Impact of off-balance sheet activities on bank profitability: Evidence from Bangladesh

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Abstract
Purpose: This study explores the role of off-balance sheet (OBS) activities in enhancing bank profitability in Bangladesh. In this emerging economy, banks increasingly rely on such exposures to diversify revenue streams. Despite their growing significance, the impact of OBS activities—such as loan commitments, guarantees, and derivatives—on profitability remains underexplored in similar contexts.

Methods: Using a panel dataset of Bangladeshi banks, the study employs Generalized Least Squares (GLS) and Panel Corrected Standard Errors (PCSE) models to address key methodological challenges, including heteroskedasticity and cross-sectional dependency. These techniques ensure robust and reliable findings.

Results: The findings reveal a positive and statistically significant relationship between OBS activities and bank profitability, emphasizing their role in enhancing financial performance without increasing balance sheet risks. This relationship holds even after controlling for factors such as bank age, credit risk, lending practices, bank size, GDP growth, and the COVID-19 pandemic.

Limitations: The study focuses on a single emerging economy, which may limit the generalizability of the findings. Additionally, the dataset spans a specific period, restricting insights into long-term effects.

Contribution: This research contributes to the limited literature on OBS activities in emerging markets, providing valuable insights for bank managers and policymakers. Managers can leverage OBS activities to boost profitability, while regulators must maintain oversight to ensure financial stability. The study also offers a foundation for future research on long-term dynamics and cross-country comparisons.

Keywords: *Off-balance sheet risk, ROA, ROE, GLS, PCSE, GDP, COVID, Emerging economies, banking strategies, profitability drivers.*

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1. Introduction

The banking industry is regarded as one of the most fundamental economic pillars because of the nature of its operations, which include using depositor funds and investing shareholder funds. It also creates potential links and obligations through off-balance sheet activities. In recent years, off-balance sheet (OBS) banking operations have expanded quickly. OBS activities' risk-based capital requirements are predicated on the idea that certain OBS operations subject banks to extra, potentially excessive risk (Hassan, 1993). Differences in OBS exposure are linked to cross-sectional variations in interest-rate risk and liquidity risk, and OBS activities promote a more diversified, margin-generating asset-based approach than deposit or equity financing (Angbazo, 1997). Continuous regulatory changes and

advancements in technologies have been shaping the banking industry thereby moving banks' activities to some uncharted business areas such as off-balance sheet activities. The exposure to off-balance sheet risk brings more risk to banks compared to those involved with traditional lines of banking business (Papanikolaou & Wolff, 2014). Despite such exposures to risks, banks have increasingly engaged in off-balance sheet (OBS) activities, including loan commitments, guarantees, derivatives, and other contingent liabilities in recent decades. These activities do not appear directly on the balance sheet but represent significant exposures that can affect the financial health and profitability of banks. However, proper management of off-balance sheet risk is risk-reducing and profit generators (Khasawneh & Al-Khadash, 2014). On the contrary, foreign exchange rate risk and bank-specific risk have a favorable relationship with OBS operations. This suggests that the foreign exchange and bank-specific risk exposures of Turkish banks are increased by OBS operations. The positive correlation could be a caution to banks about their speculative use of OBS transactions in the market (Aktan, Chan, Žiković, & Evrim-Mandaci, 2013). If we observe the recent findings particularly post-financial crisis regime, Banks' exposure to OBS was greatly decreased when the new capital regulatory framework criteria were implemented (Calice & Savoia, 2024).

Based on this backdrop, this study bridges the gap on whether OBS activities of an emerging economy like Bangladesh have any impact on the profitability of the banks. It further explores how these activities contribute to the financial dynamics of the banking sector, considering the unique regulatory and economic environment. Additionally, this study sheds light on the role of OBS activities as a strategic tool for banks to enhance profitability while managing risk. Controlling for variables such as bank age, credit risk, lending aggressiveness, bank size, economic growth, and the effects of the COVID-19 pandemic, this research provides a comprehensive analysis of factors influencing profitability within the context of Bangladeshi banks. Furthermore, the rapid growth of OBS activities has sparked interest among scholars, practitioners, and regulators who seek to understand the implications of these exposures on bank profitability, particularly in emerging markets like Bangladesh.

The significance of this study is underscored by the dual role of OBS activities. While they can generate income and diversify revenue, they also introduce unique risks that can destabilize the financial system if not properly managed. In Bangladesh, where the banking sector faces challenges, such as rising non-performing loans, limited capital, and regulatory scrutiny, understanding the impact of OBS exposure is crucial. The findings of this study can guide bank managers in optimizing their income strategies while mitigating potential risks. Furthermore, insights gained from this research may assist policymakers in designing regulatory frameworks that address the specific needs of the Bangladeshi banking sector. By focusing on Bangladesh, this study contributes to the existing body of knowledge and provides a region-specific perspective that can support banking strategies and policy decisions.

2. Literature review
Finding the significant global drivers of bank profitability has received a lot of attention. Banks' profitability is influenced by both external and internal factors, which are referred to as macroeconomic and bank-specific, respectively.

