans could theoretically impact economic outcomes (e.g., through credit risk), the data does not strongly support this within the model's context. A higher cost-to-income ratio is associated with a decrease in lending, with marginal significance. This indicates that higher operational inefficiencies in state-owned banks tend to reduce lending. Efficient cost management is crucial for better financial or economic performance, as suggested by the negative impact of higher efficiency on lending. The overall R-squared of the FE model is around 89.96% which is a bit on the higher side. R-squared values above 95% are often considered warning signs of potential overfitting, multicollinearity, or model misspecification. As the study is done only on the 4 state-owned banks of Bangladesh, we had to work with a small number of observations to reach an outcome. However, we have gone through a good

number of diagnostic tests to check the model i.e. VIF test, White test, Pesaran's test, etc.

Table 4: Ordinary Least Square regression

LEND	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
SIZE	.716	.129	5.53	0.000	.454	.978	***
INCM	.567	.164	3.45	0.001	.234	.9	***
LIQ	-.142	.079	-1.80	0.080	-.302	.018	*
NPLR	-.022	.513	-0.04	0.966	-1.061	1.018	
CIR	.499	.167	2.99	0.005	.161	.837	***
Constant	-3.287	1.889	-1.74	0.090	-7.115	.54	*

Mean dependent var	26.552	SD dependent var	0.553
R-squared	0.935	Number of obs	43
F-test	107.281	Prob > F	0.000
Akaike crit. (AIC)	-35.738	Bayesian crit. (BIC)	-25.171

**** p<.01, ** p<.05, * p<.1*

Table 5: Fixed Effects model

Fixed-effects (within) regression		Number of obs	= 43
Group variable: c_id		Number of groups	= 4
R-squared:		Obs per group:	
Within = 0.9620		Min	= 8
Between = 0.9416		Avg	= 10.8
Overall = 0.8996		Max	= 13
		F(5,34)	= 172.10
		Prob > F	= 0.0000

LEND	Coefficient	Std. err.	t	P>t	[95% conf.	interval]
SIZE	1.2556	0.1051	11.9	0.000	1.0419	1.4693
INCM	0.1269	0.1414	0.9	0.380	-0.1606	0.4144
LIQ	-0.1657	0.0495	-3.35	0.000	-0.2664	-0.0650
NPLR	0.5520	0.3273	1.69	0.100	-0.1132	1.2174
CIR	-0.2827	0.1472	-1.92	0.060	-0.5819	0.0164

Source: Authors' Calculations, *** p<.01, ** p<.05, * p<.1

The lack of statistical significance in the correlation between the Non-Performing Loan Ratio (NPLR) and lending can be ascribed to various variables. Initially, state-owned banks in Bangladesh may encounter political or regulatory pressure to emphasize socio-economic goals, persisting in lending despite elevated non-performing loans. Moreover, these banks frequently experience ineffective risk management systems, resulting in lending practices that inadequately consider credit risk. Loan restructuring strategies, which involve the rescheduling or reclassification of distressed loans, can obscure the actual magnitude of non-performing loans, hence diminishing the effect of the non-performing loan ratio on lending. Furthermore, state-owned banks may predominantly depend on collateral-based lending, prioritizing the security of collateral over borrower creditworthiness, hence diminishing the significance of NPLR in loan determinations. The reasons listed above contribute to the tenuous correlation between NPLR and lending, as evidenced in the study.

4.4. Diagnostic tests

4.4.1. Lagrangian multiplier (LM) test

The best model between a random effects model and a straightforward OLS (Ordinary Least Squares) model was identified using the Lagrangian Multiplier (LM) test. This test determines if the employment of a random effects model is justified when there is sufficient variance among entities, such as banks (Wooldridge, 2010). The Breusch and Pagan LM test's null hypothesis states that there are no random effects, meaning the variation among entities, represented by the symbol u, is zero (Breusch and Pagan, 1980). In this case, the LM test's p-value of 1.0000 suggests that there is no substantial variation between entities, so the null hypothesis cannot be rejected. As a result, the OLS regression model is more appropriate, and the random effects model is not warranted (Baltagi, 2021). The findings indicate that the variability in the dependent variable (LEND) is not influenced by individual-specific effects. Therefore, it is unnecessary to consider random effects to explain the observed variance fully. The explanatory variables and residual error adequately capture the variation. This outcome demonstrates the

homogeneity among entities in the panel, allowing for broad policy recommendations or business strategies to be formed from this model (Wooldridge, 2010; Baltagi, 2021).

