







“Triple pillars of sustainable finance: The role of green finance, CSR, and digitalization on bank performance in Bangladesh”

AUTHORS	Shaikh Masrick Hasan  K. M. Anwarul Islam   Tawfiq Taleb Tawfiq  Priya Saha 
ARTICLE INFO	Shaikh Masrick Hasan, K. M. Anwarul Islam, Tawfiq Taleb Tawfiq and Priya Saha (2025). Triple pillars of sustainable finance: The role of green finance, CSR, and digitalization on bank performance in Bangladesh. <i>Banks and Bank Systems</i> , 20(1), 38-50. doi: 10.21511/bbs.20(1).2025.04
DOI	http://dx.doi.org/10.21511/bbs.20(1).2025.04
RELEASED ON	Monday, 20 January 2025
RECEIVED ON	Tuesday, 21 May 2024
ACCEPTED ON	Monday, 06 January 2025
LICENSE	 This work is licensed under a Creative Commons Attribution 4.0 International License
JOURNAL	"Banks and Bank Systems"
ISSN PRINT	1816-7403
ISSN ONLINE	1991-7074
PUBLISHER	LLC “Consulting Publishing Company “Business Perspectives”
FOUNDER	LLC “Consulting Publishing Company “Business Perspectives”



NUMBER OF REFERENCES

53



NUMBER OF FIGURES

0



NUMBER OF TABLES

6

© The author(s) 2025. This publication is an open access article.



BUSINESS PERSPECTIVES



LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10,
Sумы, 40022, Ukraine
www.businessperspectives.org

Received on: 21st of May, 2024

Accepted on: 6th of January, 2025

Published on: 20th of January, 2025

© Shaikh Masrick Hasan, K. M. Anwarul Islam, Tawfiq Taleb Tawfiq, Priya Saha, 2025

Shaikh Masrick Hasan, Ph.D., Associate Professor, Department of Finance, Faculty of Business Studies, Jagannath University, Bangladesh. (Corresponding author)

K. M. Anwarul Islam, Ph.D., Professor, Department of Business Studies, School of Business and Social Sciences, State University of Bangladesh, Bangladesh.

Tawfiq Taleb Tawfiq, Ph.D., Assistant Professor, Charles Albert Reid School of Business, Brescia University, USA.

Priya Saha, Research Assistant & MBA Student, Department of Finance, Faculty of Business Studies, Jagannath University, Bangladesh.



This is an Open Access article, distributed under the terms of the [Creative Commons Attribution 4.0 International license](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted re-use, distribution, and reproduction in any medium, provided the original work is properly cited.

Conflict of interest statement:

Author(s) reported no conflict of interest

Shaikh Masrick Hasan (Bangladesh), K. M. Anwarul Islam (Bangladesh), Tawfiq Taleb Tawfiq (USA), Priya Saha (Bangladesh)

TRIPLE PILLARS OF SUSTAINABLE FINANCE: THE ROLE OF GREEN FINANCE, CSR, AND DIGITALIZATION ON BANK PERFORMANCE IN BANGLADESH

Abstract

This study examines the impact of sustainable finance factors on bank performance in Bangladesh. It utilizes annual data from 24 listed commercial banks in Bangladesh from 2016 to 2022. It focuses on three sustainable finance factors: green finance, corporate social responsibility (CSR), and digitalization. These factors ensure sustainable finance practices by prioritizing eco-friendly investments, responsible business operations, operational efficiency, and reduced resource consumption rather than focusing solely on short-term profit maximization. Return on assets (ROA) and return on equity (ROE) are used to measure the performance of commercial banks. This study incorporates default rate and bank size as control variables to consider inherent risk and operational scale, resulting in a more precise evaluation of the impact of digitization, CSR, and green financing on bank performance. Traditional and dynamic panel regression models, including feasible generalized least squares (FGLS) and random effects models, are applied to ensure robust findings. The findings indicate that green finance exhibits an insignificant impact on bank performance. However, corporate social responsibility (CSR) demonstrates a statistically significant positive effect on ROE through positive marketing, enhancing reputation, and building shareholder loyalty towards banks. Conversely, digitalization shows a statistically significant negative effect on performance, implying that initial implementation costs and challenges may outweigh the benefits. In addition, control variables, including default rate and bank size, exhibit a statistically significant negative relationship with performance measures. This suggests that higher default rates indicate increased credit risk and financial losses, while larger bank sizes may lead to inefficiencies due to agency costs and organizational complexities.

Keywords

green finance, digitalization, CSR, default rate, ROA, ROE, panel data, Bangladesh

JEL Classification

E58, G21, M14

INTRODUCTION

Sustainable finance integrates environmental, social, and governance (ESG) factors into investment choices to support long-term investments in sustainable economic endeavors. The Asia-Pacific region is increasingly focusing on sustainable finance, leading monetary and financial authorities to investigate the incorporation of climatic and environmental factors into policy frameworks (NGFS¹, 2020). Thompson and Cowton (2004) highlight how sustainable finance is pivotal for directing investments toward the environment, analyzing the effects of lending, investing, and other banking operations on a bank's profitability. Apart from sustainable finance, it is vital to acknowledge that company-specific factors significantly influence the performance of

¹ Network for Greening the Financial System (NGFS) is a network of 114 central banks and financial supervisors that aims to accelerate the scaling up of green finance and develop recommendations for central banks' role for climate change.

commercial banks (Pasiouras & Kosmido, 2007; Aburime, 2008). It is equally crucial to recognize that company-specific factors also have a considerable influence on the performance of banks. The importance of sustainable finance is emphasized, along with the role of individual bank characteristics in shaping performance outcomes.

In Bangladesh, sustainable finance is treated as an important avenue for sustainable economic growth. The significance of sustainable finance in Bangladesh is evident, particularly within the banking sector. The economic dimension stands out as a crucial element influencing green financing, encompassing concerns associated with the development of the green economy that creates economic value, maximizing the stakeholder's value and competitive advantage, and addressing the financial implications of climate change from the government (Zheng et al., 2021). This aligns with the role of corporate social responsibility (CSR), which plays a significant role in cultivating stakeholder trust and reducing potential risks, which ultimately strengthens a company's market position and competitiveness (Chowdhury & Nehal, 2000). Furthermore, the shift towards internet banking services through digital transformation enhances financial inclusion, driving sustainable growth within the banking sector (Serdarušić et al., 2024).