2.1 Off-Balance sheet activities and profitability
In recent years, off-balance sheet (OBS) banking activities have expanded rapidly. Risk-based capital requirements assume that certain OBS operations may expose banks to additional, potentially excessive risk (Hassan, 1993). For instance, Zhang, Chen, and Jin (2020) analyzed the impact of off-balance sheet regulations on Chinese banks' risk-taking behavior. Their findings revealed that the rapid development of OBS innovation encourages banks to take on more risks. Similarly, Papanikolaou and Wolff (2014) investigated how modern banking practices, including off-balance sheet leveraging operations, influence the risk profiles of U.S. banks and systemic risk levels. They noted that banks focusing on traditional business lines typically exhibit lower risk profiles compared to those dealing with modern financial instruments like OBS exposures. These studies underscore that OBS activities can significantly affect banks' risk behavior and raise concerns about systemic stability in the banking sector.

However, while the risk implications of OBS activities have been well-documented, their direct influence on bank profitability remains less conclusive. For instance, Khasawneh and Al-Khadash (2014) examined risk and profitability in the Middle East and North African banking system and found that OBS activities strongly influence commercial bank profitability. In Islamic banks, risk is particularly sensitive to OBS activities, underscoring their nuanced role in profitability. Similarly, Hindi and Sundaram (2002) found a negative and significant relationship between OBS activities and the profitability of large U.S. banks, as measured by return on assets (ROA) and return on equity (ROE). Aktan et al. (2013) highlighted the dual effects of OBS activities, noting that while they enhance banks' stock returns, they negatively affect ROE. In contrast, Khasawneh and Al-Khadash (2014) discovered that OBS activities help Middle Eastern and North African banks generate profits while simultaneously lowering risk. Al-Tahat and AbuNqira (2016) further expanded on this by showing that OBS activities are positively associated with liquidity risk, market risk, and revenue growth in Jordanian commercial banks, although they negatively impact capital adequacy risk.

In Bangladesh, the findings are similarly varied. M. M. Rahman, Hamid, and Khan (2015) studied 25 commercial banks and found that OBS activities negatively affect profitability. This finding aligns with Majumder and Uddin (2017), who reported a negative impact of OBS activities on the profitability of nationalized banks. On the other hand, Matin (2017) observed that OBS activities positively impacted ROA, suggesting that their effect on profitability might vary depending on the specific metric or context. The above findings illustrate that while OBS activities can act as a double-edged sword—potentially enhancing certain aspects of financial performance while undermining others—their overall impact on profitability is far from universally agreed upon. Factors such as regulatory environments, risk management practices, and the types of OBS instruments employed appear to play critical roles in determining outcomes.

Despite the growing body of literature on OBS activities, a consensus on their profitability implications remains elusive, particularly in the context of emerging economies like Bangladesh. Prior studies offer conflicting evidence, with some highlighting positive effects on metrics like ROA (Matin, 2017) and others pointing to negative impacts on profitability (M. M. Rahman et al., 2015); (Majumder & Uddin, 2017). This divergence highlights the need for a nuanced examination of OBS activities in varying institutional and economic contexts.

Given these gaps and inconsistencies, this study seeks to bridge the divide by focusing on Bangladesh, where OBS activities have gained prominence amid an evolving regulatory and economic landscape. By building on prior findings, this study aims to provide a clearer understanding of whether and how OBS activities influence bank profitability in emerging markets.
H1.a: Off-balance sheet activities have a significant impact on the profitability of banks.

2.2 Age and Profitability
Ilaboya and Ohiokha (2016) examined the connection between a company's age, size, and profitability through the lens of structural inertia. Their findings suggested that bank age positively and significantly impacts profitability, indicating that older banks benefit from accumulated experience, established customer bases, and operational stability. Conversely, M. J. Rahman and Yilun (2021), in their study of firm age, size, and profitability, observed a negative relationship between firm age and profitability. They posited that as firms age, they may face diminishing efficiency or increased rigidity, which can hinder profitability, although firm size exhibited a positive association with profitability.

In the Bangladeshi context, Hossain and Saif (2019) analyzed the effects of size, age, and the presence of independent directors on the profitability of banks. They reported a negative relationship between age and profitability, suggesting that older banks in Bangladesh might struggle to adapt to rapidly changing market conditions or may bear higher legacy costs, impacting their financial performance.
The contrasting findings in the literature underscore the complexity of the relationship between bank age and profitability. On one hand, older banks are often perceived as more reliable and capable of leveraging their extensive networks and experience for competitive advantage (Ilaboya & Ohiokha,

2016). On the other hand, aging institutions may also encounter challenges such as organizational inertia, inefficiency, and difficulty in embracing innovation, leading to diminishing returns (Hossain & Saif, 2019; M. J. Rahman & Yilun, 2021).

These differences highlight the context-dependent nature of the age-profitability relationship. In developed economies, the benefits of maturity may outweigh the drawbacks, while in emerging markets like Bangladesh, where regulatory and technological environments are rapidly evolving, older banks may find it harder to remain competitive. Furthermore, firm-specific factors such as management quality, market positioning, and adaptability play critical roles in determining how age influences profitability.

Given these findings, this study seeks to clarify whether the age of banks in Bangladesh positively or negatively impacts profitability. By focusing on this context, the study contributes to the broader discourse on structural inertia and its implications for financial performance in emerging economies.
H1.b: Banks' age has a significant impact on the profitability of the banks.

