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Bank Efficiency: What Matters in an Emerging Economy

Probir Kumar Bhowmik[1], Abdul Alim Baser[1]*, Shahadat Hussain[1], Shahadat Hussain[2],

[1]Department of Accounting and Information Systems; University of Barishal, Barishal, Bangladesh, [2]Department of Finance and Banking; University of Barishal, Barishal, Bangladesh. *Email: aabaser@bu.ac.bd

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ABSTRACT

This study investigates the determinants of bank efficiency in the banking sector, focusing on several key variables from 2011 to 2022. Initially, we applied Ordinary Least Squares (OLS) followed by feasible generalized least squares (FGLS) regression to analyze the panel dataset. The results show that the net operating profit after tax has a significant impact on CIR, suggesting that higher profitability improves efficiency. Conversely, the total assets exhibit a significant positive relationship with CIR, indicating that larger banks tend to have higher cost inefficiencies. The loan loss provisions also show a significant adverse effect, reflecting that higher provisions are associated with lower efficiency. However, the Operating Expenses variable does not significantly affect CIR. Additionally, liquidity demonstrates a significant negative impact, suggesting that higher liquidity reduces inefficiencies. These findings contribute to an understanding of the factors influencing bank efficiency and offer insights for policy and management strategies to enhance the performance of the banking sector.

Keywords: Bank Efficiency, FGLS, SIZE, Liquidity, NPL
JEL Classifications: G20, E52, M41, C33

1. INTRODUCTION

The banking sector plays a crucial role in a country's economic development by offering essential financial services and enabling the smooth flow of capital. Researchers have consistently shown interest in understanding the factors that influence bank efficiency, as this has significant implications for the performance and stability of the financial system (Sharma et al., 2013; Swank, 1996; Neuberger, 1998; Saunders & Schumacher, 2000). Bank efficiency is a crucial factor that enhances confidence, trust, and reliability within a country's banking system. According to Berger and Humphrey (1997), increased efficiency in banks leads to more robust performance, which helps banks remain competitive and resilient within the financial industry. A lack of soundness and trust may expose banks to default and insolvency risks. The prolonged underperformance of banks is often a precursor to bank failures, which can have a cascading effect on other economic sectors. Efficient banks generate a higher rate of return on costs than inefficient ones and contribute more effectively to triggering economic growth and development. Therefore, analyzing the efficiency of the banking sector is vital for policymakers, regulators, bank executives, and academics (Berger and Humphrey, 1997).

In the context of Bangladesh, an emerging economy, improving efficiency in the financial sector—particularly within the banking sector—is an urgent issue. To enhance the efficiency of bank management, the Government of Bangladesh established the National Commission on Money, Banking, and Credit in 1986. Additionally, a task force was established in 1991 to develop strategies and policies that foster growth in the banking sector. Numerous studies have explored the factors influencing bank efficiency in both developed and developing economies. As the banking sector evolves due to factors such as increasing competition, technological advancements, and regulatory changes, further research is necessary to investigate the dynamic interactions between these determinants and their broader implications for financial stability and resilience (Sun & Chi, 2009; Xu, 2011; Berger &

Mester, 1997). By gaining a comprehensive understanding of the complex relationships between bank-specific characteristics and efficiency, policymakers and bank managers can formulate more effective strategies to enhance the performance and competitiveness of the banking sector (Demirgüç-Kunt & Huizinga, 2010; Mamo, 2020). DeYoung, Evanoff, and Molyneux (2009) highlight that while North American bank mergers may improve efficiency, the mixed results on stockholder wealth creation suggest that the efficiency gains might not always translate into value for shareholders, contrasting with European mergers that appear to enhance both efficiency and stockholder value.

