ORIGINAL RESEARCH ARTICLE

J. F. Mkt. Gov. (2025) Vol. 4, Issue. 1
DOI: https://doi.org/10.54728/JFMG.202410.00103

Impact of Green Finance on the Provision and Reserve of Banks

Md. Jahangir Alam Siddikee
Hajee Mohammad Danesh Science and Technology University, Dinajpur
Email: msiddikee@yahoo.com

A. H. M Ziaul Haq, PhD
University of Rajshahi
Email: zia_haq2001@yahoo.com

Shahnaz Parvin
Hajee Mohammad Danesh Science and Technology University
Email: shahnazhstu09@gmail.com

Md. Abdullah-Al-Mamun*
Gopalganj Science and Technology University
Email: mamun1600.ju43@yahoo.com

Sakila Zabin
Hajee Mohammad Danesh Science and Technology University
Email: sakilazabin40@gmail.com

Hossen Md Abu Sufian
Mohila Bohumukhi Shikha Kendra
Email: pinusufian.ag@gmail.com

Keywords:
Green Finance, Provision, Reserve, Impact, Banks

JEL Classification:
Q5, G2, E5

Manuscript number
JFMG-202410-00103

Received: 02 October, 2024
First Revision: 02 October, 2024
Second Revision: 07 January, 2025
Third Revision: 18 March, 2025
Accepted: 20 May, 2024
Published Online: 04 June, 2025
Published in Print: 30 August, 2025

ISSN (Online): 2958-9290
ISSN (Print): 2958-9282

*Corresponding Author

This study inspects the influence of green finance on the provision and reserve of banks. Using a comprehensive dataset spanning several years from 2015 to 2023, this study employs econometric models to evaluate the impact of green finance on the provision and reserve of banks. Specifically, banks with higher involvement in green finance tend to allocate greater provisions and maintain larger reserves. Furthermore, the study examines how investments in green finance influence bank provisions and reserves. Key green finance sectors, alternative energy (AE), energy efficiency (EE), renewable energy (RE), waste management (WM), recycling and manufacturing of recyclable goods (RMGM), green industry and establishment (GIE), environmentally friendly brick production (EFBP), and other green investments (GOFI), significantly affect provision maintenance (PM). Additionally, AE, RMGM, GIE, EFBP, and GOFI drive changes in required provisions (RP), while AE, RE, WM, RMGM, GIE, and GOFI impact the statutory liquidity reserve eligible asset percentage (SLREAP). These findings underscore the importance of green finance in banking. Overall, this research advances the literature on finance and sustainability by empirically linking green finance to banking reserve and provision systems.

1. Introduction

In recent years, the global financial landscape has shifted notably toward environmentally sustainable operations. Growing concerns over social inequality, resource depletion, and climate change have pushed stakeholders across industries to reassess their operational models. Among these, the banking sector plays a critical role. As financial institutions drive economic activity, their lending and investment choices have wide-reaching consequences. In this context, green finance (GF) has gained significant attention as a means to align financial practices with sustainability goals. GF refers to financial activities that support environmental sustainability and reduce climate-related risks, offering a strategic path for institutions to confront global challenges.

A key component of banking operations is the maintenance of reserve funds, vital for meeting unexpected obligations and maintaining financial stability. The link between GF and reserve management has been explored in studies such as Jeucken (2001) and Bouma, Jeucken, and Klinkers (2017). Jeucken (2001) argued that banks committed to GF often show stronger financial health, allowing them to uphold more stable reserve funds. Bouma et al. (2017) emphasized the strategic benefits of GF, noting that banks applying environmental criteria tend to face fewer financial disruptions, thereby improving reserve management and resilience. Rozenberg et al. (2013) and Campiglio (2016) advocated for regulatory incentives to promote green investments, such as lower reserve requirements for environmentally sustainable assets, to encourage a shift from traditional to green financing. Given the systemic financial risks posed by climate change, there is strong justification for central banks to play an active role in managing these risks (Volz et al., 2020).

The environmental performance of banks is heavily shaped by their adoption of green policies and investments. Taneya and Ozen (2023) found that supporting sustainable technologies boosts both operational efficiency and client reputation. This highlights the importance of integrating environmental concerns into core banking strategies. Capital allocation decisions also affect the efficiency of global financial markets. Research by Hanra et al. (2000) and Lotto (2018) showed that inadequate capital regulation and banking crises can worsen the economic effects of unchecked climate change. Dafermos et al. (2018) further noted that sound capital management is key to mitigating these risks.

The early 21st century marked the rise of financialization in banking, marked by the concentration of financial capital and the dominance of major institutions (Boyer, 2000; Szunke, 2014). This era also saw expanded regulatory oversight, which influenced how credit institutions managed risk and liquidity (Malese, 2015). While prudential standards bolstered stability, they also altered the quality and composition of bank capital (Abreu, 2015; Boissay and Corrald, 2016; Barrios and Blanco, 2003). In recent years, the variety of green financial products such as green bonds, sustainability-linked loans, carbon trading, and green investments has grown significantly. This reflects a deeper understanding of the interplay between financial performance and environmental outcomes. The role of central banks in addressing climate risks and promoting GF has become increasingly important, particularly in line with global climate commitments under the Paris Agreement (Volz et al., 2015; Batten et al., 2016; Campiglio et al., 2018; Dikau and Volz, 2019).

This study aims to address a key gap by examining how green finance affects banks' provisioning requirements, provision maintenance, and statutory liquid reserve ratios. Specifically, it seeks to evaluate GF's impact on required provisions, provision maintained (PM), and the statutory liquid reserve percentage (SLREAP). By analyzing how GF shapes banks' risk profiles and compliance obligations, this study offers insights for policymakers, regulators, financial institutions, and investors committed to advancing sustainable finance while preserving financial resilience.

Banks in Bangladesh are required to maintain a minimum capital ratio of 10%, including 6% in Tier-1 capital and at least 4.5% in Common Equity Tier 1 (CET1) capital. As of June 2022, the sector reported a capital-to-risk-weighted asset ratio

(CRAR) of 11.2% and a CET1 ratio of 7.2%, in compliance with Basel III standards. Additionally, a capital conservation buffer (CCB) of 1.2% was maintained by that time.

To curb excessive leverage, Bangladesh Bank has set a minimum leverage ratio of 3%, while the banking sector achieved a ratio of 4.4% (ARBB, 2021–2022). In 2020, the Sustainable Finance Policy was introduced, requiring banks to allocate 5% of their loan portfolio to green finance and ensure that 20% supports green projects (SFD, 2020).