2.3 Credit risk and profitability

Credit risk, often measured through indicators such as non-performing loan ratios (NPLR) and loan loss provisions, plays a critical role in determining the profitability of banks. Ebenezer and Omar (2016) observed a negative and significant relationship between credit risk (as measured by NPLR) and profitability. They also noted a negative but insignificant relationship between financial leverage and profitability, highlighting the complex interplay of risk factors. Gizaw, Kebede, and Selvaraj (2015) studied Ethiopian commercial banks and found that credit risk indicators, including NPLs, loan loss provisions, and capital adequacy, significantly impacted profitability, indicating that increased credit risk reduces earnings. On the other hand, Buchory found a positive and significant effect of credit risk on bank profitability, suggesting that under certain conditions, managing credit risk efficiently could enhance financial performance. In Bangladesh, Bhuiya, Miah, and Chowdhury (2023) examined the impact of credit risk on profitability and reported that macroeconomic factors such as GDP, alongside NPLR and loan loss provision ratio (LLPR), significantly lowered the return on equity (ROE). Moreover, they discovered that return on assets (ROA) was significantly influenced by NPLR and the loan-to-deposit ratio (LATD), reinforcing the notion that credit risk negatively impacted various measures of profitability. While examining the impact of credit risk on profitability, Aluonzi, Byamukama, Marus, and Charity (2024) found that risk identification, assessment, and control have a significant and positive impact on the profitability of the bank.

The literature presents mixed findings regarding the effect of credit risk on bank profitability. While some studies (Bhuiya et al., 2023; Ebenezer & Omar, 2016) emphasize the negative impact of credit risk, others (e.g., Buchory) argue that effective management of credit risk could potentially enhance profitability. This dichotomy highlights the importance of contextual factors such as regulatory environments, credit risk management practices, and macroeconomic conditions in shaping the relationship between credit risk and profitability.

In emerging economies like Bangladesh, where credit risk levels are influenced by factors such as high NPL ratios, limited recovery mechanisms, and economic volatility, the negative impact of credit risk on profitability may be more pronounced. At the same time, variations in findings across studies suggest the potential for nuanced outcomes based on the measurement of credit risk (e.g., NPLR, LLPR) and profitability (e.g., ROE, ROA). By synthesizing prior research, this study seeks to address the gap in understanding how credit risk influences bank profitability within the Bangladeshi context. It aims to provide insights into whether the challenges posed by credit risk outweigh its potential as a strategic tool for financial management.
H1.c: The credit risk of banks has a significant impact on the profitability of the banks.

2.4 Lending aggressiveness and profitability

The advance-to-deposit (AD) ratio reflects the lending aggressiveness of banks, which significantly influences profitability. Ramchandani and Jethwani (2017) studied the impact of the AD ratio on Indian commercial banks and concluded that it significantly affects profitability, implying that effective utilization of deposits in generating advances can enhance financial performance. Opoku, Angmor, and Boadi (2016) found a substantial inverse association between return on equity (ROE) and the ratio of loans and advances to total deposits in Chinese banks, signaling that excessive lending relative to deposits can strain resources and negatively impact profitability.

The findings suggest that while the AD ratio is a critical determinant of profitability, its impact is context-dependent. Aggressive lending strategies, reflected in higher AD ratios, may boost profitability in the short term but could expose banks to heightened risks in the long run, especially in volatile economic conditions. This study aims to explore whether lending aggressiveness, as captured by the AD ratio, has a significant impact on the profitability of Bangladeshi banks.

H1.d: Lending aggressiveness of banks has a significant impact on the profitability of the banks.

2.5 Size and Profitability

The relationship between bank size and profitability has been debated extensively. Tharu and Shrestha (2019) found no significant impact of size on the profitability of Nepalese commercial banks, suggesting that factors other than size might play a dominant role. In contrast, Ali and Ghazali (2018) observed that smaller Islamic banks in Pakistan were more profitable, highlighting potential efficiencies and market niches unique to smaller banks. In the Bangladeshi context, Hossain and Saif (2019) identified a positive relationship between the number of branches, staff, total assets, and profitability, indicating that scale benefits positively influence performance. While assessing the size of the bank, Nurullah et al. (2024) found that the dividend payout ratio and total assets of the banks have a significant impact on the performance of banks.

The literature provides mixed evidence on the impact of size, influenced by regional dynamics, regulatory frameworks, and operational efficiencies. For instance, while larger banks might benefit from economies of scale, smaller banks could exploit niche markets more effectively. By examining bank size in Bangladesh, this study seeks to resolve these inconsistencies in an emerging market context.

H1.e: The size of banks has a significant impact on the profitability of the banks.

2.6 COVID, economic growth, and profitability

The COVID-19 pandemic reshaped the global banking landscape, significantly affecting profitability. Katusiime (2021) found that while bank profitability in Uganda was negatively affected by the pandemic in the long run, the short-term impact was less pronounced. Gazi et al. (2021) highlighted several pandemic-related challenges, such as high non-performing loan rates and liquidity constraints, which negatively affected profitability. Macroeconomic conditions also play a crucial role. (Tan & Floros, 2012) observed a negative correlation between Chinese bank profitability and GDP growth, while Gazi et al. (2021) found that the GDP growth rate significantly impacts profitability in Bangladeshi banks.

Tosin and Otonne (2019) found that GDP is a significant determinant of commercial banks' profitability. The pandemic exposed vulnerabilities in banking systems, with long-term challenges outweighing short-term adjustments. The mixed impact of GDP growth on profitability, as seen in different studies, further indicates the complex interplay between macroeconomic conditions and firm-level variables. This study aims to evaluate the long-term impact of COVID-19 and economic growth on bank profitability in Bangladesh, providing critical insights into these emerging challenges.