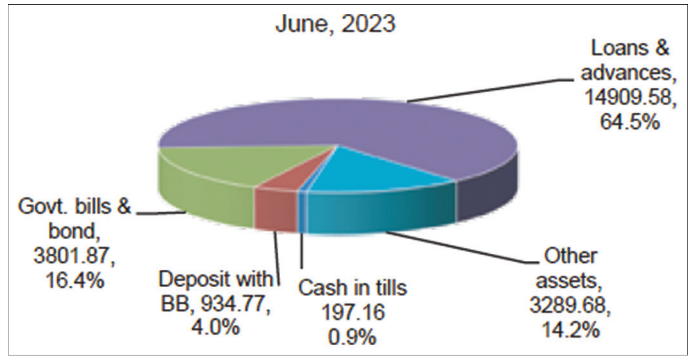
To the best of our knowledge, no recent studies have examined the key factors contributing to the improvement of bank efficiency in commercial banks in Bangladesh. This study aims to address this gap by providing empirical evidence. The study aims to identify the factors influencing bank efficiency in commercial banks in Bangladesh.

The remainder of this paper is organized as follows: The next section will review the existing literature. Section 3 will present the methodology and data used in the study. The empirical findings and discussions are provided in Section 4, while Section 5 concludes the paper.

According to the Bangladesh Bank, 61 scheduled banks in Fiscal Year 2023 could be classified into four categories. They are State Owned Commercial Banks (SOCBs) (6), Specialized Banks (SDBs) (3), Private Commercial Banks (PCBs) (43), and Foreign Commercial Banks (FCBs) (9). The number of bank branches increased to 11,088 at the end of December 2022. In 2023, the total loans and advances totaled BDT 14,909.58 billion (64.5% of total assets) (Chart 1). At the same time, the total deposits and total shareholders' equity were BDT 16,976.1 billion (73.4% of total Liabilities) and BDT 1,261.08 billion (5.5% of total Liabilities), respectively (Chart 2).

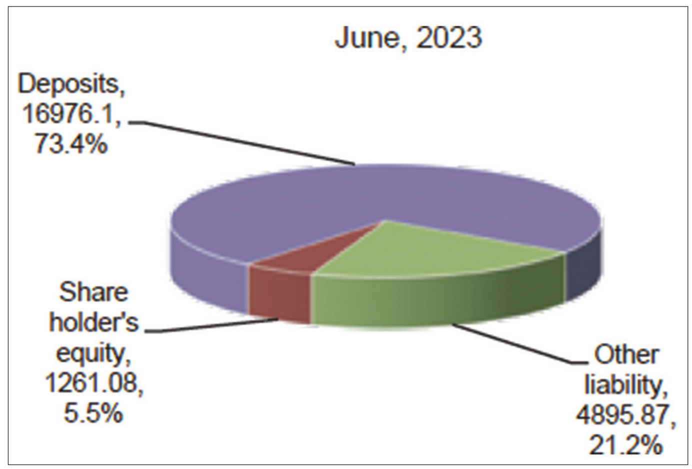
Table 1 shows that in 2022, the shares of the total assets of SCBs, PCBs, and FCBs were 24.2%, 67.8%, and 5.7%, respectively, compared to 24.9%, 67.4%, and 5.5% in 2021. At the end of December 2022, the banking sector's total assets stood at BDT 23142.8 billion, which was 13.28% higher than the previous year. Similarly, the total deposit of the banking sector stood at BDT 16981.2 billion in 2022, showing an increase of 11.9% compared to the previous year. From 2021 to 2022, considering the share in total deposits of the banking sector, SCBs' share decreased from 26.3% to 25.4%, PCBs' share increased from 66.8% to 67.1%, and FCBs' share increased from 4.2% to 4.7%.

Chart 1: Aggregate industry assets (billion BDT).



Source: Bangladesh Bank

Chart 2: Aggregate industry liabilities (billion BDT).



Source: Bangladesh Bank

2. LITERATURE REVIEW

The existing literature highlights the complex nature of bank efficiency, which can be categorized into two main types: technical efficiency and profit efficiency. Technical efficiency refers to the optimal utilization of resources to maximize output, while profit efficiency focuses on controlling production costs to maximize revenues. According to Burki and Ahmad (2010) and Sharma et al. (2013), a profit-generating firm can either be cost-efficient or revenue-efficient, as outlined by Badunenko et al. (2012). Bank efficiency is multifaceted and is influenced by various factors including banking performance, market competition, ownership structures, regulatory frameworks, technological advancements, macroeconomic conditions, and bank-specific factors (Arner et al., 2017; Basel Committee on Banking Supervision [BCBS], 2011).