The central bank also uses differentiated reserve requirements based on factors like geographic credit allocation or portfolio composition as a tool to manage credit distribution (Chandavarkar, 1988). Variable asset-based reserve requirements have been widely used to encourage lending to specific sectors (Epstein, 2007). Reserve requirements significantly influence banks' ability to extend credit, thereby affecting the money supply. Lowering reserve requirements can lead to increased bank lending.

2. Review of Literature

Weber (2016) emphasized the growing role of banks in green financing, highlighting their key function in channeling capital toward environmentally sustainable projects. This financial support can yield significant environmental benefits. Similarly, Wang and Zhi (2016) examined the impact of government policies on green finance, arguing that well-structured regulations enhance the appeal of green investments. These policies not only promote sustainable banking practices but also bolster financial stability and risk management. Bocken et al. (2014) further noted that sustainable investments often carry lower financial risk than traditional ones.

Wu and Broadstock (2015) identified two main ways the financial sector supports renewable energy: through capital accumulation and the efficient allocation of funds to viable projects. While banks may initially be cautious about financing renewable energy, research suggests such investments improve financial stability and lower credit risk (Cui et al., 2018). Choudhury et al. (2023) supported this view, finding that a higher share of renewable energy in a country's energy mix significantly reduces banks' default risk, thereby affecting their reserve positions.

The banking sector's role in energy efficiency has also been studied in sub-Saharan Africa, where evidence shows a positive impact (Mensa et al., 2018). Fan (2024) argued that investing in clean, affordable energy promotes sustainable development and reduces loan default risks by aligning financial operations with environmental responsibility. This alignment leads to lower non-performing loans, influencing banks' reserve requirements. Li and Lin (2024) examined the link between green finance and corporate financial performance, analyzing data from 2012 to 2022 on green-listed firms to assess their financial responses to sustainable investments.

Diamond and Rajan (2000) emphasized that regulatory requirements force banks to balance their reserves carefully. Inefficiencies and waste can drain necessary capital, while effective waste management helps maintain adequate reserves. Slack, Chambers, and Johnston (2007) reinforced the value of minimizing waste to enhance operational efficiency and reduce costs, ultimately affecting reserve allocation.

Government incentives and penalties also shape green finance outcomes. Wang and Liu (2023) showed that recycling incentives help businesses improve both environmental results and operational efficiency. These policies reduce risks related to raw materials and environmental liabilities, thereby influencing banks' reserve calculations. Similarly, Islam et al. (2022) found that recycling industries have lower energy use and carbon emissions, improving their risk profiles and affecting banks' reserve requirements.

Investment levels in green industries directly impact banks' provisions and reserves, as institutions adjust capital allocation to manage green project risks. However, regional inconsistencies in regulations hinder uniform policy implementation (Yong et al., 2022). Solgi et al. (2022) found that energy-efficient practices in sectors like brick manufacturing lower emissions and environmental risks, influencing credit profiles and reserve levels. Similarly, Islam et al. (2023) highlighted that sustainable brick production, especially in emerging economies, contributes to social and environmental stability, affecting financial institutions' risk assessments and reserve provisions.

Integrating green finance into banking benefits both the financial sector and the environment (Abuatwan, 2023). Green banking, such as funding sustainable projects, improves environmental outcomes while prompting banks to adjust reserves in response to climate-related risks (Chen et al., 2022). Given the connection between green finance and reserve management, the conceptual framework (Figure 1) outlines eight sectors of green finance derived from Bangladesh Bank's annual reports. It categorizes reserve elements into Required Provision (RP), Provision Maintenance (PM), and Statutory Liquidity Reserve in Environmentally Aligned Projects (SLREAP), identifying green finance as an exogenous variable and reserve-related factors as endogenous. The relationships are tested using panel ordinary least squares (POLS), fully modified ordinary least squares (FMOLS), fixed effects models (FEM), and quantile regression. Citil (2024) found that green finance significantly promotes green growth, while Sharma (2024) demonstrated its positive effect on financial performance.

This analysis highlights the pivotal role of green finance in shaping required provisions, provision maintenance, and statutory liquidity reserves-reinforcing the financial and environmental value of green banking. Based on this literature, the following hypotheses and conceptual framework are proposed:

H_1: GF influences RP significantly and positively.

H_2: GF influences PM significantly and positively.

H_3: GF influences significantly and positively.

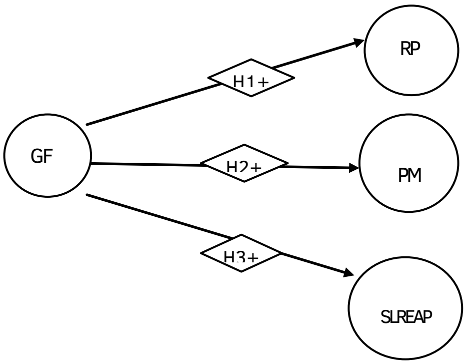

Figure 1: *Conceptual Framework with hypotheses*

3. Methodology

3.1 Research Design

This study adopts a numerical research design to examine the impact of green finance on the required provision, provision maintenance (PM), and statutory liquid reserve eligible asset percentage (SLREAP) of Banks.

3.2 Data with Sample

The source of data is the annual reports of Bangladesh Bank, focusing on the following categories, State-Owned Commercial Banks (SCB), Specialized Banks (SB), Private Commercial Banks (PCB), and Foreign Commercial Banks (FCB). SCB includes six banks, SB includes three banks, PCB includes forty-three banks, and FCB includes nine banks. The study covers a period of nine years from 2015 to 2023 to analyze the impacts effectively. The time duration has been chosen considering the availability of the green banking practices data.

3.3 Variables and Data Source

The data has been sourced from financial statements, annual reports, and other relevant bank publications. Figures from 2015 to 2023 were collected from the annual reports of Bangladesh Bank. Green finance variables AE, RE, EE, WM, RMRG, GIE, EFBP, and GOFI are reported in millions of takas. Provision and reserve variables RP and PM are in billions of takas, while SLREAP is expressed as a percentage.