H1.f: COVID has a significant negative impact on the profitability of the banks.

H1.g: Economic growth has a significant impact on the profitability of the banks

2.7 Research Gap

The existing literature extensively explores the relationship between off-balance sheet (OBS) activities and bank profitability, yet it presents mixed findings that vary across regions, bank types, and macroeconomic environments. For instance, studies such as (Hindi & Sundaram, 2002) and Aktan et al. (2013) found that OBS activities negatively influence profitability due to heightened risks, while (Khasawneh & Al-Khadash, 2014) argued that OBS activities could contribute to profit generation by diversifying revenue streams. However, the contextual factors influencing these relationships remain underexplored, particularly in emerging markets like Bangladesh. In the Bangladeshi context, limited studies have addressed OBS activities' role in determining bank profitability. M. M. Rahman et al. (2015) reported a negative relationship between OBS activities and profitability, while Matin (2017) observed a positive association. Such conflicting results highlight the need for further investigation into how OBS activities influence profitability within the specific regulatory, economic, and operational environment of Bangladeshi banks. Additionally, most studies analyzing OBS activities in Bangladesh rely on smaller samples or outdated timeframes, making it challenging to capture the evolving dynamics of the banking sector.

This study bridges the gap by investigating the impact of OBS activities on the profitability of banks in Bangladesh using a unique dataset that spans a broader and more recent sample period (2014–2023). The extended sample period allows for analyzing the long-term effects of OBS activities, considering significant regulatory changes and economic developments during this time. Moreover, the study contributes to the existing literature by focusing on an emerging economy, offering new insights into the implications of OBS activities on profitability in a developing financial market context.

By addressing these gaps, the study aims to provide a comprehensive understanding of the relationship between OBS activities and profitability, offering valuable implications for policymakers, practitioners, and academics.

3. Research Methodology

3.1 Composition of the study

The study includes twenty-nine (29) DSE-listed banking companies in Bangladesh. A convenient sampling technique has been chosen while selecting companies for the study. Altogether, there are around 290 observations ranging from 2014 to 2023. The sample period was chosen from 2014 to 2023 so that there is no missing data in the panel set. Data has been collected every year. A list of banks' names has been depicted in the appendices section. However, the composition of the banks' names is as follows:

Table 1. Composition of banks

Types of Banks	Number of Banks	% of Total
Conventional	19	65.51%
Islamic	10	34.49%
Total	**29**	**100.00%**

3.2 Sources of data

For this study, secondary sources have been used. The dependent and independent variables that were selected were taken from the corresponding company's annual reports. Furthermore, the macroeconomic data used in this study was sourced from the World Bank Indicator. The precise variables' names and sources are to be portrayed in the next section. Modern papers and literature that are relevant to this subject have been aligned to deepen and enrich the investigation. Data has been collected in Excel and processed using STATA software.

3.3 Research type

The research is quantitative. This study used panel data, a kind of dataset that combines features of time series and cross-sectional data. The study used the Fixed Effect model and the Generalized Least Square model for empirical analysis. However, the presence of heteroskedasticity and cross-sectional dependency requires the use of Panel-Corrected Standard Errors (PCSE).

3.4 Variables

The dependent variable of the study is the return on assets which is calculated by dividing the bank's net income by total assets. However, to check the robustness of the study, return on equity has also been considered as the dependent variable. The main independent variable concern for this study is the off-balance sheet activities of the bank. However, the study also assumes several control variables including age, credit risk exposure, lending aggressiveness, size, Covid, and economic growth. The measurement of the said variables is in the following section.

3.5 Definition of variables

The definition of variables along with measurement has been depicted in the following tables:
Table 2. Definition of the variables

Variable Definition	Acronym	Variable Type	Measurement	References	Expected Sign
Profitability	roa	Dependent	Net income divided by total assets	(Hindi & Sundaram, 2002)	
Profitability	roe	Dependent	Net income divided by total shareholders' equity	Aktan et al. (2013)	
Off-balance sheet exposure	off	Independent	Total off-balance sheet exposure divided by total assets	M. M. Rahman et al. (2015)	(+/-)
Age of the bank	lineage	Control	The logarithm of the number of years since the bank's establishment till the observation date	(Ilaboya & Ohiokha, 2016)	(+/-)
Credit risk exposure	npltoloan	Control	The ratio of non-performing loans to total loan	Gizaw et al. (2015)	(+/-)
Lending aggressiveness	adoration	Control	The ratio of total loan to total deposit	(Opoku et al., 2016)	(+/-)
Size of the bank	last	Control	Logarithm of total assets	Tharu and Shrestha (2019)	(+/-)
Presence of Covid	Cov	Control	The presence of COVID marks 1 and absence marks 0	Tan and Floros (2012)	(-)
Economic growth	GDP	Control	GDP growth rate of the respective year	Gazi et al. (2021)	(+/-)

3.6 Model of the study

Based on two dependent variables, the model for the study can be written as follows:

$ROA_{it} = \beta0 + \beta2OFFTA_{it} + \beta3lnAGE_{it} + \beta4NPLTOLOAN_{it} + \beta5ADRATIO_{it} + \beta6lnASSET_{it} + \beta7COV_{it} + \beta8GDPGR_{it} + \varepsilon_{it}$………………………………………………….(1)

$ROE_{it} = \beta0 + \beta2OFFTA_{it} + \beta3lnAGE_{it} + \beta4NPLTOLOAN_{it} + \beta5ADRATIO_{it} + \beta6lnASSET_{it} + \beta7COV_{it} + \beta8GDPGR_{it} + \varepsilon_{it}$…………………………………………….(2)

3.7 Diagnostic tests

After performing a number of diagnostic tests, the study finally identified the best models to meet the underlying Panel Data Analysis assumptions. The tests that were conducted and the outcomes are described in the section that follows.