One crucial aspect of bank efficiency is its impact on the real economy and financial stability. Efficient banks can better allocate funds from deposits to investment and financing activities, which in turn contributes to economic growth (Lantara et al., 2022). However, borrowers need to consider several factors, such as banking efficiency, price stability, financial structure, and operational systems, to ensure the overall stability of the financial sector (Yudaruddin et al., 2023; Bhowmik & Islam, 2025).

Bank-specific characteristics, such as profitability, liquidity, capital adequacy, and asset quality, are primary factors affecting bank efficiency (Bhowmik, Sarker, & Sharif, 2024). Profitability ratios like return on assets and return on equity measure a bank's income generation and resource utilization efficiency. Liquidity, reflected by the loan-to-deposit ratio, assesses the bank's capacity to meet short-term obligations. The capital-to-asset ratio determines capital adequacy, ensuring enough equity to absorb potential losses (Kartikasari et al., 2023). Finally, asset quality, measured through the non-performing loan ratio, highlights the

Table 1: Bank types, number of banks and their assets and deposits shares (in billion BDT)

Bank types	2021						2022					
	Number of banks	Number of branches	Total assets	Share in industry assets (in percent)	Total deposits	Share in industry deposits (in percent)	Number of banks	Number of branches	Total assets	Share in industry assets (in percent)	Total deposits	Share in industry deposits (in percent)
SCBs	6	3810	5080.5	24.9	3991.2	26.3	6	3836	5600.7	24.2	4324.6	25.4
SBs	3	1512	445.9	2.2	412.2	2.7	3	1523	539.1	2.3	467.8	2.8
PCBs	43	5550	13769.0	67.4	10136.0	66.8	43	5666	15688.3	67.8	11385.7	67.1
FCBs	9	65	1133.9	5.5	642.0	4.2	9	63	1314.7	5.7	802.9	4.7
Total	61	10937	20429.3	100	15181.4	100	61	11088	23142.8	100	16981.2	100

Source: Bangladesh Bank

bank's ability to manage credit risk (Jati, 2021; Altunbas et al., 2007; Bhowmik & Sarker, 2021).

Researchers have used structural and non-structural measures to assess bank efficiency. Structural measures, including cost efficiency, allocative efficiency, and scale efficiency, provide insights into internal operations and resource utilization (Mahendru and Bhatia, 2017). Non-structural measures, such as profitability ratios and market-based indicators, offer a broader view of bank performance within the financial system (Sharma et al., 2013).

The literature has widely explored the relationship between efficiency and banking performance. Regulatory and market pressures drive many banks to increase their capital levels through enhanced efficiency (Insani, 2021). Studies on Chinese banks, for instance, have found a negative correlation between efficiency and profitability (Li and Zhao, 2016; Lei et al., 2020), although banks can still increase profitability by improving efficiency.

Market competition also plays a significant role in influencing bank efficiency. Market concentration, competition, and ownership structure impact efficiency levels (Casu & Girardone, 2006). Berger et al. (2004) noted that market concentration could positively or negatively affect efficiency depending on the market structure and regulatory environment. Beck, Demirgüç-Kunt, and Levine (2006) suggested that while higher concentration can lead to greater stability, it might also lower competitive pressures and reduce efficiency. Foreign bank entry is another factor influencing efficiency. Claessens and Van Horen (2012) found that foreign banks enhance competition and efficiency, although the effects may vary by market conditions. García and Zarruk (2015) also supported that foreign bank presence generally improves market performance.

The regulatory framework shapes bank efficiency as well. Basel III regulations aim to strengthen banks' resilience but may also increase costs and affect efficiency (King, 2013). Pasiouras et al. (2009) pointed out that while stringent regulations improve efficiency by mitigating risks, they may impose additional costs. Technological advancements, particularly FinTech, are reshaping the banking landscape (Puschmann, 2017; Bhowmik & Islam, 2024). Gomber et al. (2018) and Philippon (2016) discussed how digital finance could reduce transaction costs and enhance efficiency, though new challenges, such as cybersecurity risks, must be addressed (Kashyap and Wetherilt, 2019).