Table 6: Panel data model estimation results

Variable	Variance (Var)	Standard Deviation (SD = sqrt(Var))
LEND (Dependent Variable)	0.3061	0.5533
idiosyncratic error (*e*)	0.0085	0.0921
random effects (*u*)	0	0

Table 7: Tests for random effects

Statistic	Value
Null Hypothesis (H_0)	σ^2_u=0 (No significant random effects)
Test Statistic ($\chi 2$)	0.00
p-value	1.00

4.4.2. Hausman Test

The Hausman test was conducted to determine whether a fixed or random effects model is more suitable for the data. The test checks for a correlation between unique errors and the regressors, with the null hypothesis suggesting no correlation. A p-value of 0.00, less than 0.05, led to rejecting the null hypothesis, indicating a significant coefficient difference between the models. This result suggests that the fixed effects model is more appropriate, as it captures individual-specific effects that the random effects model does not (Hausman, 1978; Baltagi, 2008; Wooldridge, 2010). Therefore, the fixed effects model should be preferred for this analysis.

Table 8: Hausman test

	Coef.
Chi-square test value	8.95
P-value	0.0028

Source: Author's Calculations

4.4.3. Pesaran's test

Pesaran's test was utilized to examine the presence of cross-sectional dependence. Panel data can be affected by cross-sectional dependence, which contradicts the concept of independence between entities and can introduce bias into the results (Pesaran, 2021; Baltagi, 2008). The results of Pesaran's test indicate that the assumption of cross-sectional independence does not hold for the given panel data (Beck and Katz, 1995). This finding has implications for the modeling and analysis of the data, suggesting the need to account for cross-sectional dependence in the regression models to ensure valid statistical inferences (Chamberlain, 1984; Hsiao, 2003; Cameron and Trivedi, 2009).

Table 9: Pesaran's test

Pesaran's test of cross-sectional independence	=	*6.178*	Pr = 0.0000
Average absolute value of the off-diagonal elements	=	*0.823*	

Source: Author's Calculations

4.4.4. Variance inflation factor test

The Variance Inflation Factor (VIF) values provided indicate the extent of multicollinearity among the independent variables in a regression model. A VIF value greater than 10 is typically a cause for concern, suggesting high multicollinearity (Hair et al., 2010; O'Brien, 2007). However, in this case, all VIF values are below this threshold. This indicates that multicollinearity is not a significant issue in the model. The 1/VIF values, which represent the tolerance, further confirm this with all values less than 1, signifying very low collinearity (Montgomery et al., 2012). The mean VIF is 4.48, reinforcing the conclusion that the variables marginally exhibit problematic multicollinearity (Allison, 1999). Thus, the model's independent variables are sufficiently independent, ensuring reliable coefficient estimates and valid statistical inferences (Field, 2013).

Table 10: Variance of inflation factor test

	VIF	1/VIF
SIZE	10.694	.094
INCM	6.384	.157
LIQ	4.343	.23
CIR	1.453	.688
NPLR	1.325	.755
Mean VIF	4.84	.

5. Conclusion

The outcome of this study suggests that lending in state-owned banks in Bangladesh is influenced by the size of banks, bank liquidity, and efficiency significantly. Regression analysis, in summary, offers significant new information on the variables affecting bank lending. Larger banks are thought to be better at granting credit due to their enormous resource bases and sophisticated risk management, as indicated by the extremely significant and positive coefficient for bank size (SIZE). This is consistent with economic theories that suggest larger banks have more lending capability due to economies of scale and improved diversity. Lending is positively impacted by the income variable (INCM), but statistically insignificantly. This suggests that state-owned banks could give other considerations more weight than income levels when making loan decisions, suggesting that borrower creditworthiness or general economic conditions may be given more weight than internal income. Lending and liquidity (LIQ) have a substantial inverse connection, indicating that lending activity may decline as liquidity levels rise. This is economically justified by banks' inclination to keep cash as a safety net against possible dangers, which lessens their willingness to lend, particularly in erratic economic times. Despite having a positive correlation with lending, the non-performing loan ratio (NPLR) shows marginal statistical significance, suggesting state-owned banks may provide loans on considerations that are not justified with standards being set. The fairly substantial negative coefficient of the cost-to-income ratio (CIR) suggests that lending operations may be restricted by greater operating expenses in relation to income. State-owned banks have a long history of inefficiency which is being justified with this current study. This demonstrates how crucial operational efficiency is to improving a bank's capacity to lend, bolstering the theory in economics that says cutting operational inefficiencies may free up resources for lending and other more fruitful uses.