3.7.1 Multicollinearity test

To check the multicollinearity, the study employed the Variance Inflation Factor (VIF). Based on the test, the mean VIF is 1.44. As it is less than 10, it indicates that the model does not have multicollinearity.

Table 3. Result of the VIF test

Variable	VIF	1/VIF
An asset	1.740	0.575
Npltoloan	1.700	0.588
Covid	1.530	0.653
Gdpgr	1.480	0.675
Age	1.360	0.734
Offta	1.160	0.861
Adratio	1.080	0.922
Mean VIF	**1.440**	

Source: Authors' calculation

3.7.2 Heteroskedasticity test

To check the heteroskedasticity, the research adopted the Breusch-Pagan / Cook-Weisberg test. Based on the P value which is close to 0.00 where the chi-square value is 96.88, the model shows that there is the presence of heteroscedasticity.

Table 4. Result of the Heteroskedasticity test

Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity			
Model	**chi2**	**Prob>chi2**	**Presence of Heteroscedasticity**
1	127.11	0.0000	Yes

Source: Authors' calculation

3.7.3 Autocorrelation test

Wooldridge test has been used to examine the autocorrelation. At the 5% significance level, it can be concluded that there is no statistically significant indication of first-order autocorrelation.

Table 5. Result of the Autocorrelation test

Wooldridge test for autocorrelation in panel data			
Model	**F value**	**Prob>F**	**Presence of Autocorrelation**
1	2.8555	0.1022	No

Source: Authors' calculation

3.7.4 Cross-sectional dependency

To verify the cross-sectional dependence within the panel data set, the model employed Pesaran's test. Since the p-value is less than 0.05, there is strong evidence of cross-sectional dependence in the data.

Table 6. Result of Pesaran's test of Cross-sectional independence

Pesaran's Test of Cross-sectional Independence			
Model	*Pesaran's Value*	*Prob. Value*	*Presence of Cross-Sectional Dependence*
1	*16.551*	*0.0000*	Yes

Source: Authors' calculation

3.7.5 Hausman test

According to the Hausman test, the p-value is 0.0000, which is less than the 0.05 significance level. This indicates that the random effects model is not appropriate, and there is evidence that the fixed effects model is more consistent and should be used.

Table 7. Result of Hausman test

	(b)	(B)	(b-B)	sqrt(diag(V_bV_B))
	Fixed	random	Difference	S.E.
off	0.010	0.017	-0.007	0.004
age	-0.002	0.000	-0.001	0.000
npltoloan	0.004	-0.002	0.006	0.001
adoration	0.000	0.000	0.001	.
last	0.009	0.005	0.004	0.002
covid	0.000	-0.002	0.002	.
gdpgr	-0.028	-0.055	0.027	.
Chi2 (7)	**(b-B)'[V_b-V_B)^(-1) (b-B)= 810.23**			
Prob>chi2	**0.0000**			

Source: Authors' calculation

3.8 Model justification

Since the data exhibits the presence of heteroscedasticity and cross-sectional dependency, the Generalized Least Square (GLS) method is specifically designed to handle heteroscedasticity and cross-sectional dependency in panel data. GLS transforms the data to correct for these issues, providing efficient and unbiased parameter estimates. It accounts for both the heterogeneity of error variances and potential correlations across cross-sectional units, making it well-suited for this study's data characteristics. In addition, Panel panel-corrected standard Errors (PCSE) model complements the study