Table 1: Variable Clarification and Data Source

Variables	Explanation
Alternative Energy (AE)	In contemporary times, energy development increasingly emphasizes alternative sources, with a particular focus on solar energy and wind energy (Baitanayeva et al., 2020).
Renewable Energy (RE)	Renewable energy harnesses sunlight, wind, and water to breed sustainable power, playing a vital role in economic growth and tackling environmental issues (Shinwari et al., 2022).
Efficient Energy (EE)	Efficient energy recovery and energy use by reducing waste, promoting sustainability, and increasing productivity. Energy efficiency means delivering an identical level of performance while using less energy (Dunlop, 2022).
Wastage Management (WM)	Waste management entails the collection, transportation, and disposal of waste materials (Panchal et al., 2021).
Recycling and Manufacturing of Recyclable Goods (RMRG)	Recycling involves recovering packaging materials from waste and converting them into new products through reprocessing products (Filyaw, 2022).
Green Industry & Establishment (GIE)	The green industry covers more than eco-friendly development, involving the adoption of integrated, comprehensive, efficient, and effective industrial systems (Aryani Siregar et al., 2020).
Environmentally Friendly Brick Production (EFBP)	Eco-bricks provide additional benefits, including enhanced thermal and sound insulation, long-lasting durability, and straightforward recyclability (Jha & Kewate, 2024).
Green Other Factor Investment (GOFI)	It includes manufacturing, the safety of the factory, and other green investments in the project. Ensuring safety in manufacturing involves technological and managerial strategies (Pačaiová et al., 2024).
Required Provision (RP)	Bank capital provisions significantly influence the capital efficiency of global financial markets, playing a crucial role in their overall performance and stability (Cohen, 2013).
Provision Maintenance (PM)	The central bank can use differentiated reserve requirements, such as those tied to geographic credit distribution or commercial bank portfolio composition, as a tool to regulate credit allocation (Chandavarkar, 1988).
Statutory Liquid Reserve Eligible Asset Percentage (SLREAP)	The liquidity coverage percentage could be an effective macro-prudential tool if regulators have the flexibility to determine how liquidity buffers are utilized during periods of financial stress (Van den End & Kruidhof, 2013).

3.4 Descriptive Statistics

In econometrics, heteroscedasticity is commonly addressed by applying a natural logarithm transformation to the variables, as noted by Charfeddine and Khediri (2016) and Ntarma et al. (2020). In our analysis, the data were transformed using a base-10 logarithm (log10). Table 2 presents the means, standard deviations, and correlation matrix, showing relationships among the regressors. The Variance Inflation Factor (VIF) values are below 5, and tolerance (TOL) values exceed 0.2, indicating no multicollinearity among the explanatory variables. WM shows the highest correlation with GIE (r = .829), while PM has the lowest correlation with RP (r = –.613).

Table 2: Descriptive Statistics

Var.	MN and SD		Correlation matrix											Collinearity statistics	
	MN	**SD**	**RE**	**EE**	**AE**	**WM**	**RMGM**	**GIE**	**EFBP**	**GOFI**	**RP**	**PM**	**SLREAP**	**Tol**	**VIF**
RE	7.95	1.10	1.0											.405	2.467
EE	-1.27	11.82	.606	1.0										.456	2.194
AE	-8.06	10.62	.583	.597	1.0									.439	2.275
WM	2.07	10.80	.556	.430	.456	1.0								.233	4.284
RMRG	1.25	10.98	.447	.357	.370	.724	1.0							.439	2.279
GIE	1.96	11.43	.648	.590	.458	.829	.638	1.0						.201	4.976
EFBP	0.23	11.64	.257	.340	.539	.271	.345	.175	1.0					.585	1.709
GOFI	7.18	4.24	.139	.328	.328	.413	.392	.429	.378	1.0				.642	1.557
RP	10.88	.57	.461	.407	.649	.599	.590	.485	.797	.429	1.00			-	-
PM	.96	.19	-.006	.033	-.143	-.295	-.196	-.125	-.515	-.150	-.613	1.00		-	-
SLREAP	.24	.17	.301	.167	-.01	.493	.258	.640	.271	-.120	. 024	-.117	1.00	-	-

Note: *MN means mean; SD stands for standard deviations; TOL and VIF are tolerance and variance influence factors, respectively. The endogenous variables for the collinearity diagnostics are RP, PM, and SLREAP.*

3.5 Cross-section Dependence Test

The first-generation tests, which assume that data across sections are independent, include those developed by Im et al. (2003), Choi (2001), and Maddala and Wu (1999). In contrast, the second-generation tests, which consider cross-sectional dependence, were applied by Pesaran (2007), Moon and Perron (2004); and Ntarmah et al. (2019). Table 3 illustrates that in the case of the impact of GF on RP, PM, and SLREAP, follow the cross-section independence under BPLM, PCD, and PSLM.

$$\mathrm{BPLM} = \mathrm{T}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{p}\ _{ij}^{2} \tag{1}$$

$$\mathrm{PCD} = \frac{\sqrt{2\mathrm{T}}}{\mathrm{N}(\mathrm{N}-1)}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{p}\ _{ij}^{2} \tag{2}$$

$$\mathrm{PSLM} = \frac{\mathrm{T}}{\sqrt{\mathrm{N}}}\sum_{j=1}^{N}\frac{1}{\mathrm{N}}\sum_{i=1}^{N}\hat{p}\ _{i,j} \tag{3}$$

Where

N is the number of cross-sectional units (e.g., SCB, SB, PCB, and FCB).

$\hat{p}\_(i,j)$ is the estimated correlation between the residuals from the i^{th} and j^{th} cross-sectional units.

n is the number of observations.

σ^2 is the estimated variance of the errors.

T is the number of periods or data points.

$\hat{e}\_t$ represents the residuals from the model.