Macroeconomic conditions, including inflation and economic stability, also influence bank efficiency. Boyd et al. (2001) argued that high inflation increases uncertainty and operational costs, thus eroding financial sector performance. The impact of economic conditions on bank efficiency varies across regions. Sufian (2009) found that unstable macroeconomic conditions in Malaysia negatively affected bank efficiency—market conditions, including competition, also foster efficiency. Claessens and Laeven (2004) found that competitive markets encourage banks to innovate and cut costs, thereby improving efficiency. Weill (2004) compared cost efficiency measures across European banks and highlighted the role of market conditions in shaping efficiency.

Comparative studies across regions reveal exciting findings. Fries and Taci (2005) showed that privatization and market reforms significantly improved bank efficiency in post-communist countries. In China, Berger et al. (2009) found that foreign ownership enhanced efficiency more than domestic ownership. Similarly, Sathye (2005) concluded that privatized Indian banks outperformed state-owned banks. Yildirim and Philippatos (2007) noted that competition and regulatory reforms have made banks in transition economies more efficient.

Bank-specific characteristics play a key role in determining efficiency. The literature highlights the importance of ownership structure, bank size, capital adequacy, and management practices (Burki and Ahmad, 2010; Sharma et al., 2013). Ownership structure, especially state versus private ownership, is significant. La Porta et al. (2002) and Cornett et al. (2010) found that privately owned banks are more efficient due to better management practices and stronger profit incentives. Micco et al. (2007) indicated that political influence in state-owned banks often leads to inefficiencies. Foreign-owned banks, meanwhile, tend to be more efficient due to better managerial practices and access to global resources (Lensink et al., 2008; Amel et al., 2004).

Bank size also influences efficiency, with larger banks often exhibiting higher technical and scale efficiency (Usman et al., 2010), potentially due to economies of scale. Capital adequacy, measured by the ratio of equity to total assets, positively impacts bank efficiency by providing a cushion against risks (Burki and Ahmad, 2010). Finally, quality management practices, including strong risk management and operational controls, are essential for efficiency (Burki and Ahmad, 2010).

In summary, the literature emphasizes bank efficiency's complex and multifaceted nature. Various factors, including ownership structure, bank size, capital adequacy, management practices, market competition, regulatory frameworks, and macroeconomic conditions, all play a role in shaping bank performance and efficiency. Policymakers and bankers must understand these dynamics to improve the financial system's performance and resilience (Svirydzenka, 2016). Further research is necessary to explore the interplay between these factors and their impact on financial stability (Sharma et al., 2013; Bono, 2020; Li and Zhao, 2016; Sun and Chi, 2009; Xu, 2011).

3. DATA, VARIABLE DEFINITION, AND METHODOLOGY

3.1. The Data

We have used balance sheet data from 31 commercial banks, covering 12 years from 2011 to 2022. New banks that have not been in operation for at least 5 years are excluded from the analysis. All the major banks have been taken into consideration. Three hundred thirty-five observations have been arranged to make panel data for regression. The natural logarithm was taken where figures represented amounts rather than percentages of proportions. We have taken the natural logarithm for bank total lending, amount of non-performing loans, and total operating expenses. Other variables are in either proportion or percentile form. In this research, STATA 17 was used to perform the econometric analysis.

3.2. Methodology and Variable Definition

The econometric form of the model is as follows:

The panel data estimations enable the control of both observable and unobservable heterogeneity at the bank and temporal levels. The empirical model specification for this study is as follows:

$$Efficiency_{ij} = \beta_0 + \beta_{1*}(Profitability)_{ij} + \beta_{2*}(Size)_{ij} + \beta_{3*}(Risk)_{ij} + \beta_{4*}(Op.\ Expense)_{ij} + \beta_{5*}(Liquidity)_{ij} + e_{ij}$$

Where CIR represents the Cost-Income Ratio, α is the constant term, lnNOPAT represents the natural logarithm of Net Operating Profit After Tax (Profitability), lnTA shows the natural logarithm of Total Assets (Size), lnLLP shows the natural logarithm of Loan Loss Provisions (Risk), lnOPEX represents the Operating Expenses, and lnLIQ represents the natural logarithm of Liquidity (Liquidity). The parameters estimate of lnNOPAT, lnTA, lnLLP, lnOPEX, and lnLIQ are represented by β_1, β_2, β_3, β_4, and β_5, and ϵ represents the white noise error term. We have taken the natural logarithm of the variables in amount.