Therefore, this study is crucial as it integrates green finance, corporate social responsibility (CSR), and digitalization to examine the sustainable factors influencing the performance of commercial banks in Bangladesh.

1. LITERATURE REVIEW

Sustainability is comprehensively linked with the well-being, standard of living, and progress of humans. Sustainable finance emphasizes the centrality of environmental and social considerations in driving economic growth (Ziolo et al., 2019). Various factors are used to reflect the diverse dimensions of sustainable finance, such as green banking (Tara et al., 2015), sustainable agriculture (Reganold et al., 1990), green finance (Julia & Kassim, 2019); corporate social responsibility (Belasri et al., 2020), and digital banking (Serdarušić et al., 2024). In addition to these factors, sustainable MSMEs (Micro, Small, and Medium Enterprises) have been treated as a sustainable finance factor in Bangladesh since 2023 as per the sustainable finance policy of the Bangladesh Bank (Central Bank of Bangladesh) (Bangladesh Bank, 2023). Tara et al. (2015) stated that environmentally sustainable banking practices promote clients' reduction of carbon footprints in their daily activities. To protect banks and communities from the unpredictability of economic problems like climatic disasters, social upheaval, corporate scandals, and worldwide financial events, banks are increasingly focusing on eco-friendly banking initiatives (Ziolo et al., 2019). Karjaluoto et al. (2002) emphasize the importance of integrating sustainability principles into financial operations.

There is a notable shift in the conventional banking paradigm toward offering eco-friendly products. Stakeholder theory expands this perspective, defining stakeholders as individuals or groups impacted by organizational outcomes, which refers to integrating sustainable finance practices in banks addressing ESG issues, thereby improving bank performance and meeting broader societal obligations (Bhaskaran et al., 2023). Moreover, the resource-based view (RBV) theory examines how businesses achieve competitive benefits and outperform rivals by implementing strategies that generate unique value (Wernerfelt, 1984). Integrating ESG considerations into decision-making processes within sustainable finance aligns with the core principles of RBV theory that represent a strategic utilization of resources by banks. The encouragement of eco-friendly financial products and the introduction of refinancing schemes to green technologies demonstrate banks' commitment to leveraging financial resources for environmental and technological advancements. The standpoint of the resource-based view of the organization refers to implementing environmentally sustainable practices that correlate with enhanced business performance (Clarkson et al., 2011).

Sustainable finance incorporates environmental, social, and corporate governance (ESG) factors into the decision-making processes (Hasan

& Minhath, 2021). Sustainable finance generally includes three distinct dimensions: green finance, corporate social responsibility (CSR), and digitalization. Green finance supports eco-friendly projects, environmental protection, climate change, sustainable energy, and green building while promoting sustainable development (Zheng et al., 2021; Urban & Wójcik, 2019). CSR encourages banks to invest in broader socially and environmentally responsible projects (Soppe, 2009). Additionally, digitalization increases operating efficiency, reducing the number of employees and reliance on paper transactions, cutting resource use, and lowering carbon emissions from physical document transportation, thus promoting sustainability (Serdarušić et al., 2024).

Green finance, a dynamically evolving concept, is designed to synchronize monetary activities with environmental stability, ecological protection, and achieving the Sustainable Development Goals (SDGs). Bangladesh shifted its focus to sustainable financing through the establishment of Policy Guidelines on Green Banking in 2011. Until 2013, only public commercial banks (PCBs) and foreign commercial banks (FCBs) had implemented eco-friendly banking guidelines and funded related projects (Ullah, 2013). Julia and Kassim (2019) and Hossain et al. (2020) revealed a positive relationship between the performance of banks and their engagement in green financing. Moreover, the proposition from Stakeholder theory and RBV also supports that green banking brings positive performance to banks' profitability (Clarkson et al., 2011). On the other hand, Rahman et al. (2013) carried a study to find out how green financing affected banks' profits in Bangladesh, and their findings revealed that no such correlation was observed between performance and green financing. Also, Julia and Kassim (2019) stated that the ROE did not have a significant relationship with the green funding of commercial banks.

Corporate Social Responsibility (CSR) reduces risks, fosters stakeholder trust, and gives businesses a competitive edge by drawing in socially conscious investors and consumers. In 2008, Bangladesh Bank Guidelines prompted banks to participate in such activities in a more structured manner, marking a notable paradigm shift in CSR practices. Research by Inoue and Lee (2011) and

Belasri et al. (2020) ascertained that financial performance is positively impacted by corporate social responsibility. Consequently, implantation of CSR in banking sectors may also help to mitigate stakeholder-related risks and bring customer commitments towards the implementing banks, and thus, the performance of banks is expected to increase. Financial performance and corporate social responsibility were found to be negatively correlated and statistically significant by Hemingway and Maclagan (2004) and Brammer et al. (2006). The expenditure in CSR may not significantly enhance banks' performance; however, the associated costs and benefits tend to offset each other within the broader framework of profitability (Chowdhury & Nehal, 2000). This suggests that the relationship between CSR initiatives and financial outcomes may have a neutral effect, which leads to the outcomes being neither entirely positive nor negative.

Digitalization is advancing rapidly, making the sustainability of banks increasingly dependent on their successful transition from traditional paper transactions. Serdarušić et al. (2024) opined that digital banking minimizes energy and paper use, which aligns with sustainability goals and lowers operating expenses and environmental effects. Furthermore, digital platforms improve financial inclusion by addressing underprivileged people, which supports economic sustainability (Singh & Gupta, 2022). According to Karjaluto et al. (2002), traditional banks view online banking as an enhanced method to efficiently and conveniently serve their expanding customer base, expecting it to contribute to profitability significantly. Wadesango and Magaya (2020) discovered a steady increase in the ratio of online bank transactions to total assets, suggesting a favorable trend in their investigation of how digital banking services affect the operations of commercial banks. Njogu (2014) supports these conclusions by stating that using online and mobile banking has a significant and favorable impact on Kenya's commercial banks' financial performance. Conversely, Malhotra and Singh (2009) explored the influence of internet banking on risk and performance and revealed that there is no significant link between Internet banking and profitability. The research findings indicate that a rise in fees and commissions associated with online banking leads to decreased overall profitability for commercial banks.