Table 3: Cross-section Dependence Test

DV	BPLM	PCD	PSLM
RP	[.4711] (5.59)	[.5505] (.60)	[.9049] (-.12)
PM	[.3863] (6.34)	[.9168] (-2.030)	[.9220] (.10)
SLREAP	[.2491] (7.85)	[.2491] (-1.15)	[.5928]* (.53)

[] denotes the p-value and () denotes the statistic value.
Source: Compiled data by authors
Note: *BPLM stands for Breusch Pagan Lagrange Multiplier, PCD stands for Pesaran Cross-section Dependence, and PSLM denotes Pesaran Scaled Lagrange Multiplier.*

3.6 Unit Root Test

The unit root test results provide strong evidence against the presence of unit roots in all examined indicators. Ntarmah et al. (2019) applied the unit root test to assess the stationarity of their variables at both level and first-difference forms. Table 4 presents the unit root test results for the GF variables: RP, PM, and SLREAP. These results are based on the second difference, incorporating individual effects of exogenous variables, and using the Newey-West automatic bandwidth selection with a Bartlett kernel. The PP Fisher chi-square test statistics range from 25.5 to 53.0, with corresponding p-values between 0.0000 and 0.0019, strongly rejecting the null hypothesis of unit roots. Similarly, the PP Choi Z test statistics range from -6.229 to -2.814, with all p-values below 0.05, further confirming the rejection of unit root presence. This indicates that the data for all indicators exhibit stationary behavior and are not prone to non-stationarity.

$$\hat{\mathrm{P}} = -2\sum_{i=1}^{N}\ln\left(P\ _{i}\right) \tag{4}$$

$$\mathrm{Z} = \frac{1}{\sqrt{\mathrm{N}}}\sum_{i=1}^{N}\left(\pi\ _{i}\right) \tag{5}$$

Where

Pi is the p-value of the unit root test in respect of the ith cross-section.

N is the number of cross-sections in the panel.

π_i is the individual Phillips-Perron test statistic with respect of the ith cross-section.

Table 4: Individual Unit Root Process

Indicators	PP Fisher Chi-squ.	Prob.	PP Choi Z stat	Prob.
RP	43.370	0.0001***	-5.060	0.0001***
PM	38.950	0.0000***	-4.590	0.0000***
SLREAP	25.380	0.0000***	-3.150	0.0000***
RE	41.439	0.0000***	-4.629	0.0000***
EE	25.502	0.0013***	-3.270	0.0005***
AE	31.869	0.0000***	-4.733	0.0000***
WM	28.489	0.0004***	-2.814	0.0024***
RMRG	46.227	0.0000***	-4.878	0.0000***
GIE	52.939	0.0000***	-6.229	0.0000***
EFBP	20.974	0.0019***	-2.999	0.0014***
GOFI	33.441	0.0001***	-3.833	0.0001***

Source: Compiled data by authors

*'***' '**' and '*' signify the significance at the 1%, at the 5 % and at the 10% level, respectively.*

3.7 Hausman Test

The Hausman (1978) test for panel data serves as a general specification test, indicating that rejection of the null hypothesis signifies misspecification rather than endorsing the fixed effects estimator, while non-rejection supports the random effects estimator, which is efficient under the null hypothesis (Baltagi, 2024). Both the fixed effects and random effects models suggest a spatial Hausman test to compare these two models while considering spatial autocorrelation in the errors (Mutl and Pfaffermayr, 2011) to decide if a time-varying covariate is exogenous in the random effects model for panel data (Mainzer, 2018). The Hausman test judges against the estimators from the random effects model (RE) and the fixed effects model (FE). The equation for the Hausman test statistic (H) is:-

Regarding control variables we find similar directions to all control variables we get in our main analysis. For instance, we document that the highly levered firms are likely to hold lower cash as these firms have more debt obligations to fund providers and they are prone to hide their cash levels. Accordingly, we find the negative coefficient for leverage with corporate cash holding.

We also document that cash holding is negatively associated with net working capital and the proportion of capital expenditure to total assets and the coefficients are statistically significant and they are consistent with prior literature. Prior research shows that firms with higher government ownerships are more likely to hold greater cash as the management of these organizations are inclined to earnings manipulations or cash manipulations or they tunnel resources for their private interests (Alkhataybeh, AlSmadi, Shakhatreh, & Khataybeh, 2022; Dewenter & Malatesta, 2001). Consistently, we find, in our analysis, that corporate cash holding is significantly higher in organizations with greater gover nment ownership. All other control variables show consistent signs and significant levels with respect to our dependent variable.

$$\mathrm{H} = (\hat{\beta}_{FE} - \hat{\beta}_{RE})' \, [\mathrm{Var}(\hat{\beta}_{FE}) - \mathrm{Var}(\hat{\beta}_{FE})]^{-1} (\hat{\beta}_{FE} - \hat{\beta}_{RE}) \quad (6)$$

Where:

$(\hat{\beta}_{FE})$ is the estimated coefficient for the fixed effects model,

$(\hat{\beta}_{FE})$ is the estimated coefficient for the random effects model,

Var$(\hat{\beta}_{FE})$ and Var$(\hat{\beta}_{FE})$ are the variances of the coefficients for the respective models.

Table 5 represents Hausman test results that indicate which model is appropriate for our data set. Chi-square statistic value with corresponding p-value tells that for PM and SLREAP, a random effect model is appropriate, while for RP, a fixed effect model is suitable.

Table 5 represents Hausman test results that indicate which model is appropriate for our data set. Chi-square statistic value with corresponding p-value tells that for PM and SLREAP, a random effect model is appropriate, while for RP, a fixed effect model is suitable.

Table 5: Hausman Test Result

Variables	Chi-sq. statistics	Prob.	Model specification
RP	28.830	.0003***	Fixed Effect Model (FEM)
PM	6.850	.5520	Random Effect Model (REM)
SLREAP	2.990	.9349	REM

Source: Compiled data by authors

*'***' '**' and '*' signify the significance at the 1%, the 5 %, and the 10% level, respectively.*

3.8 Econometric Models

This study uses a quantitative approach to investigate the impact of green finance on bank provisions and reserves. Multiple regression analysis is employed to assess the effects of green finance components RE, EE, AE, WM, RMRG, GIE, EFBP, and GOIF on RP, PM, and SLREAP. The model includes green finance factors as explanatory variables, while provisions and reserves serve as both dependent and explanatory variables. A log10 transformation is applied to the green finance variables and RP.

3.8.1 Panel Ordinary Least Squares (POLS) and FMOLS

POLS method for regression is used in our panel data. The independent variables are GF, and the dependent variables are RP, PM, and SLREAP. Accordingly, the equations for the Panel Ordinary Least Squares regression and fully modified ordinary least squares (FMOLS) are as follows. The structure of POLS and FMOLS is the same, but with the adjustment for biases caused by endogeneity and serial correlation.

$$RP_{it}= \beta_0+ \beta_i\, GF_{it} + \varepsilon_i \quad (8)$$

$$PM_{it}= \beta_0+ \beta_i GFit +\varepsilon_i \quad (9)$$

$$SLREAP_{it}= \beta_0+ \beta_i GF_{it} +\varepsilon_i \quad (10)$$

Where:

RP_{it}, PM_{it}, and $SLREAP_{it}$, are the values of the endogenous variables for the i^{th} observation in period t.