The dataset examines several financial indicators, with a focus on Operating Expense (lnOPEX), which is crucial for understanding a firm's cost structure and efficiency. lnOPEX has a mean of 0.098 with a standard deviation of 0.096, indicating moderate firm variability (Table 2). The range of lnOPEX, from −0.255 to 0.545, suggests that while most firms operate within a relatively narrow cost framework, there are instances where operating expenses exceed revenue, as reflected by negative values. This could indicate operational inefficiencies or external shocks impacting firms' cost structures. High operating expenses relative to income often correlate with diminished profitability as firms struggle to manage costs effectively. These variations in lnOPEX, in conjunction with other variables like CIR (Cost-to-Income Ratio) and lnLIQ (Liquidity), provide insight into the economic performance and risk exposure of the firms within the dataset, highlighting the importance of cost control in maintaining profitability.

4. ANALYSIS AND FINDINGS

Several key correlations were observed in this study, exploring the relationships between financial variables and firm performance. The cost-income ratio showed negative correlations between long-term liabilities, total assets ratio, and liquidity. Net Operating Profit After Tax is negatively correlated with, but positively correlated with, total assets and liquidity.

Table 2: Descriptive statistics

Variable	Obs	Mean	Standard deviation	Min	Max
CIR	335	1.0350	9.206	(6.285)	167.851
lnNOPAT	335	19.964	4.887	0000	22.980
lnTA	335	26.205	0.862	22.698	28.240
lnLLP	335	18.946	6.276	0000	23.951
lnOPEX	335	0.0980	0.096	(0.255)	0.545
lnLIQ	335	24.021	0.785	21.843	26.499

Table 3: Results of pairwise correlations

Variables	(CIR)	(lnNOPAT)	(lnTA)	(lnLLP)	(lnOPEX)	(lnLIQ)
CIR	1.000					
lnNOPAT	(0.202)***	1.000				
lnTA	(0.007)	0.234***	1.000			
lnLLP	(0.168)***	0.150***	0.358***	1.000		
lnOPEX	(0.052)	0.033	(0.129)**	(0.072)	1.000	
lnLIQ	(0.043)	0.195***	0.892***	0.254***	(0.110)**	1.000

***P<0.01, **P<0.05, *P<0.1

Table 4: Results of linear regression

Source	SS	df	MS	Number of obs	=	335
Model	2379.9336	5	475.98672	F (5, 329)	=	6.04
Residual	25927.815	329	78.807948	Prob >F	=	0
Total	28307.749	334	84.753738	R-squared	=	0.084
				Adj R squared	=	0.07
				Root MSE	=	8.877

CIR	Coefficient	Standard Error	t-value	P-value	[95% Conf	Interval]	Significant
lnNOPAT	(0.375)	0.103	(3.65)	0000	(0.577	(0.173)	***
lnTA	3.544	1.316	2.69	0.007	0.955	6.134	***
lnLLP	(0.286)	0.084	(3.40)	0.001	(0.452)	(0.121)	***
lnOPEX	(4.236)	5.106	(0.83)	0.407	(14.28)	5.809	
lnLIQ	(2.999)	1.385	(2.17)	0.031	(5.722)	(0.275)	**
Constant	(6.490)	15.861	(0.41)	0.683	(37.692)	24.713	

Mean dependent var	1.035	SD dependent var	9.206
R-squared	0.084	Number of obs	335
F-test	6.040	Prob >F	0.000
Akaike crit. (AIC)	2419.584	Bayesian crit. (BIC)	2442.469

***P<0.01, **P<0.05, *P<0.1

Table 5: Results of cross-sectional time-series FGLS regression

CIR	Coefficient	Standard Error	t-value	P-value	[95% Conf	Interval]	Significant
lnNOPAT	(0.375)	0.102	(3.68)	0000	(0.574)	(0.175)	***
lnTA	3.544	1.305	2.72	0.007	0.987	6.101	***
lnLLP	(0.286)	0.083	(3.43)	0.001	(0.450)	(0.123)	***
lnOPEX	(4.236)	5.060	(0.84)	0.403	(14.153)	5.682	
lnLIQ	(2.999)	1.372	(2.19)	0.029	(5.688)	(0.309)	**
Constant	(6.490)	15.719	(0.41)	0.680	(37.298)	24.318	

Mean dependent var	1.035	SD dependent var	9.206
Number of obs	335	Chi-square	30.750
Prob>chi2	1.000	Akaike crit. (AIC)	2419.584

***P<0.01, **P<0.05, *P<0.1

Total assets exhibited positive correlations with profitability, risk, and liquidity (Table 3).