In addition to the sustainable finance factor, company-specific factors directly influence the performance of commercial banks. Among the company-specific factors, the impact of default rate and size on performance is significant (Waweru & Kalani, 2008; Anbar & Alper, 2011). Default rate reflects credit risk, which directly impacts profitability, while bank size captures economies of scale, influencing operational efficiency and financial capacity. According to Ongore and Kusa (2013), poor quality of loans and limited liquidity have a significant negative impact on bank profitability, which could ultimately lead to bank failure. Amador et al. (2013) argued that high loan growth in banks may involve increased credit risk, creating a risk-return trade-off. Waweru and Kalani (2008) opined that a higher default rate reduces bank performance. After the COVID-19 epidemic, the default rate in Bangladesh has grown to be a serious problem that affects bank profitability (Ahmed & Abedin, 2021).

Bank size is often linked to economies of scale, suggesting larger banks can achieve higher efficiency. Anbar and Alper (2011) found that the size of assets positively influences bank profitability. Furthermore, bank size is important because bigger banks may invest more in sustainable financing, which increases profitability and adherence to sustainability goals (Pinchot et al., 2019). However, extremely large banks may experience a negative relationship with efficiency because managing big enterprises comes with several problems, including agency charges and bureaucratic procedures (Pasiouras & Kosmido, 2007). Thus, default rate and bank size also need to be considered when determining the influence of sustainable finance on a bank's performance.

Existing literature has explored various aspects of sustainable finance, often concentrating solely on individual aspects of banking performance, such as green finance (Julia & Kassim, 2019; Akhter et al., 2020), corporate social responsibility (Belasri et al., 2020; Chowdhury & Nehal, 2020), or digitalization (Wadesango & Magaya, 2020; Njogu, 2014). Moreover, the majority of research on sustainable finance factors and commercial bank performance focuses on developed countries, overlooking the rapid growth of Bangladeshi commercial banks that possess distinct potential and

challenges. A few studies have investigated the performance of commercial banks using a single sustainable finance factor (either green finance or CSR) in the context of Bangladesh (Akhter et al., 2020; Chowdhury & Nehal, 2020). However, digitalization is yet to get attention in academic research. Furthermore, the combination of bank-specific factors and sustainable finance factors to determine the banks' profitability is under-investigated. Controlling the impact of default rate and bank size isolates the effect of sustainable finance on bank performance, offering a clearer understanding of its impact.

Therefore, this study aims to fill the research gap by analyzing the impact of three sustainable finance factors, such as digitalization, CSR, and green finance, along with controlling for company-specific factors (default rate and bank size) on commercial bank performance in Bangladesh. The following hypotheses are proposed for this study:

H_1 : *Green finance has a significant influence on the performance of commercial banks.*

H_2 : *CSR has a significant influence on commercial banks' performance.*

H_3 : *Digitalization has a significant influence on commercial banks' performance.*

2. METHODS

The study examined 24 listed commercial banks over a seven-year period from 2016 to 2022 (Appendix 1 shows the list of banks). In the early 2000s, Standard Chartered Bangladesh Limited (SCB) introduced digital banking; Bangladesh Bank incorporated CSR practices in 2008, and green finance practices started to be implemented within Bangladesh's banking sector in 2013 following the guideline of Green Banking, which was introduced in 2011. Initially, a low number of banks fully adopted all three sustainable finance factors such as digitalization, CSR, and green finance; however, 24 banks incorporated all three sustainable finance factors by 2016. Considering this, a sample of 24 commercial banks is chosen, and the study's duration is set for 2016 to 2022 for a more representative sample size and to create a

balanced dataset. Here, audited annual financial statements of the respective commercial banks are used to collect the required data related to sustainable finance factors (digitalization, CSR, and green finance) and company-specific characteristics (bank size and default rate).

Return on assets (ROA) and return on equity (ROE) are two performance indicators that have been utilized in this research following previous studies, e.g., Socol and Danuletiu (2013), Flamini et al. (2009), and Hasan et al. (2024a). Three sustainable finance factors (green finance, CSR, and digitalization) are selected as explanatory variables considering the execution of sustainable finance factors in Bangladesh as well as following several authors like Zheng et al. (2021), Hossain et al. (2020), Julia and Kassim (2019), and Karjaluo et al. (2002). Default rate and bank size are considered in this study as a bank's specific variables, following Waweru and Kalani (2008) and Flamini et al. (2009), and the impact of these specific factors is controlled while identifying the influence of

sustainable finance factors on profitability. Table 1 provides an overview of the variables.

The data collected for this study contain both characteristics of a time series and cross-sectional dimensions as the variables change across different units (different banks) and periods (different years). Following previous authors (Zhou, et al., 2020; Umoru & Osemwegie, 2016), this study utilizes the panel data regression model to capture the effects of both time and unit differences. The dynamic panel data analysis model, i.e., the Feasible Generalized Least Squares (FGLS) model, is employed in this study to produce plausible results in agreement with Umoru and Osemwegie (2016). FGLS model can produce bias-free results in the presence of autocorrelation, heteroscedasticity, and cross-sectional correlation problems (Hoechle, 2007).