GF_i is the value of the explanatory variable (GF) for the i^{th} observation in period t.

β_0 is the intercept.

β_i is the coefficient of explanatory variables.

ε_i is the error term.

3.8.2 Fixed Effect Model

Fixed effects method with time-fixed effects allows us to control for unobserved entity-specific characteristics, focus on within-entity changes, account for time-specific factors, and provide consistent estimates of the relationship between GF and provision & reserve.

$RP_{it} = \alpha_0 + GF_{it}\beta + \gamma_{it} + \varepsilon_{it}$ (11)

$PM_{it} = \alpha_0 + GF_{it}\beta + \gamma_{it} + \varepsilon_{it}$ (12)

$SLREAP_{it} = \alpha_0 + GF_{it}.\beta + \gamma_{it} + \varepsilon_{it}$ (13)

Where

RP_{it} PM_{it}, and $SLREAP_{it}$ are the dependent variables for individual iat time t.

α_i represents the individual-specific intercept, also known as the fixed effect.

GF_{it} is a vector of independent variables for individual i at time t.

β is a vector of coefficients representing the effect of independent variables on the dependent variable.

γ_t stands for the time-fixed effects, accounting for time-specific influences.

ε_{it} is the error term for individual i at time t, representing unobserved factors affecting the dependent variable.

3.8.2 Random Effect Model

Random Effects Model (REM) is commonly used in econometrics and statistics when dealing with panel data or hierarchical data structures. The general form of a random effects model can be written as:-

$RP_{it} = B_0 + GF_{it}\beta + u_i + \varepsilon_{it}$ (14)

$PM_{it} = B_0 + GF_{it}\beta + u_i + \varepsilon_{it}$ (15)

$SLREAP_{it} = B_0 + GF_{it}.\beta + u_i + \varepsilon\_it$ (16)

Where

RP_{it} PM_{it}, and $SLREAP_{it}$ are the dependent variables for individual i at time t.

B represents the individual specific intercept, also known as the fixed effect.

GF_{it} is a vector of independent variables for individual i at time t.

β is a vector of coefficients representing the effect of independent variables on the dependent variable.

u_i is the random effect, capturing unobserved heterogeneity specific to the individual i (assumed to be normally distributed.

ε_{it} is the idiosyncratic error term.

4. Result and Discussion

4.1 Impact of green factors on provision and reserve

In this study, researchers have quantified the connection between green factors - AE, EE, RE, WM, RMGM, GIE, EFBP, and GOFI and provision and reserve- RP, PM, and SLREAP. Through this analysis, it becomes possible to discern the degree to which these green finance factors influence RP, PM, and SLREAP. The association between green banking activities and banks' environmental performance is mediated by green financing (Zhang, et al, 2022).

Table 6: ANOVA of Green Finance and Provision with Reserve

DV	Statistic	Sum of Squares	df	Mean Square	F	R	Adj. R^2	Sig.
RP	Regression*	9.491	8	1.186	15.462	.906	.768	.000
	Residual	2.072	27	.077				
	Total	11.563	35					
PM	Regression*	0.128	8	.016	2.402	.645	.243	.042
	Residual	0.179	27	.007				
	Total	0.307	35					
SLREAP	Regression*	1243.165	8	155.396	24.543	.938	.843	.000
	Residual	170.950	27	6.331				
	Total	1414.115	35					

Dependent Variable: RP, PM, and SLREAP.

Predictors: (Constant), EFBP, GIE, GOFI, AE, RE, RMGM, EE, and WM

Source: *Compiled data by authors.*

Table 6 presents the results of the POLS model, showing that Green Finance (GF) explains 76.8% of RP, 24.3% of PM, and 84.3% of SLREAP. The F-statistics for all three models indicate that GF significantly affects RP, PM, and SLREAP. Additionally, the p-values ($p < .05$) across all three regression models confirm significance at the 0.05 level, warranting the rejection of the null hypotheses.

Table 7 shows that the standard error for RE (0.067) is relatively high, while for EFBP it is low (0.005), indicating a variability range between 0.067 and 0.005 around the true coefficient for RP. For PM, the predictor coefficient variability lies between 0.002 and 0.020; for SLREAP, between 0.048 and 0.605. Among the regressors, RE exhibits both the highest upper bound and lowest lower bound across RP, PM, and SLREAP. Green finance indicators with t-statistics exceeding ±2.120 have a significant impact on RP, PM, and SLREAP.

Table 7: Individual Impact on RP, PM and SLREAP

DV	IV	UC		SC	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
RP	(Constant)	10.74	.584	-	18.37	.000	9.539	11.938
	RE	.021	.067	.040	.315	.755	-.116	.158
	EE	-.006	.006	-.117	-.969	.341	-.018	.006
	AE	.010	.007	.186	1.510	.143	-.004	.024
	WM	.013	.009	.236	1.403	.172	-.006	.031
	RMRG	.007	.006	.127	1.034	.310	-.007	.020
	GIE	.003	.009	.060	.330	.744	-.016	.022
	EFBP	.030	.005	.609	5.72	.000***	.019	.041
	GOFI	.000	.014	-.003	-.033	.974	-.029	.028
PM	(Constant)	-.163	.172	-	-.946	.352	-.516	.190
	RE	.018	.020	.209	.904	.374	-.022	.058
	EE	.001	.002	.185	.851	.402	-.002	.005
	AE	.002	.002	.170	.768	.449	-.003	.006
	WM	-.004	.003	-.459	-1.51	.144	-.009	.001
	RMRG	.001	.002	.171	.769	.448	-.002	.005
	GIE	-.001	.003	-.148	-.450	.656	-.007	.004
	EFBP	-.005	.002	-.663	-3.45	.002***	-.009	-.002
	GOFI	.003	.004	.131	.713	.482	-.005	.011
SLREAP	(Constant)	-3.78	5.310	-	-.712	.483	-14.674	7.115
	RE	.257	.605	.045	.424	.675	-.985	1.499
	EE	-.031	.053	-.058	-.588	.561	-.141	.078
	AE	-.023	.060	-.038	-.374	.711	-.147	.101
	WM	.173	.082	.294	2.12	.043**	.006	.340
	RMRG	.017	.058	.029	.289	.775	-.103	.137
	GIE	.427	.083	.769	5.15	.000***	.257	.598
	EFBP	.037	.048	.067	.770	.448	-.061	.135
	GOFI	-.537	.125	-.358	-4.29	.000***	-.794	-.280

Source: *Compiled data by authors*

Moreover, the p-value has confirmed those significant factors that have an impact on RP, PM, and SLREAP. Accordingly, WM, GIE, and GOFI have a significant impact on SLREAP, while EFBP has a significant impact on RP and PM.