Risk was negatively correlated with efficiency and Operating Expenses, but positively correlated with profitability, size, and liquidity. Operating expenses were negatively correlated with bank risk, while liquidity was positively correlated with profitability, size, and bank risk. These findings underscore the intricate interrelationships among financial variables, providing valuable insights for managerial and investment decision-making processes.

Initially, we conducted an OLS regression model (Table 4), followed by a Generalized Least Squares (GLS) regression model, given the results of Pesaran's test of cross-sectional independence. Pesaran's test indicates significant cross-sectional dependence among observations within the panel dataset, implying that observations within the same cross-section are likely correlated, thereby violating the assumption of independence typically assumed in Ordinary Least Squares (OLS) regression (Pesaran, 2004). GLS is a suitable technique for panel data when issues such as heteroskedasticity and serial correlation exist, and it can also accommodate cross-sectional dependence (Baltagi, 2008). Using GLS, we can simultaneously account for heteroskedasticity and cross-sectional dependence. This method can potentially enhance the efficiency of parameter estimates compared to OLS, as it enables weighting observations based on their variances and covariances (Greene, 2012).

Additionally, GLS regression (Table 5) is robust to violations of assumptions such as homoskedasticity and independence, making it a suitable choice when dealing with correlated data (Wooldridge, 2010). However, ensuring that the GLS model is correctly specified is essential, which may require estimating the covariance structure appropriately to account for the observed cross-sectional dependence. Common covariance structures used in GLS for panel data include the feasible generalized least squares (FGLS) estimator or employing a spatial or time-series covariance structure (Baltagi, 2008). Therefore, considering the significant cross-sectional dependence indicated by Pesaran's test, using a GLS regression model would be a reasonable approach to account for this dependence and obtain efficient parameter estimates. In this paper, the cost-income ratio is used as the dependent variable to represent the bank's efficiency. The independent variables are Net Operating Profit After Tax (lnNOPAT), Total Assets (lnTA), Loan Loss Provisions (lnLLP), Operating Expenses (lnOPEX), and liquidity (lnLIQ). Therefore, the model can be written as CIR = f(lnNOPAT, lnTA, lnLLP, lnOPEX, lnLIQ).

The linear regression analysis reveals a negative relationship between efficiency and profitability, bank risk, liquidity, and operating expenses.

4.1. Cross-sectional Time-series FGLS Regression

This study uses panel data analysis to investigate the determinants of financial performance in Bangladesh's banking sector. Employing generalized least squares (GLS) regression, the analysis examines various financial indicators and their impacts on bank performance. The findings reveal that higher net operating profit after tax is associated with a lower Cost-Income Ratio (CIR), indicating that increased profitability enhances operational efficiency and financial performance. Conversely, banks with larger total assets tend to exhibit higher CIR, suggesting that while economies of scale may exist, they do not necessarily lead to cost efficiency.

Additionally, increased provisions for loan losses are associated with a lower CIR, underscoring the importance of prudent risk management practices in enhancing overall efficiency. The study also finds that operating expenses do not significantly impact CIR, implying that variations in these expenses may not critically affect cost efficiency in this context. Higher liquidity levels are associated with a lower CIR, indicating that excess liquidity might negatively impact profitability and emphasizing the need for balanced liquidity management.