As a prerequisite of panel data analysis, the Shapiro-Wilk test, variance inflation factor (VIF), and Breusch-Pagan test are performed to check

Table 1. Variable description

Serial No.	Variable Name	Variable Definition	Formula	References
Performance Measure Variables				
1	Return on Asset (ROA)	Return on asset (ROA) indicates how efficiently a business uses its resources to produce earnings	$\frac{\text{Net Profit}}{\text{Total Asset}}$	Socol and Danuletiu (2013), Flamini et al. (2009)
2	Return on Equity (ROE)	Return on Equity (ROE) is a measure that assesses the efficiency of a company utilizing its equity capital to generate profits	$\frac{\text{Net Profit}}{\text{Shareholder's Equity}}$	Socol and Danuletiu (2013)
Sustainable Finance Variables				
3	Green Finance	Green finance is defined as a revolutionary financial development that combines financial gains with environmental protection	–	Zheng et al. (2021), Clarkson et al. (2011)
4	Corporate social responsibility (CSR)	Corporate Social Responsibility (CSR) is an effort to contribute positively to society and the environment, going beyond just making profits	–	Inoue and Lee (2011), Belasri et al. (2020),
5	Digitalization	Digitalization refers to transforming traditional banking services to internet-based digital operations, leveraging technology to enhance efficiency thus encouraging sustainable finance	–	Karjaluo et al. (2002), Singh and Gupta (2022) Wadesango and Magaya (2020)
Company-Specific Variables				
6	Default Rate	Default rate determines the percentage of uncovered loans from the borrowers of banks	$\frac{\text{Non-Performing Loan}}{\text{Total Loan}}$	Waweru and Kalani (2008)
7	Bank Size	Bank size is measured as the value of total assets. The value of the entire asset worth of commercial banks is used to calculate bank size	–	Aburime (2008), Flamini et al. (2009)

the normality, multicollinearity, and heteroscedasticity of the data, respectively (Wooldridge, 2010). Additionally, the Wooldridge test and Pesaran's CD test are applied to check the autocorrelation and cross-sectional dependence of the data, respectively (Petersen, 2009). The raw data exhibited a normality problem; thus, the two-step data normalization model is utilized to normalize the data following Hasan et al. (2024b) and Templeton (2011), and transformed data become normally distributed. The panel data regression equation is given below:

$$\begin{aligned} Performance_{i,t} = & \beta_0 + \beta_1 GRN_{i,t} \\ & + \beta_2 CSR_{i,t} + \beta_3 D.Digit_{i,t} \\ & + \beta_4 Controls_{i,t-1} + \varepsilon_{i,t}, \end{aligned} \quad (1)$$

where *Performance* presents performance measures (ROA and ROE) of a bank, *GRN* stands for the amount of investment in green projects; *CSR* represents expenditure in corporate social responsibility, *D.Digit* is the dummy variable, which equals 1 if the bank implements digitalization by incorporating internet banking or otherwise 0. Control variables are represented as *Controls_{i,t-1}* that capture the influence of company-specific characteristics. All company-specific characteristic variables are lagged by one year to mitigate potential endogeneity problems following Leszczensky and Wolbring (2019) and Hasan et al. (2024a). The control variables consist of (i) *Default*, the loan default rate; and (ii) *Bank Size*, the bank size is taken as the value of the total assets of commercial banks. By controlling for default rate and bank size, the study isolates the influence of sustainable finance on bank performance, providing a more distinct insight into its effects. Here, *i* denotes the commercial banks, *t* stands for time. β stands for coeffi-

cients which indicate the relationship between performance proxy and specific sustainable finance factors, and ε indicates the error term.

3. RESULTS AND DISCUSSION

The descriptive statistics of the examined variables of 24 commercial banks in Bangladesh from 2016 to 2022 are displayed in Table 2. The mean annual ROA and ROE are 0.8% and 10%, respectively, and the standard deviation of ROA and ROE are 0.007 and 0.083, respectively. This indicates a lower level of bank performance while a higher level of deviation in performance measures.

Here, the annual mean of investment in green finance is BDT 6,393.764 and CSR expenditure is BDT 311.765 million, respectively, whereas the standard deviations are BDT 15,274.17 and BDT 1132.657 million, respectively. This indicates that investment in green finance and CSR exhibits notable variability. Digitalization, with a mean of 0.929, indicates a predominantly digitalized environment among the entities. The mean and standard deviation of the default rate are 6.70% and 0.057, which is consistent with Ethiopia, according to Kotiso (2018). In addition, the mean and standard deviation of bank size are BDT 360,117.32 million and BDT. 287,963.71 million respectively, which are closely aligned with the findings of Al-Amin et al. (2024).

Table 3 shows the pairwise correlation matrix. Digitalization and default rate and bank size exhibit a statistically significant inverse relationship with both ROA and ROE, which is aligned with Mulwa (2017) and Pasiouras and Kosmido (2007). This indicates that when investment in digitaliza-

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min.	Max.
Return on Asset	168	0.008	0.007	-0.060	0.023
Return on Equity	168	0.100	0.083	-0.709	0.292
Green Finance (million)	168	6393.76	15274.17	0	97,476.00
Corporate Social Responsibility (million)	168	311.77	1132.66	0	1,1507.11
Digitalization (Dummy)	168	0.929	0.258	0	1
Default Rate	168	0.067	0.057	0.005	0.337
Bank Size (million)	168	360,117.32	287,963.71	29,953.00	1,838,371.00

Note: The table shows descriptive statistics of examined variables in the form of a number of observations, mean, standard deviation, minimum, and maximum values for 24 commercial banks in Bangladesh from 2016 to 2022.

Table 3. Correlation matrix

Variables	(1) ROA	(2) ROE	(3) GRN	(4) CSR	(5) DIGIT	(6) DEF	(7) B.SIZE
(1) Return on Assets (ROA)	1.000	–	–	–	–	–	–
(2) Return on Equity (ROE)	0.773**	1.000	–	–	–	–	–
(3) Green Finance (GRN)	–0.030	0.004	1.000	–	–	–	–
(4) CSR	0.001	0.191*	0.246**	1.000	–	–	–
(5) Digitalization (DIGIT)	–0.242**	–0.195*	–0.008	–0.078	1.000	–	–
(6) Default Rate (DEF)	–0.455**	–0.491*	0.007	–0.207**	–0.004	1.000	–
(7) Bank Size (B.SIZE)	–0.243**	–0.082*	0.373**	0.582**	0.054	0.052	1.000

Note: The table shows the Pairwise Correlation Matrix, which demonstrates the correlation between variables for the period 2016 to 2022. Here, CSR stands for corporate social responsibility. Statistically Significant * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

tion, default rate, and bank size increased, then the performance of banks decreased. CSR exhibits a statistically significant positive correlation with ROE, which is consistent with the findings of Belasri et al. (2020). Moreover, green finance is negatively correlated with ROA but positively correlated with ROE, and CSR is positively correlated with ROA.