since the PCSE model is suitable to provide robust standard errors that correct for heteroscedasticity and contemporaneous cross-sectional dependency without requiring stringent assumptions about the covariance structure of the errors. By using GLS and PCSE, this study ensures that the econometric models are robust to heteroscedasticity and cross-sectional dependency, providing reliable estimates and valid statistical inferences. The following figure highlights the research process and model justification.
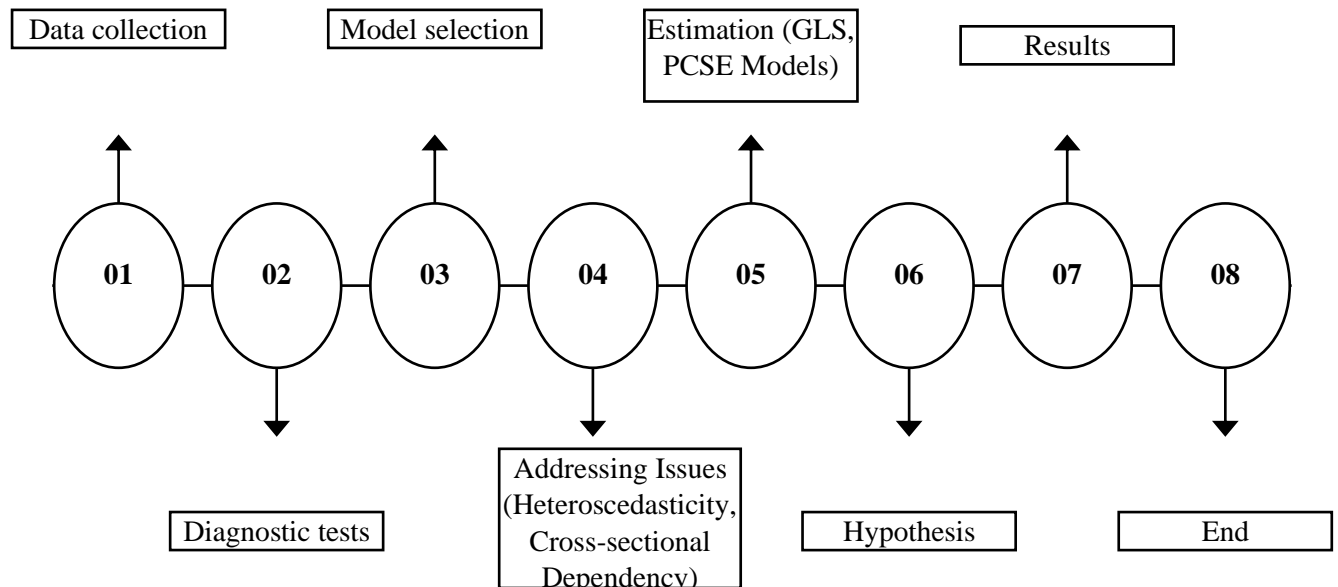

Figure 1. Research process
Source: Authors developed

4. Results and Discussions
4.1 Findings
4.1.1 Descriptive statistics
This research includes 290 observations from 29 banks. The minimum, maximum, standard deviation, and mean of the observations are displayed in the following table.

Table 8. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
roa	290	0.01	0.01	-0.06	0.02
off	290	0.27	0.14	0.02	0.66
age	290	24.47	9.30	1.00	47.00
npltoloan	290	0.08	0.16	0.00	0.98
adoration	290	0.94	0.62	0.06	9.26
asset (in million)	290	265696.36	2.27	104053.90	2032321.80
covid	290	0.20	0.40	0.00	1.00
GDP	290	0.07	0.01	0.03	0.08

Source: Authors' calculation

The average return on assets (ROA) is 1%, indicating modest profitability, with some firms facing losses of up to 6% and others achieving a maximum return of 2%. Banks have an average off-balance

sheet exposure to total assets (OFFTA) of 27%, ranging from 2% to 66%, showing varying levels of contingent risks. The average bank age is 24.47 years, spanning from 1 to 47 years, indicating a mix of both younger and mature firms. Non-performing loans to total loans (NPL to Loan) average 8%, with a range from 0% to 98%, highlighting potential financial distress for some banks. The advanced-to-deposit ratio (AD ratio) averages 0.94, suggesting that firms, on average, lend out an amount close to their deposits, with significant variability (0.06 to 9.26). The average total assets of firms amount to 265.7 billion BDT, with a wide range from 104.1 billion to 2 trillion BDT, reflecting substantial differences in bank size. Around 20% of the banks were impacted by COVID-19, as indicated by the binary COVID variable. Lastly, the GDP growth rate (GDPGR) averages 7%, with a range from 3% to 8%, indicating the general economic environment during the period.

The following table highlights the correlation matrix of the variables.

Table 9. Correlation matrix

	roa	offta	age	npltoln	adratio	lnasset	covid	gdpgr
roa	1.00							
off	0.39	1.00						
age	-0.21	0.04	1.00					
npltoloan	-0.52	-0.31	0.18	1.00				
adoration	0.04	-0.08	-0.14	-0.20	1.00			
lnasset	0.47	0.26	0.34	-0.45	-0.02	1.00		
covid	-0.04	0.00	0.11	0.05	-0.04	0.15	1.00	
gdpgr	0.00	0.07	-0.03	0.00	0.03	-0.03	-0.56	1.00

Source: Authors' calculation

Return on assets (ROA) is positively correlated with off-balance sheet exposure (OFFTA) (0.39) and bank size (LnAsset) (0.47), indicating that higher off-balance sheet activities and larger banks tend to be more profitable. ROA is negatively correlated with non-performing loans (NPLtoLoan) (-0.52) and bank age (-0.21), suggesting that banks with higher NPLs or older banks tend to have lower profitability. OFFTA shows a positive correlation with ROA (0.39) but a negative correlation with NPLtoLoan (-0.31), meaning banks with higher off-balance sheet exposure are more profitable but tend to have fewer non-performing loans. NPLtoLoan is negatively correlated with bank size (-0.45), indicating that larger banks tend to have fewer non-performing loans. The advanced-to-deposit ratio (ADRatio) shows weak correlations with other variables, while the impact of COVID (Covid) is only slightly correlated with bank size (0.15) and age (0.11). GDP growth (GDPGR) has a significant negative correlation with the presence of COVID-19 (-0.56), indicating that COVID had a noticeable impact on GDP growth. Overall, the matrix suggests that profitability is influenced by bank size, risk exposure, and the level of non-performing loans.