These findings underscore several key strategies for enhancing the financial performance of banks in Bangladesh. First, banks should strive to increase their net operating profit after tax to improve operational efficiency through diverse income streams and effective cost management practices. Second, larger banks must carefully manage their total assets to avoid inefficiencies, leveraging technology and optimizing processes to maintain economies of scale. Third, prudent provisioning for loan losses is crucial, and banks should adopt robust risk management frameworks to ensure adequate provisioning and minimize potential financial risks. Fourth, maintaining a lean cost structure through efficient management can contribute to overall financial health despite the non-significant impact of operating expenses. Ultimately, maintaining optimal liquidity levels is crucial, as banks must manage their liquidity to ensure sufficient reserves without compromising profitability.

This analysis provides valuable insights into the financial dynamics of the banking sector in Bangladesh, highlighting that the efficient management of profitability, risk, and liquidity is crucial for enhancing cost efficiency and overall financial performance. Policymakers and bank managers can leverage these findings to formulate strategies that promote stability and growth within the sector. Further investigation into the specific nature of operating expenses and other influential factors could offer a deeper understanding and additional opportunities for improvement.

- Coefficients: Generalized least squares
- Panels: Homoskedastic
- Correlation: No autocorrelation

4.2. Variance inflation factor

The Variance Inflation Factor (VIF) table (Table 6) presents measures of multicollinearity among predictor variables in a regression analysis. In this table, variables such as lnTA and lnLIQ exhibit relatively high VIF values (>5), indicating potential multicollinearity issues with other variables in the model, which may obscure the interpretation of their coefficients. Conversely, lnLLP, lnNOPAT, and lnOPEX have VIF values close to 1, suggesting low multicollinearity. The 1/VIF values indicate the degree to which the variance of regression coefficients is inflated due to multicollinearity, with values closer to 1 indicating less inflation. While some variables may require closer examination or possible treatment for multicollinearity, most of the predictors appear to be reasonably independent in the model.

4.3. Test of Heteroscedasticity

White's test is used to assess the presence of heteroskedasticity (unequal variances) in a regression model. The test statistic follows a chi-squared distribution with degrees of freedom equal to the number of regressors in the model. In your case, the test statistic is Chi-square (20) = 152.47 with a P = 0.0000 (Table 7), indicating strong evidence against the null hypothesis of homoskedasticity. Therefore, you would reject the null hypothesis in favor of the alternative, suggesting the presence of heteroskedasticity in the model.

Cameron and Trivedi's decomposition of the IM-test is likely referring to a decomposition of the LM (Lagrange Multiplier) test for heteroskedasticity proposed by Cameron and Trivedi. This test is often used to diagnose the source of heteroskedasticity in a regression model, whether it's due to omitted variables, functional form misspecification, or other reasons. However, without the

Table 6: Variance inflation factor

Variables	VIF	1/VIF
lnTA	5.462	0.183
lnLIQ	5.013	0.199
lnLLP	1.181	0.847
lnNOPAT	1.069	0.936
lnOPEX	1.023	0.978
Mean VIF	2.75	.

Table 7: Results of Cameron and Trivedi's decomposition of IM-test

Source	Chi-square	df	P-value
Heteroskedasticity	152.47	20	0.0000
Skewness	31.94	5	0.0000
Kurtosis	1.02	1	0.3127
Total	185.42	26	0.0000

Table 8: Results of Breusch and Pagan lagrangian multiplier test for random effects

Source	Var	SD=sqrt (Var)
CIR	84.75374	9.206179
e	80.84619	8.991451
u	0	0

Test: Var (u)=0, Chi-square (01)=0.00, Prob>Chi-square=1.0000

specific results of the decomposition, it's hard to provide further interpretation.

White's test
- H_0: Homoskedasticity
- H_a: Unrestricted heteroskedasticity
- Chi-square (20) = 152.47
- Prob > Chi-square = 0.0000.

4.4. Breusch and Pagan Lagrangian Multiplier Test for Random Effects

The Breusch and Pagan Lagrangian multiplier test for random effects (Table 8) was conducted to assess individual-specific (random) effects in a panel data regression model. The estimated results indicate that the individual-specific effects (u) variance is very close to zero (0), suggesting little variation in the effects across individuals once the model's covariates are considered. The standard deviation (SD) of the error term (e) is estimated to be 8.991451, while the SD of the composite error term (CIR) is 9.206179. The test statistic for the random effects variance is Chi-square (01) = 0.00, with a P = 1.0000, indicating that there is no significant variation in the individual-specific effects beyond what is captured by the model's covariates. Therefore, the findings imply that the random effects model may not be necessary for explaining the data, and a fixed effects model or a pooled OLS model might be more appropriate for further analysis.