Relevant diagnostic tests (details in Section 3.2) have been performed to ensure the authenticity and reliability of the data and found that data is normally distributed; there is no problem with multicollinearity, heteroscedasticity, and cross-sectional correlation. However, the Wooldridge test and Pesaran's CD test indicate little evidence

of an autocorrelation problem. The FGLS method a dynamic model can produce bias-free results in the presence of multicollinearity, heteroscedasticity, and autocorrelation problems (Petersen, 2009; Wooldridge, 2010). Thus, following recent studies that utilized panel data (e.g., Umoru & Osemwegie, 2016), the FGLS method (a dynamic model) is utilized in this study, and the result of the regression analysis is given in Table 4:

Based on Table 4, Model 1 and Model 2 reveal that the coefficient of green finance is positive for both ROA ($\beta = 0.001$, $p > 5\%$) and ROE ($\beta = 0.001$, $p > 5\%$), although the effect is not statistically significant. Therefore, the study fails to accept hypothesis H_7 , suggesting that green finance

Table 4. Regression results of the impact of sustainable finance on the performance of commercial banks (Feasible Generalized Least Squares)

Variables	Model 1	Model 2
	ROA (T-Stat)	ROE (T-Stat)
Green Finance	0.001 (0.81)	0.001 (0.32)
CSR	0.001 (0.20)	0.001** (2.04)
Digitalization	–0.007*** (–3.53)	–0.055*** (–2.67)
Default rate	–0.063*** (–6.57)	–0.643*** (–6.63)
Bank size	–0.001*** (–2.81)	–0.001* (–1.84)
Constant	.021*** (10.04)	.207*** (9.68)
Chi-Square	76.28***	71.99***
No. Observations	168	168

Notes: The table represents the result of the FGSL model of panel data analysis of 2 performance measures on sustainable finance factors for the period of 2016 to 2022 using the annual data of 24 commercial banks in Bangladesh. All the variables are transformed through the two-step data transformation method to improve the normality of the data (Templeton, 2011). All the sustainable finance factors and company-specific factors are lagged by 1 year to eliminate the effect of endogeneity. Statistically Significant * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; t statistics are enclosed in parentheses.

does not have a significant effect on the performance of commercial banks in Bangladesh. The coefficient of CSR shows a statistically significant positive relationship with ROE ($\beta = 0.001, p < 1\%$) but there is no statistically significant relationship with ROA ($\beta = 0.001, p > 5\%$). This finding partially supports the hypothesis H_2 , indicating that CSR has an impact on performance, particularly on ROE. Consequently, the coefficient of digitalization indicates a statistically significant negative impact on both ROE ($\beta = -0.007, p < 0.1\%$) and ROA ($\beta = -0.055, p < 0.1\%$), consistent with hypothesis H_3 . These results suggest that as digitalization increases, there is a measurable decrease in both return on equity and return on assets. Moreover, the control variables, default rate and bank size, show statistically significant inverse relationships with performance. This implies that higher default rates and larger bank sizes are associated with lower performance levels.

The random effect model is applied (Table 5) to check the robustness of the results of the FGLS model following the findings of the Breusch-Pagan Lagrangian Multiplier and Hausman tests (Wooldridge, 2010). In general, it is evident that the result is consistent with the FGLS model that digitalization has a negative relation with a bank's

performance (ROA and ROE), and CSR exhibits a positive effect on ROE. Moreover, the company-specific factors show similar findings as the FGLS model.

Three hypotheses have been tested in the study. The findings of the study indicate that green finance positively and insignificantly influences performance. Banks that adopt green finance practices often experience enhanced financial performance. Studies by Julia and Kassim (2019) and Hossain et al. (2020) confirm that engaging in green financing correlates with better financial performance. CSR has a positive impact on performance. This indicates that increasing CSR activities will bring goodwill and stakeholders will become loyal, promote this as a positive marketing strategy, and have a stakeholder effect on ROE, as supported by Belasri et al. (2020).

Digitalization has a negative impact on performance. This indicates that when the bank implements digitalization, the expense of digitalization increases, resulting in a decline in bank performance. This finding is similar to Mulwa (2017), who identified a negative relationship between expenses on Internet banking and ROA in Kenya. According to Niemand et al. (2021), the initial in-

Table 5. Regression result of the impact of sustainable finance on the performance of commercial banks (Random Effect Model)

Variables	Model 1	Model 2
	ROA (T-stat)	ROE (T-stat)
Green Finance	0.001 (0.57)	-0.001 (-1.22)
CSR	-0.001 (-1.07)	0.001*** (2.97)
Digitalization	-0.008*** (-4.11)	-0.072*** (-3.88)
Default rate	-0.043*** (-3.77)	-0.526*** (-4.57)
Bank size	-0.001*** (-3.09)	-0.001 (-1.12)
Constant	.022*** (10.03)	.22*** (10.19)
No. Observation	168	168
R ²	0.2340	0.2620
Chi-Square	62.65***	46.482***

Note: The table represents the result of the robust random-effect model of panel data analysis of 2 performance measures on sustainable finance factors for the period of 2016 to 2022 using the annual data of 24 commercial banks in Bangladesh. All the variables are transformed through the two-step data transformation method to improve the normality of the data (Templeton, 2011). All the sustainable finance factors and company-specific factors are lagged by 1 month to eliminate the effect of endogeneity. Statistically Significant * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; t statistics are enclosed in parentheses.

vestment in digitalization might negatively affect performance.

Moreover, both the company-specific factors show that when the default rate and bank size increase, then the performance of the bank decreases and vice-versa. A higher default rate indicates greater credit risk and potential financial losses for the bank. This result aligns with the findings of Waweru and Kalani (2008), who demonstrated that an increase in non-performing loans (NPL) can adversely affect banking performance. Moreover, extremely large banks

may face a decline in efficiency due to agency costs, bureaucratic processes, and other costs associated with managing large firms supported by Pasiouras and Kosmido (2007).