5.3 Long-term Effect of GF on Provision and Reserve

The study of Mahmood (2019) utilizes the fully modified ordinary least squares (FMOLS) to investigate the effects of macro- and bank-specific variables on bank liquidity from 2000 to 2017 and found that there was a long-run relation between bank liquidity and macro and bank-specific factors. Table 8 shows that the SEs of the coefficient of the predictor are high for RMRG and low for GIE with respect to all three models. Accordingly, the large variability in the estimation of the coefficient of GF factors is included in RMRG, and the small variability in GIE. The long-run variance (LRV) is large for RP and small for PM.

Table 8: Long-term Effect of GF on Provision and Reserve

DV	IV	Coef	Std. error	t- statistic	P-value	LRV
RP	RE	0.026598	0.037995	0.700036	0.5225	0.040
	EE	0.018953	0.031754	0.596881	0.5827	
	AE	-1.027988	0.373906	-2.749321	0.0514**	
	WM	-0.121661	0.372439	-0.326661	0.7603	
	RMRG	4.063435	0.772844	5.257767	0.0063***	
	GIE	-0.051115	0.023711	-2.155765	0.0974*	
	EFBP	0.922080	0.544773	1.692593	0.1658	
	GOFI	1.089382	0.209982	5.187968	0.0066***	
PM	RE	0.183053	0.006778	27.00543	0.0000***	0.001
	EE	-0.082176	0.005665	-14.50603	0.0001***	
	AE	-0.499368	0.066706	-7.486139	0.0017***	
	WM	0.983702	0.066444	14.80501	0.0001***	
	RMRG	5.294350	0.137877	38.39909	0.0000***	
	GIE	-0.028019	0.004230	-6.623707	0.0027***	
	EFBP	-1.313180	0.097189	-13.51166	0.0002***	
	GOFI	0.204521	0.037461	5.459541	0.0055***	
SLREAP	RE	1.417461	0.079421	17.84740	0.0001***	0.060
	EE	0.007766	0.006745	1.151378	0.3137	
	AE	-0.120883	0.008070	-14.97835	0.0001***	
	WM	-0.125626	0.079109	-1.588004	0.1875	
	RMRG	-6.968009	0.164159	-42.44664	0.0000***	
	GIE	0.031880	0.005036	6.329932	0.0032***	
	EFBP	0.160220	0.115715	1.384610	0.2384	
	GOFI	-0.337249	0.044602	-7.561265	0.0016***	

Source: *Compiled data by authors*
*'***' '**' and '*' signify the significance at the 1%, 5 % and 10% level respectively*
The t-statistic of significant GF variables contains a value greater than (|t|> 2.15) of the respective GF predictors on DVs. Besides, the p-value less than .10 at the 0.10 level has ensured the impact of GF on RP, PM, and SLREAP. So, all variables have a long-run impact on PM; four variables- AE, RMRG, GIE, and GOFI on RP, and five variables- AE, RE, RMGM, GIE, and GOFI on SLREAP at the 0.01 level.

5.4 Fixed and Random Effect of GF on Provision and Reserve

Following the Hausman test, the effects of green finance on provision and reserve were analyzed. Table 9 presents the fixed and random effects of green finance on these variables. Significant factors are identified by t-values exceeding ±1.81. Statistical significance is confirmed by p-values at or below 0.10, 0.05, or 0.01 levels.

Specifically, EFBP shows a significant fixed effect on RP at the 0.05 level. EE, WM, and EFBP exhibit significant random effects on PM at the 0.10, 0.05, and 0.01 levels, respectively. Additionally, GIE and GOFI have significant random effects on SLREAP at the 0.05 level.

Table 9: Fixed and Random Effect of GF on Provision and Reserve

Variables	PR (FEM)		PM (REM)		SLREAP (REM)	
	t-statistics	p-value	t-statistics	p-value	t-statistics	p-value
RE	0.982	0.341	0.641	0.539	-1.326	0.222
EE	-1.372	0.1891	2.053	0.074*	-0.942	0.374
AE	0.430	0.673	0.515	0.620	-1.383	0.204
WM	0.698	0.450	-2.462	0.039**	0.410	0.693
RMRG	0 .433	0.671	0.858	0.415	-1.345	0.216
GIE	-0.040	0.970	-0.545	0.600	3.018	0.017**
EFBP	2.637	0.018*	-4.321	0.003***	-1.260	0.243
GOFI	0.062	0.951	1.797	0.110	-3.356	0.010***

Source: *Compiled data by authors*

*'***' '**' and '*' signify the significance at the 1%, 5 % and 10% level respectively.*

6. Conclusion

This study highlights how various factors differently influence key variables RP, PM, and SLREAP across both short-term and long-term contexts, emphasizing their interconnections at different significance levels. WM, GIE, and GOFI show a strong influence on SLREAP, while EFBP significantly affects RP and PM. Over the long term, factors such as RE, EE, AE, WM, RMGM, GIE, EFBP, and GOFI impact PM. Specifically, AE, RMGM, GIE, and GOFI influence RP, and AE, RE, RMGM, GIE, and GOFI affect SLREAP at the 0.01 significance level. Additionally, EFBP has a fixed effect on RP at the 0.05 level, while EE, WM, and EFBP significantly affect PM under random effects. GIE and GOFI also show significant random effects on SLREAP.

The study faces several limitations. One major challenge is data availability and consistency, as green finance is still developing and lacks uniform measurement standards across regions. Differences in national green finance regulations, policies, and adoption rates may also lead to inconsistent results. Moreover, external economic variables such as market fluctuations, interest rates, and inflation could influence the findings, making it difficult to isolate the impact of green finance.

Future research should work toward standardized metrics for green finance, include long-term and cross-regional assessments, and examine the relationship between green finance and broader macroeconomic trends. It would also be valuable to study how green finance affects not only traditional banks but also emerging financial institutions, considering both financial and environmental outcomes.

Authors' Contribution Statement

This paper is collaborative research where multiple authors gave their valuable intellectual contribution.

Introduction & Literature review was written by Dr. A. H. M Ziaul Haq and Shahnaz Pervin. Md. Jahangir Alam Siddikee and Md. Abdullah-Al-Mamun provided their significant insight on data collection, data analysis and discussion part. Lastly, the abstract and conclusion was covered by Sakila Zabin & Md. Abu Sufiyan.