4.1.2 Results of models
Based on the Hausman test result, the study employs the Fixed Effect Model (FE). However, since the variables in the study exhibit heteroskedasticity and cross-sectional dependence, the study further employs Generalized Least Squares (GLS) and Panel-Corrected Standard Errors (PCSE) to justify the findings.

Table 10. Results Based on FE, GLS and PCSE

	FE		GLS		PCSE	
	Coef.	**t**	**Coef.**	**z**	**Coef.**	**z**
off	0.0099*	1.69	0.0155***	5.89	0.0148***	5.29
age	-0.0016***	-5.82	-0.0003***	-11.13	-0.0003***	-4.99
npltoloan	0.0041	1.16	-0.0068***	-4.28	-0.0097**	-2.08
adoration	0.0004	0.7	-0.0002	-0.86	-0.0002	-0.44
last	0.0088***	3.9	0.0052***	12.25	0.0051***	6.51
covid	5.18E-05	0.05	-0.0024	-2.39	-0.0022	-0.89
GDP	-0.0283	-0.83	-0.0229	-0.71	-0.0532	-0.62
_cons	-0.1864	-3.54	-0.1247	-11.52	-0.1170	-5.59
R-square	22.15%				46.35%	
prob>chi2	0.0000		0.0000		0.0000	
*Note: *** significant at 1%, ** significant at 5% and * significant at 10%*						

Source: Authors' calculation

The table presents the results of three models: Fixed Effects (FE), Generalized Least Squares (GLS), and Panel-Corrected Standard Errors (PCSE), with the dependent variable being Return on Assets (ROA), a proxy for bank profitability.

Off-balance sheet exposure is consistently positive and significant across all models, indicating that off-balance sheet exposure is positively associated with bank profitability. Bank age is negatively associated with ROA across all models, showing that older banks tend to be less profitable. NPL to total loan, a measure of credit risk, has a significant negative impact on ROA in both GLS and PCSE models, suggesting that credit risk exposure reduces profitability. Bank Size (LnAsset) positively and significantly affects profitability in all models, with larger banks consistently being more profitable. COVID-19 shows a negative impact on profitability in the GLS model, but this is not consistent across all models. However, the coefficient is not statistically significant. Economic growth as measured by GDP growth is not significant in any of the models, indicating that macroeconomic conditions do not have a clear impact on bank profitability in this dataset.

To check the robustness and consistency of the models, the study used return on equity (ROE) as another profitability indicator of the banks. The result of the two models is as follows:

Table 11. Results of alternative models (Robustness check)

	GLS		PCSE	
	Coef.	**z**	**Coef.**	**z**
offta	0.123***	3.730	0.123***	3.720
age	-0.002***	-3.640	-0.002***	-4.520
npltoloan	0.007	0.200	0.007	0.360
adoration	-0.003	-0.420	-0.003	-0.540

lnasset	0.008	1.100	0.008**	2.400
covid	-0.002	-0.130	-0.002	-0.210
gdpgr	-0.044	-0.100	-0.044	-0.140
_cons	-0.087	-0.480	-0.087	-0.970
R-square			10.07%	
prob>chi2	0.0000		0.0000	
*Note: *** significant at 1%, ** significant at 5% and * significant at 10%*				

Source: Authors' calculation

Based on the above table, the study found that the impact of off-balance sheet activities on profitability is positive. The coefficients in both models are statistically significant. Therefore, we can state that when banks are exposed to off-balance sheet activities by one unit, their profitability increases by 0.123 units, other things remaining constant. Among the control variables, age is statistically significant in both models. However, the relationship between age and profitability here is negative which means as the bank grows their profitability shrinks. Only bank size among the other control variables is significant in the PCSE model. The coefficient of bank size is 0.008 and it is statistically significant. However, based on the overall p-value, both of the models are significant. The R-square of the PCSE model is around 10% which means around 10 percent variability in dependent variables is explained by independent variables.

Based on the above results, we can reject the null hypothesis and state that Off-balance sheet activities have a significant impact on the profitability of the banks.

4.2 Discussion

Exposure to off-balance sheet risk escalates the bank risk profile (Hassan, 1993). In addition, several prior studies found that off-balance sheet activities have a significant impact on the profitability of the banks (Hindi & Sundaram, 2002; Khasawneh & Al-Khadash, 2014). Several studies found a negative impact of off-balance sheet activities on profitability (Aktan et al., 2013; M. M. Rahman et al., 2015). On the other hand, according to several studies, off-balance activities improve banks' profitability (Al-Tahat & AbuNqira, 2016; Khasawneh & Al-Khadash, 2014) Therefore, according to earlier studies, the impact of off-balance sheet risk on profitability has a mixed relationship. However, this study found that off-balance sheet risk has a positive impact on the profitability of the banks. Contingent liabilities and fee-based financial services like taking part in derivative contracts or giving guarantees are examples of off-balance sheet items. It is not necessary to directly expand asset investments to create additional revenue through these services. Banks may increase profitability and diversify their revenue sources by growing these activities. Moreover, financial risk management and hedging frequently involve the use of derivatives and other off-balance sheet assets. These tactics can improve profitability by stabilizing revenue and guarding against unfavorable market swings if they are handled well. Even if the positive correlation suggests that off-balance sheet operations can boost profitability, it is crucial to take the risks into account. Banks that rely too heavily on off-balance sheet instruments run the danger of experiencing hidden risks and possible financial trouble if market circumstances shift or if their risk management plans don't work. Investors and authorities may also closely examine such actions, especially if openness and risk disclosure are issues.