The state-owned banks suffer from a number of problems including high non-performing loans and low efficiency. This study throws light into the issues of bank sustainable lending behavior of state-owned banks. To guarantee a stable and favorable lending environment, regulatory agencies should concentrate on optimizing bank size and maintaining sufficient liquidity levels. Furthermore, improving the operational efficiency of banks can have a substantial impact on their capacity to provide loans. A wider variety of macroeconomic and qualitative elements should be included by policymakers in regulatory frameworks to promote lending conditions that uphold financial stability and support economic growth such as policymakers may utilise the findings to establish laws that mitigate risks, such as ensuring state-owned banks uphold sufficient liquidity reserves while fostering sustainable loan expansion. Bank management can enhance efficiency by decreasing the cost-to-income ratio, resulting in improved profitability and lending practices without augmenting non-performing loans. Policymakers and bank management can enhance the oversight of non-performing loans, utilising the insights to enforce more stringent credit risk management policies that alleviate the risks linked to increased lending. Bank management may leverage the favourable association between size and loan growth to seek strategic expansions, including mergers or operational scaling, to augment lending capacity while ensuring stability.

The study has multiple shortcomings mostly concentrating on internal factors while omitting macroeconomic variables such as inflation and interest rates, which may also affect lending. The decade from 2012 to 2022 may not reflect long-term patterns or recent advancements, and the emphasis on state-owned banks restricts applicability to other banking institutions. Furthermore, several variables such as income and non-performing loan ratios had negligible significance, necessitating further investigation. Future research may encompass external macroeconomic variables, perform comparative analysis with private banks, increase time scope, and integrate qualitative insights to augment comprehension.

List of Abbreviations

FE : Fixed effect; LM: Lagrangian Multiplier; NPLR: Non-performing loan ratio; CIR: Cost to Income Ratio;VIF: Variance inflation factor;

Data availability: The datasets generated and analyzed during the current study are available on the Dhaka Stock Exchange, Investing.com, Macrotrends and the World Bank websites.

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Probir Kumar Bhowmik (0000-0002-4487-8144) is an accomplished academic and researcher, currently serving as an Associate Professor in the Department of Accounting and Information Systems at the University of Barishal, Bangladesh. Dr. Bhowmik completed his PhD in Finance from Huazhong University of Science and Technology (HUST), China, where he was awarded the Outstanding PhD Student Award. Dr. Bhowmik specializes in bank risk, corporate governance, and south Asian economy. He holds an MBA and BBA in Accounting from the University of Dhaka, maintaining an impressive academic track record. Dr. Bhowmik has over 12 years of teaching experience and previously worked as a Credit Analyst at IDLC Finance Limited. He has publications in prominent journals like Heliyon (Elsevier) and Sustainability (MDPI). He also serves as a reviewer for reputable journals, including Wiley, Emerald Insight, and Taylor & Francis. He is a founder member of the Bangladesh Business Research Foundation (BBRF). With an academic focus on green banking, financial economics, and business economics, Dr. Bhowmik is committed to advancing knowledge and mentoring future generations of scholars and professionals.

Gopal Karmakar (0009-0003-8078-6153) is a Lecturer in the Department of Business Administration at Varendra University, Bangladesh. He earned his Master of Business Administration (MBA) and Bachelor of Business Administration (BBA) in Accounting and Information Systems from University of Barishal. His research interests encompass ESG, Cost Accounting and AIS, Bank Performance, with a particular focus on bank performance and profitability. Karmakar's academic journey reflects his dedication to research, especially in the field of banking, where he has contributed to several publications. His work showcases his expertise and commitment to advancing knowledge in the financial sector.