References

Abreu, JF. (2015). "The Effectiveness of Regulatory Capital Requirements Prior to the Onset of the Financial Crisis." Int. Rev. Financ.. 15, 199–221.

Abuatwan, N. (2023). The impact of Green Finance on the sustainability performance of the banking sector in Palestine: The moderating role of female presence. Economies, 11(10), 247. https://doi.org/10.3390/economies11100247

Amuakwa-Mensah, F., Klege, RA., Adom, PK., Amoah, A. Hagan E.(2018). Unveiling the energy saving role of banking performance in Sub-Sahara Africa, Energy Econ, 1 (74), 828-842.

Aryani Siregar, S., Napitupulu, H., & Ginting, R. (2020). Identification of factors affecting a green industry: A literature review. IOP Conference Series: Materials Science and Engineering, 801(1), 012097.

Baitanayeva, B., Yerezhepova, A., Nurmanova, B., & Andabayeva, G. (2020). Current state and problems of alternative energy development in the world. E3S Web of Conferences, 159, 07004.

Baltagi, B.H. (2024), Hausman's Specification Test for Panel Data: Practical Tips", Essays in Honor of Subal Kumbhakar (Advances in Econometrics), Emerald Publishing Limited, Leeds, 46, 13-24.

Barrios, VE. and Blanco, JM.(2003)." The effectiveness of bank capital adequacy regulation: A theoretical and empirical approach." J. Bank. Financ. 27, 1935–1958.

Batten, S., Sowerbutts, R., Tanaka, M. (2016). Let's talk about the weather: the impact of climate change on central banks. In: Working Paper No. 603. Bank of England, London.

Bocken, NMP., Short, SW., Rana, P. and Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. Journal of Cleaner Production, 65, 42-56.

Boissay, F.; Collard, F. Macroeconomic of bank capital and liquidity regulations. BIS Work. Pap. 2016, 596, 1–43.

Bouma, JJ., Jeucken, M., and Klinkers, L. (2017). Sustainable banking: The greening of finance. Routledge.

Boyer, R. (2000). Is a Finance-led Growth Regime a Viable Alternative to Fordism? A Preliminary Analysis. Econ. Soc., 29, 111–145.

Campiglio, E. (2016) "Beyond Carbon Pricing: The Role of Banking and Monetary Policy in Financing the Transition to a Low-carbon Economy", Ecological Economics, 121, 220–230.

Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G., Tanaka, M. (2018). Finance and climate change: what role for central banks and financial regulators? Nat. Clim. Chang., Vol. 8, no. 6, 462–468.

Chandavarkar, A.G. (1988). "Promotional Role of Central Banks in Developing Countries", IMF Working Paper No. 87/20, Washington, DC: International Monetary Fund.

Chen J., Siddik, AB., Zheng ,GW., Masukujjaman ,M. and Bekhzod, S..2022. The Effect of Green Banking Practices on Banks' Environmental Performance and Green Financing: An Empirical Study, Energies, 15, 1292.

Choi, I. (2001). Unit root tests for panel data. Journal of International Money and Finance, 20(2), 249-272.

Choudhury, T., Kamran, M., Djajadikerta, HG and Sarker, T. 2023.Can Banks Sustain the Growth in Renewable Energy Supply? An International Evidence. Eur J Dev Res, 35, 20–50.

CİTİL, M. (2024). Is green finance a prerequisite for green growth of G-20 economies. Innovation and Green Development, 3(4), 100170. https://doi.org/10.1016/j.igd.2024.100170

Cohen, BH. (2013)."How have banks adjusted to higher capital requirements?" BIS Q. Rev., 17, 25–41.

Cui, Y., et al. 2018. The impact of green lending on credit risk in China. Sustainability 10 (6): 2008.

Dafermos,Y., Nikolaidi, M and Galanis, G.(2018). "Climate Change, Financial Stability and

Monetary Policy" Ecological Economics, 152, 219-234.

Diamond, D. W., & Rajan, R. G. (2000). A theory of bank capital. The Journal of Finance, 55(6), 2431-2465.

Dikau, S., Volz, U.(2019). Central banking, climate change and green finance, Springer Handbook of Green Finance: Energy Security and Sustainable Development. Springer, New York, pp. 81–102.

Dunlop, T. (2022). Energy efficiency: The evolution of a motherhood concept. Social Studies of Science, 52(5), 710–732.

Epstein, GA. (2007). "Central Banks as Agents of Economic Development", in Chang, H.-J. (ed.), Institutional Change and Economic Development, New York et al.: co-published by United Nations University Press and Anthem Press, 95–114.

Fan, M., Mo, Z., Fu, H. Wu, TH. Chen Z and He Y. 2024. Does climate policy uncertainty matter for bank value? Econ Change Restruct, 57, 56.

Filyaw, M. H. (2022). Recycled plastics in food contact. Global Legislation for Food Contact Materials, 2, 193–202.

Hausman, J. A., (1978). Specification tests in econometrics', Econometrica, 46, 1251–1271.

HU, Y., Wang, H. , Jiayao Liang, J.3, Jinrui Li, J. 2022. Green Credit Service in China: Policy Review and Flawed Regulation, Industrial Engineering and Innovation Management, 5(2), 50207.

Hunjra, AI., Zureigat, Q.and Mehmood, R.(2020) "Impact of Capital Regulation and Market Discipline on Capital Ratio Selection: A Cross Country Study." Int. J. Financ. Stud., 8, 21.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. Journal of Econometrics, 115(1), 53–74.

Islam K. , Masaharu Motoshita, M. and Murakami, S. 2023. Environmental Sustainability of Bricks in an Emerging Economy: Current Environmental Hotspots and Mitigation Potentials for the Future. Sustainability, 15, 5228.

Islam, MT., Raniga, U. and Trewick,S.2022. Recycling Perspectives of Circular Business Models: A Review, Recycling, 7(5), 79.

Jeucken, M. (2001). Sustainable Finance and Banking: The Financial Sector and the Future of the Planet. Earthscan.

Jha, A. K., & Kewate, S. P. (2024). Manufacturing of eco bricks: A sustainable solution for construction. International Conference on Innovative Product Design and Intelligent Manufacturing Systems , 66(`1), 28.