From the above discussion, it can be said that sustainable finance factors present mixed evidence of results. While green finance does not have any significant impact on performance, corporate Social Responsibility (CSR) influences Return on Equity (ROE) but does not affect Return on Assets (ROA). In contrast, digitalization has a significant impact on both ROA and ROE.

CONCLUSION

The study examines the impact of sustainable finance factors (green finance, CSR, digitalization) on the performance of commercial banks. The study reveals that higher levels of digitalization are statistically linked to decreased bank performance. This result indicates that the initial costs and challenges inherent in implementing digitalization may present a substantial hurdle, potentially overshadowing the expected benefits for banks. Other sustainability-related variables examined in the study do not show any impact on the performance, except CSR shows a positive impact on ROE. This indicates that CSR practice improves the stakeholder commitment toward the banks and positively affects performance. Additionally, company-specific variables like (default rate and bank size) have a significantly negative relationship with performance.

The findings provide practical information that contributes to cautious consideration in the central bank's policy formulation. In addition, the management and board of directors of commercial banks may reassess their resource allocation and strategic priorities and could benefit from adopting a more balanced approach, integrating digitalization efforts with a heightened awareness of the influence of CSR and green finance endeavors. This diversification can mitigate the negative consequences of extensive digitalization and contribute positively to overall bank performance.

The limitation of this study creates opportunities for future research. Enhancing the sample size from 24 commercial banks and increasing the study period from more than 2016 to 2022 might give more interesting insights. Instead of using yearly data, monthly data frequency may be able to catch more subtle trends and swings. Putting the results including other variables like corporate governance factors and macroeconomic factors could be helpful for the policymakers. Furthermore, it would be advantageous to look into the long-term effects of digitalization, including any potential cost savings and increases in efficiency over time.

AUTHOR CONTRIBUTIONS

Conceptualization: Shaikh Masrick Hasan, Priya Saha.

Data curation: Shaikh Masrick Hasan, K. M. Anwarul Islam, Priya Saha.

Formal analysis: Shaikh Masrick Hasan.

Funding acquisition: Tawfiq Taleb Tawfiq.

Investigation: Shaikh Masrick Hasan, Tawfiq Taleb Tawfiq, Priya Saha.

Methodology: Shaikh Masrick Hasan, Priya Saha.

Project administration: Shaikh Masrick Hasan.

Resources: Shaikh Masrick Hasan, K. M. Anwarul Islam, Tawfiq Taleb Tawfiq, Priya Saha.

Software: Shaikh Masrick Hasan, K. M. Anwarul Islam, Priya Saha.

Supervision: Shaikh Masrick Hasan.

Validation: Shaikh Masrick Hasan, K. M. Anwarul Islam, Priya Saha.

Visualization: Shaikh Masrick Hasan, Tawfiq Taleb Tawfiq, Priya Saha.

Writing – original draft: Shaikh Masrick Hasan, Priya Saha.

Writing – reviewing & editing: Shaikh Masrick Hasan, K. M. Anwarul Islam, Tawfiq Taleb Tawfiq, Priya Saha.

REFERENCES

- Aburime, T. (2008). Determinants of bank profitability: Industry-level evidence from Nigeria. *International Journal of Nigerian Studies and Development*, 14, 21-34. Retrieved from <https://ssrn.com/abstract=1120232>
- Ahmed, N., & Abedin, M. J. (2021). The impact of Covid-19 pandemic on the non-performing loans: A study on schedule banks in Bangladesh. *AIUB Journal of Business and Economics*, 18(1), 1-14. Retrieved from <https://ajbe.aiub.edu/index.php/ajbe/article/view/94>
- Akhter, I., Yasmin, S. & Faria, N. (2020). Green Banking Practices and Its Implication on Financial Performance of the Commercial Banks in Bangladesh. *Journal of Business Administration*, 42(1), 1-23. <https://doi.org/10.5281/zenodo.7013423>
- Al-Amin, M., Mia, R., & Hasan, S. M. (2024). FinTech Adoption and Its Impact on Bank Profitability: A Study of Bangladeshi Commercial Banks. *The Cost and Management*, 52(4), 27–40. Retrieved from <https://icmab.gov.bd/wp-content/uploads/2024/10/FinTech-Adoption-and-Its-Impact-on-Bank-Profitability-A-Study-of-Bangladeshi-Commercial-Banks-.pdf>
- Amador, J. S., Gómez-González, J. E., & Pabón, A. M. (2013). Loan growth and bank risk: New evidence. *Financial Markets and Portfolio Management*, 27(4), 365-379. <https://doi.org/10.1007/s11408-013-0217-6>
- Anbar, A., & Alper, D. (2011). Bank specific and macroeconomic determinants of commercial bank profitability: Empirical evidence from Turkey. *Business and Economics Research Journal*, 2(2), 139-152. Retrieved from <https://ssrn.com/abstract=1831345>
- Bangladesh Bank. (2023). *Sustainable Finance Policy for Banks and Financial Institutions*. Sustainable Finance Department of Bangladesh Bank, Dhaka. Retrieved 8 October 2024, from <https://www.bb.org.bd/mediaroom/circulars/gbcrd/oct222023sfd03new.pdf>
- Belasri, S., Gomes, M., & Pijourlet, G. (2020). Corporate social responsibility and bank efficiency. *Journal of Multinational Financial Management*, 54, 100612. <https://doi.org/10.1016/j.mul-fin.2020.100612>
- Bhaskaran, R. K., Sujit, K. S., & Mongia, S. (2023). Linkage between performance and sustainability initiatives in banking sector—An empirical examination. *International Journal of Productivity and Performance Management*, 72(1), 200-225. <https://doi.org/10.1108/IJPPM-07-2020-0385>
- Brammer, S. J., Pavelin, S., & Porter, L. A. (2006). Corporate social performance and geographical diversification. *Journal of Business Research*, 59(9), 1025-1034. <https://doi.org/10.1016/j.jbusres.2006.04.001>
- Chowdhury, Y., & Nehal, M. N. (2020). Effect of corporate social responsibility expenditures on financial performance in banking sector of Bangladesh. *Journal of Economics, Business and Management*, 8(1), 44-49. <https://doi.org/10.18178/joebm.2020.8.1.610>
- Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2011). Does it really pay to be green? Determinants and consequences of proactive environmental strategies. *Journal of Accounting and Public Policy*, 30(2), 122-144. <https://doi.org/10.1016/j.jaccpub-pol.2010.09.013>
- Flamini, V., McDonald, C. A., & Schumacher, L. B. (2009). *The Determinants of Commercial Bank Profitability in Sub-Saharan Africa* (IMF Working Paper No. 09/15). Retrieved from <https://ssrn.com/abstract=1356442>
- Hasan, S. M., Tawfiq, T. T., Hasan, M. M., & Islam, K. A. (2024a). Corporate Governance Dynamics in Financial Institution Performance: A Panel Data Analysis. *Investment Management and Financial Innovations*, 21(3), 292-303. [http://dx.doi.org/10.21511/imfi.21\(3\).2024.24](http://dx.doi.org/10.21511/imfi.21(3).2024.24)
- Hasan, S. M., Tawfiq, T. T., Hasan, M. M., & Islam, K. A. (2024b). Risk in the Shadows: Macroeconomic Shifts and Their Effects on Bangladeshi Mutual Funds. *Innovations*, 21(4), 371-384. [http://dx.doi.org/10.21511/imfi.21\(4\).2024.30](http://dx.doi.org/10.21511/imfi.21(4).2024.30)
- Hasan, S.M., & Minhat, M. (2021). Diversity in Ethical Funds. In Minhat, M., Dzolkarnaini, N. (Eds.), *Ethical Discourse in Finance*. Palgrave Studies in Impact Finance (pp. 125-147). Cham: Palgrave Macmillan. https://doi.org/10.1007/978-3-030-81596-7_7
- Hemingway, C. A., & Maclagan, P. W. (2004). Managers' Personal Values as Drivers of Corporate Social Responsibility. *Journal*