According to earlier studies, there are mixed effects of a bank's age on profitability (Ilaboya & Ohiokha, 2016; M. J. Rahman & Yilun, 2021). We have found in this study that age hurts the profitability of banks. This means as the bank ages, its profitability shrinks. There might be several dynamics behind this. Compared to newer banks with more contemporary infrastructures, older banks frequently have legacy systems and procedures that are more expensive to maintain and modernize. Older branches,

legacy IT systems, and increased maintenance expenses can deplete resources and lower profitability. Moreover, as banks age, they accumulate a more complex regulatory profile and may face more rigorous scrutiny, often due to their larger asset bases and broader risk exposure. Compliance and risk management costs, while essential, add operational costs that can impact profitability. While the negative impact of age on profitability suggests challenges in adapting to a dynamic environment, mature banks can counteract these trends by focusing on modernization, efficiency improvements, and digital transformation.

Likewise, credit risk has a mixed impact on the profitability of the banks (Ebenezer & Omar, 2016; Gizaw et al., 2015). We have found that credit risk has a negative and significant impact on the profitability of the banks. Higher credit risk typically necessitates larger loan loss provisions to cover potential defaults. As provisions rise, they directly reduce net income, leading to lower profitability. In addition, high credit risk often attracts regulatory scrutiny, requiring banks to maintain higher capital adequacy ratios or additional risk controls. These requirements, while promoting stability, can impose constraints on capital utilization, limiting profit-generating capabilities and impacting overall returns. Another significant variable is the bank's size. Prior studies found that a bank's size does not affect its profitability (Tharu and Shrestha, 2019). Whereas, another study found it has a positive and negative impact on profitability (Ali & Ghazali, 2018; Hossain & Saif, 2019). In this study, we have found that larger banks enjoy more profits.

5. Conclusion

This study investigates the impact of off-balance sheet (OBS) activities on the profitability of banks in Bangladesh while controlling for factors such as age, credit risk, lending aggressiveness, bank size, COVID-19, and GDP growth rate. The findings reveal a positive and statistically significant effect of OBS activities on bank profitability, highlighting their critical role in income generation beyond traditional lending. Specifically, activities such as guarantees, derivatives, and loan commitments have been found to diversify revenue streams and enhance financial flexibility for banks.

The implications of these findings are both practical and strategic for bank managers and policymakers. For bank managers, the results suggest that leveraging OBS activities can be a profitable strategy to boost revenue while minimizing balance sheet exposure. However, it is essential to implement robust risk management frameworks to address the inherent risks associated with these activities, especially under volatile economic conditions. Effective monitoring and hedging mechanisms, along with staff training in managing complex financial instruments, can further mitigate these risks.

For policymakers, the study underscores the importance of a balanced regulatory framework. Policymakers should ensure that while promoting the use of OBS activities, adequate safeguards are in place to prevent systemic risks. Regulations could include regular stress testing of OBS exposures, mandating transparency in disclosures, and ensuring that capital adequacy requirements account for potential risks associated with such activities. This would help maintain banking sector stability while encouraging innovation and efficiency. The study's findings have broader implications for banking practices, particularly in emerging markets with similar economic structures. By focusing on OBS activities, banks in these markets can achieve profitability gains without excessive reliance on traditional lending, which may be constrained by capital requirements or market conditions. Additionally, the insights from this research can guide cross-country regulatory bodies in creating frameworks that encourage responsible adoption of OBS activities while safeguarding financial stability.

5.1 Future research directions

Future research could delve into the long-term impacts of specific OBS instruments on bank stability and risk management. Comparative studies across multiple countries would provide valuable insights into how different regulatory environments influence the contribution of OBS activities to bank profitability. Moreover, examining the role of technological advancements in facilitating OBS activities could offer additional perspectives on their evolution and strategic importance in the banking sector.

In conclusion, this study not only highlights the profitability potential of OBS activities but also emphasizes the need for proactive risk management and regulatory oversight. By addressing these dimensions, banks and regulators can ensure sustainable growth and stability in the banking sector.

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Appendices

Table 12: List of banks

Serial	Bank Name
1	Islami Bank Bangladesh PLC
2	Export-Import Bank Bangladesh
3	First Security Islami Bank Ltd.
4	Global Islami Bank PLC
5	Alarafah Islami Bank Ltd
6	Shahjalal Islami Bank Ltd.
7	Social Islami Bank Ltd
8	ICB Islamic Bank Ltd.
9	Standard Bank Ltd.
10	Union Bank Ltd.
11	Brac Bank Ltd.
12	Bank Asia Ltd.
13	The City Bank Ltd.
14	Dhaka Bank Ltd.
15	Eastern Bank Ltd..
16	International Finance Investment and Commerce Bank Ltd.
17	Dutch Bangla Bank Ltd.
18	Jamuna Bank Ltd.
19	Mercantile Bank Ltd.
20	Mutual Trust Bank Ltd
21	National Bank Ltd..
22	National Credit and Commerce Bank Ltd.
23	One Bank Plc
24	The Premier Bank Ltd.
25	Prime Bank Ltd.
26	Pubali Bank PLC
27	Southeast Bank Ltd.
28	United Commercial Bank PLC
29	AB Bank Ltd.