4.5. Pesaran's Test of Cross-sectional Independence

Pesaran's test of cross-sectional independence was conducted to examine whether observations across different cross-sections (units) are independent in a panel dataset. The test statistic is 4.162 with a P = 0.0000, indicating strong evidence against the null hypothesis of cross-sectional independence. This suggests that significant cross-sectional dependencies are present in the data, meaning that observations within the same cross-section are likely correlated. Additionally, the average absolute value of the off-diagonal elements, which measures the average pairwise correlation between cross-sections, is 0.376. These results imply substantial correlation or similarity among observations within different units, potentially violating the independence assumption across cross-sections. Researchers should consider these dependencies carefully in their analysis, as ignoring them could lead to biased estimates and incorrect inferences. Techniques accounting for cross-sectional dependence, such as panel data models or robust standard errors, may be warranted to obtain reliable results.
- Pesaran's test of cross sectional independence = 4.162, Pr = 0.0000
- Average absolute value of the off-diagonal elements = 0.376.

5. CONCLUSION

Analyzing the determinants of the banking sector's Cost-to-Income Ratio (CIR) reveals significant insights into the factors influencing bank efficiency. The study highlights that higher profitability, as indicated by the natural logarithm of net operating profit after tax (lnNOPAT), significantly reduces the CIR, underscoring the importance of profitability in enhancing bank efficiency. On the other hand, larger banks, reflected by the natural logarithm of total assets (lnTA), tend to exhibit higher cost inefficiencies, suggesting that scale does not necessarily translate to efficiency.

Furthermore, the negative relationship between the natural logarithm of loan loss provisions (lnLLP) and CIR indicates that banks with higher loan loss provisions tend to be more efficient, possibly due to better risk management practices. The study also finds that Operating Expenses (lnOPEX) do not significantly impact CIR, implying that operating expenses alone are not decisive in determining bank efficiency. Lastly, the significant negative impact of the natural logarithm of liquidity (lnLIQ) on CIR suggests that higher liquidity levels contribute to improved efficiency, highlighting the role of liquidity management in achieving cost efficiency. These findings provide a comprehensive understanding of the factors influencing bank efficiency, which can be instrumental in guiding policy and management strategies to enhance the performance of the banking sector. In conclusion, the regression results reveal several key economic insights for the banking sector. Firstly, the coefficient for lnNOPAT (Net Operating Profit After Tax) indicates a significant negative relationship with CIR (Cost-to-Income Ratio), implying that higher profitability is associated with a lower cost-to-income ratio, which is crucial for banks' efficiency. This suggests that banks with higher profits tend to operate more efficiently in terms of cost management. Secondly, lnTA (Natural Logarithm of Total Assets) shows a positive relationship with CIR, indicating that larger banks tend to have higher cost-to-income ratios, possibly due to economies of scale diminishing. This highlights a challenge for larger banks to maintain efficiency as they grow.

Additionally, the negative coefficient for loan loss provision suggests that higher provisions for loan losses are associated with lower cost-to-income ratios, indicating the importance of risk management practices. However, operating expenses do not significantly affect CIR, suggesting that controlling operating expenses alone may not have a substantial impact on efficiency. Moreover, liquidity (LIQ) exhibits a negative relationship with CIR, suggesting that more liquid banks tend to have lower cost-to-income ratios, possibly because liquidity enables smoother operations and reduces funding costs. Overall, these findings highlight the importance of profitability, risk management, and asset size management for banks in maintaining operational efficiency. However, a limitation of this study is that it is conducted based on commercial banks and does not incorporate multiple macroeconomic variables, such as GDP and inflation. Further study could be done using other specialized or public commercial banks incorporating the key macroeconomic variables.

The study's main limitation is that it could have been conducted from a broader perspective within the South Asian economic context. Due to data inaccessibility, the study's scope could not be extended. However, the current study will hopefully add value to the existing literature and may help understand the reasons for banks' inefficiency, which is a significant threat to the existence of banks in the economy.

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