- of *Business Ethics*, 50(1), 33-44. <https://doi.org/10.1023/B:BUSI.0000020964.80208.c9>
18. Hoehle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal*, 7(3), 281-312. Retrieved from <http://www.stata-journal.com/article.html?article=st0128>
 19. Hossain, M. A., Rahman, M. M., Hossain, M. S., & Karim, M. R. (2020). The effects of green banking practices on financial performance of listed banking companies in Bangladesh. *Canadian Journal of Business and Information Studies*, 2(6), 120-128. <https://doi.org/10.34104/cjbis.020.01200128>
 20. Inoue, Y., & Lee, S. (2011). Effects of different dimensions of corporate social responsibility on corporate financial performance in tourism-related industries. *Tourism Management*, 32(4), 790-804. <https://doi.org/10.1016/j.tourman.2010.06.019>
 21. Julia, T. & Kassim, S. (2019). Exploring green banking performance of Islamic banks vs conventional banks in Bangladesh based on Maqasid Shariah framework. *Journal of Islamic Marketing*, 11(3), 729-744. <https://doi.org/10.1108/jima-10-2017-0105>
 22. Karjaluoto, H., Mattila, M., & Pentto, T. (2002). Factors underlying attitude formation towards online banking in Finland. *International Journal of Bank Marketing*, 20(6), 261-272. <https://doi.org/10.1108/02652320210446724>
 23. Kotiso, M. S. (2018). Factors affecting default risk of commercial banks: Evidence from Ethiopian banking industry. *Research Journal of Finance and Accounting*, 9(1), 1-10. Retrieved from <https://www.iiste.org/Journals/index.php/RJFA/article/view/40798>
 24. Leszczensky, L., & Wolbring, T. (2019). How to Deal with Reverse Causality Using Panel Data? Recommendations for Researchers Based on a Simulation Study. *Sociological Methods & Research*, 51(2), 837-865. <https://doi.org/10.1177/0049124119882473>
 25. Malhotra, P., & Singh, B. (2009). The impact of Internet banking on bank performance and risk: The Indian experience. *Eurasian Journal of Business and Economics*, 2(4), 43-62. Retrieved from <https://core.ac.uk/download/pdf/25988647.pdf>
 26. Mulwa, F. (2017). *Effect of Internet banking on the financial performance of commercial banks in Kenya* (Doctoral Thesis). University of Nairobi. Retrieved from <https://erepository.uonbi.ac.ke/handle/11295/102111>
 27. Network for Greening the Financial System (NGFS). (2020). *NGFS Annual Report 2019* (pp. 1-9). The Central Banks and Supervisors, NGFS Paris, France. Retrieved from <https://www.ngfs.net/en/publications-and-statistics/publications/ngfs-annual-report-2019>
 28. Niemand, T., Rigtering, J. C., Kallmünzer, A., Kraus, S., & Maalaoui, A. (2021). Digitalization in the financial industry: A contingency approach of entrepreneurial orientation and strategic vision on digitalization. *European Management Journal*, 39(3), 317-326. <https://doi.org/10.1016/j.emj.2020.04.008>
 29. Njogu, J. N. (2014). *The effect of electronic banking on profitability of commercial banks in Kenya* (Doctoral Thesis). University of Nairobi. Retrieved from https://erepository.uonbi.ac.ke/bitstream/handle/11295/75003/Njogu_The%20effect%20of%20electronic%20banking%20on%20profitability%20of%20commercial%20banks.pdf
 30. Ongore, V. O., & Kusa, G. B. (2013). Determinants of Financial Performance of Commercial Banks in Kenya. *International Journal of Economics and Financial Issues*, 3(1), 237-252. Retrieved from <https://dergipark.org.tr/en/pub/ijefi/issue/31956/351900>
 31. Pasiouras, F., & Kosmidou, K. (2007). Factors influencing the profitability of domestic and foreign commercial banks in the European Union. *Research in International Business and Finance*, 21(2), 222-237. <https://doi.org/10.1016/j.ribaf.2006.03.007>
 32. Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *The Review of Financial Studies*, 22(1), 435-480. <https://doi.org/10.1093/rfs/hhn053>
 33. Pinchot, A., Sato, I., Christianson, G., & Zhou, L. (2019). *Unpacking Green Targets: A Framework for Interpreting Private-Sector Banks' Sustainable Finance Commitments*. Washington, DC: World Resources Institute. Retrieved from <https://www.wri.org/research/unpacking-green-targets-framework-interpreting-private-sector-banks-sustainable-finance>
 34. Rahman, M. M., Ahsan, M. A., Hossain, M. M., & Hoq, M. (2013). Green banking prospects in Bangladesh. *Asian Business Review*, 2(2), 59-63. Retrieved from <https://ssrn.com/abstract=2273140>
 35. Reganold, J. P., Papendick, R. I., & Parr, J. F. (1990). Sustainable agriculture. *Scientific American*, 262(6), 112-121. Retrieved from <https://www.jstor.org/stable/24996835>
 36. Scholtens, B., & Kang, F. (2013). Corporate Social Responsibility and Earnings Quality: Evidence from Korean Firms. *Corporate Social Responsibility and Environmental Management*, 20(6), 345-360. <https://doi.org/10.1002/csr.1318>
 37. Serdarušić, H., Pancić, M., & Zavišić, Ž. (2024). Green finance and Fintech adoption services among Croatian online users: how digital transformation and digital awareness increase banking sustainability. *Economies*, 12(3), 54. <https://doi.org/10.3390/economies12030054>
 38. Singh, R., & Gupta, A. (2022). Digital Platforms and Financial Inclusion: A Pathway to Economic Sustainability. *International Journal of Finance & Economics*, 27(4), 789-803.
 39. Socol, A., & Danuletiu, A. E. (2013). Analysis of the Romanian banks performance through ROA, ROE and non-performing loans models. *Annales Universitatii Apulensis Series Oeconomica*, 2(15), 594-604. <https://doi.org/10.29302/oeconomica.2013.15.2.2>