Li, Y., & Lin, A. (2024a). Assessing the impact of Green Finance on Financial Performance in Chinese eco-friendly enterprise. Heliyon, 10(7). https://doi.org/10.1016/j.heliyon.2024.e29075

Lotto, J.(2018). "The Empirical Analysis of the Impact of Bank Capital Regulations on Operating Efficiency". Int. J. Financ. Stud., 6, 34.

Maddala, G., & Wu, S. (1999). A comparative study of unit root tests and a new simple test. Oxford Bulletin of Economics and Statistics, 61, 631–652.

Mahmood H., Khalid, S. Waheed, A. and Arif, M.(2019). "Impact of Macro Specific Factor and Bank Specific Factor on Bank Liquidity using FMOLS Approach", Emerging Science Journal, Vol. 3, no. 3, 168-178.

Mahmood, H., Khalid, S., Waheed, A. and Arif, M.(2019). "Impact of Macro Specific Factor and Bank Specific Factor on Bank Liquidity using FMOLS Approach."Emerging Science Journal, Vol. 3, no. 3, 168-178.

Mainzer R. (2018). The effect of preliminary Hausman test on confidence interval. Bull. Aust. Math. Soc. 98, 518-519.

Melese, Nigist, and Laximikantham.(2015). "Determinants of Banks Liquidity : Empirical Evidence on Ethiopian Commercial Banks." Journal of Economics and Sustainable Development, 36–47.

Moon, H. R., & Perron, B. (2004). Testing for a unit root in panel with dynamic factors. Journal of Econometrics, 122(1), 81–126.

Morina F., Ergün U., Hysa E. (2021). "Understanding drivers of renewable energy firm's performance", Environ. Res. Eng. Manage., Vol. 77, no. 3, 32-49,

Mutl, J. and Pfaffermayr M. The Hausman test in a Cliff and Ord panel model, The econometric journal, 14 (1), 48-76.

Naseer, MM. Muhammad, AK., Bagh , T., Guo, Y. and Zhu, X.(2024). "Firm climat change risk and financial flexibility: Drivers of ESG performance and firm value", Borsa Istanbul Review, Vol. 24, no. 1, 106-117.

Ntarmah, A. H., Kong, Y., & Gyan, M. K. (2019). Banking system stability and economic sustainability: A panel data analysis of the effect of banking system stability on sustainability of some selected developing countries. Quantitative Finance and Economics, 3(4), 709-738.

Pačaiová, H., Turisová, R., Glatz, J., & Onofrejová, D. (2024a). Sustainability assessment of Machinery Safety in a manufacturing organization using AHP and CART methods. Sustainability, 16(9), 3718.

Panchal, R., Singh, A., & Diwan, H. (2021). Does circular economy performance lead to sustainable development? – A systematic literature review. Journal of Environmental Management, 293, 112811.

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross section dependence. Journal of Applied Econometrics, 22(2), 265–312.

Rozenberg, J., Hallegatte, S., Perrissin-Fabert, B. and Hourcade, J.-C. (2013): "Funding Low-carbon Investments in the Absence of a Carbon Tax", Climate Policy, Vol. 13 no. 1, 134–141.

Sharma, V. (2024). Green Finance and firm performance, research gaps and Future Directions. Proceedings of the International Scientific Conference ECONOMIC POLICY, 236–250. https://doi.org/10.2478/9788367405973-021

Shinwari, R., Yangjie, W., Payab, A. H., Kubiczek, J., & Dördüncü, H. (2022). What drives investment in renewable energy resources? Evaluating the role of Natural Resources Volatility and Economic Performance for China. Resources Policy, 77, 102712.

Slack, N., Chambers, S., & Johnston, R. (2007). Operations management (5th ed.). Pearson Education.

Solgi E., Hossein Gitinavard H. and Moghaddam, RT. 2022.Sustainable High-Tech Brick Production with Energy-Oriented Consumption: An Integrated Possibilistic Approach Based on Criteria Interdependencies Sustainability 2022, 14, 202.

Stockhammer, E. (2004). "Financialisation and the Slowdown of Accumulation." Camb. J. Econ., 28, 719–741.

Sustainable Finance Policy (2020) - Bangladesh Bank Circular No. 01, Sustainable Finance Department.

Szunke, A. (2014). The role of financialization in banking sector instability. J. Econ. Manag. 2014, 16, 97–111.

Taneja, S. and Ozen E. (2023). "To analyse the relationship between bank's green financing and environmental performance. "International Journal of Electronic Finance, Vol. 12, no. 2, 163-175.

Tung, HT., Belás, J. and Baideldinova, T.(2018). "How do banks implement the capital regulation requirement?" J. Int. Stud., 11, 161–175.

Volz, U., (2017). On the Role of Central Banks in Enhancing Green Finance. Inquiry Working Paper No. 17/01. UNEP Inquiry into the Design of a Sustainable Financial System, Geneva.

Volz, U., Beirne, J., Ambrosio Preudhomme, N., Fenton, A., Mazzacurati, E., Renzhi, N., Stampe, J., (2020). Climate Change and Sovereign Risk. SOAS University of London, Asian Development Bank Institute, World Wide Fund for Nature Singapore, and Four Twenty Seven, London, Tokyo, Singapore, and Berkeley, CA.

Wang, X. Li, Z. and Liu P. 2023. Production and Incentive-Penalty Strategies in Closed-Loop Supply Chains under Remanufacturing Policies, Recycling, 15(12), 9750.

Wang, Y., and Zhi, Q. (2016). The role of green finance in environmental protection: Two aspects of market mechanism and policies. Energy Procedia, 104, 311-316.

Weber, O. (2016). The financial sector's impact on sustainable development. Journal of Sustainable Finance & Investment, Vol. 6, no.1, 1-13.

WU, L. and Broadstock, DC. (2015).Does economic, financial and institutional development matter for renewable energy consumption? Evidence from emerging economies, International Journal of Economic Policy in Emerging Economies, Vol. 8, No. 1, 20-39.

Zhang, X., Wang, Z., Zhong, X., Yang, S. and Siddik, A.B. (2022). Do green banking activities improve the banks'environmental performance? The mediating effect of green financing. Sustainability, 14(989),1-18.

Zhang, X., Wang,Z., Zhong, X., Yang, S. and Siddik, AB. (2022). "Do green banking activities improve the banks' environmental performance? The mediating effect of green financing", Sustainability, Vol.14, no. 989 1-18, https://doi.org/10.3390/su14020989 Access on December 7, 2023.