40. Soppe, A. (2009). Sustainable finance as a connection between corporate social responsibility and social responsible investing. *Indian School of Business WP Indian Management Research Journal*, 1(3), 13-23. Retrieved from <https://ssrn.com/abstract=1336182>
41. Tara, K., Singh, S. & Kumar, R. (2015). Green Banking for Environmental Management: A Paradigm Shift. *Current World Environment*, 10(3), 1029-1038. <https://doi.org/10.12944/cwe.10.3.36>
42. Templeton, G. F. (2011). A two-step approach for transforming continuous variables to normal: implications and recommendations for IS research. *Communications of the Association for Information Systems*, 28(4), 41-58. <https://doi.org/10.17705/1CAIS.02804>
43. Thompson, P., & Cowton, C. J. (2004). Bringing the environment into bank lending: implications for environmental reporting. *The British Accounting Review*, 36(2), 197-218. <https://doi.org/10.1016/j.bar.2003.11.005>
44. Ullah, M. M. (2013). Green Banking in Bangladesh- A comparative analysis. *World Review of Business Research*, 3(4), 74-83. Retrieved from <https://www.semanticscholar.org/paper/Green-Banking-in-Bangladesh-A-Comparative-Analysis-Ullah/f72a79700a4759d8b3fc9382593a42b5baf6d104>
45. Umoru, D., & Osemwegie, J. O. (2016). Capital adequacy and financial performance of banks in Nigeria: empirical evidence based on the fgls estimator. *European Scientific Journal*, 12(25), 295-305. <https://doi.org/10.19044/esj.2016.v12n25p295>
46. Urban, M. & Wójcik, D. (2019). Dirty Banking: Probing the Gap in Sustainable Finance. *Sustainability*, 11(6), 1745. <https://doi.org/10.3390/su11061745>
47. Wadesango, N., & Magaya, B. (2020). The impact of digital banking services on the performance of commercial banks. *Journal of Management Information and Decision Sciences*, 23, 343-353. Retrieved from <https://www.abacademies.org/articles/THE-IMPACT-OF-DIGITAL-BANKING-SERVICES-ON-PERFORMANCE-OF-COMMERCIAL-BANKS-1532-5806-23-S1-204.pdf>
48. Waweru, N., & Kalani, V. M. (2008). Commercial banking crises in Kenya: Causes and remedies. *Global Journal of Finance and Banking Issues*, 3(3), 12-33. Retrieved from <https://ssrn.com/abstract=1536159>
49. Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171-180. <https://doi.org/10.1002/smj.4250050207>
50. Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. MIT press.
51. Zheng, G. W., Siddik, A. B., Masukujjaman, M., & Fatema, N. (2021). Factors affecting the sustainability performance of financial institutions in Bangladesh: the role of green finance. *Sustainability*, 13(18), 10165. <https://doi.org/10.3390/su131810165>
52. Zhou, X., Tang, X., & Zhang, R. (2020). Impact of green finance on economic development and environmental quality: a study based on provincial panel data from China. *Environmental Science and Pollution Research*, 27, 19915-19932. <https://doi.org/10.1007/s11356-020-08383-2>
53. Ziolo, M., Filipiak, B. Z., Bąk, I., & Cheba, K. (2019). How to design more sustainable financial systems: The roles of environmental, social, and governance factors in decision-making. *Sustainability*, 11(20), 5604. <https://doi.org/10.3390/su11205604>

APPENDIX A

Table A1. List of commercial banks included in the sample

SL No.	Bank Name	Year of Inception	SL No.	Bank Name	Year of Inception
1	Agrani Bank PLC	1972	13	Dhaka Bank Limited	1995
2	Janata Bank PLC	1972	14	NCC Bank PLC	1985
3	Rupali Bank PLC	1972	15	Mercantile Bank	1999
4	Pubali Bank PLC	1959	16	Union Bank Limited	2013
5	Bank Asia Limited	1999	17	Premier Bank PLC	1999
6	BRAC Bank	2001	18	Social Islami Bank Limited	1995
7	City Bank PLC	1983	19	Al-Arafah Islami Bank PLC	1995
8	Trust Bank Limited	1999	20	Uttara Bank PLC	1965
9	United Commercial Bank PLC	1983	21	Islami Bank Bangladesh Limited	1983
10	Eastern Bank PLC	1992	22	Dutch Bangla Bank Ltd	1996
11	IFIC Bank PLC	1976	23	National Bank Limited	1983
12	NRB Commercial Bank	2013	24	Midland Bank Limited	2013