



GREEN LENDING AND RETURN ON ASSETS OF LISTED DEPOSIT MONEY BANKS IN NIGERIAN

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Abstract

In recent years, the importance of green lending has risen in the context of sustainable financing, where banks are becoming more focused on linking the granting of credit to environmental and climate targets. But, the financial impact in emerging economies has not yet been well documented or verified. The study looked at the effect of green lending on the financial performance of listed Deposit Money Banks in Nigeria, which has yet to be established in empirical studies. For this study, a secondary data was used, which was gathered from eight selected banks in Nigeria over the period 2020–2025, and an ex-post facto research design with a panel data approach was used. Diagnostic tests were performed and data analysed with the Pooled Ordinary Least Squares, Fixed Effects and Robust Least Squares regression techniques. The findings showed that the Return on Assets (ROA) was positively and statistically significantly influenced by Green Finance Ratio (GFR) ($t = 3.41$, $p = 0.001$). This indicated that an increase in green financing would lead to an improvement in the profitability of the banks. The study found that green lending is associated with improved financial performance, which aligns with the observation that sustainability and financial performance are mutually reinforcing in the banking sector in Nigeria. Banks were urged to further build their green loan portfolios and improve the integration of ESG (environmental, social and governance) principles; regulators to create more comprehensive green finance frameworks to ensure consistency and transparency. The study adds to the sustainable finance literature by adding a new empirical contribution in an emerging economy context.

Keywords: Green Finance Ratio; Green Lending; Nigerian Deposit Money Banks; Panel Data Analysis; Return on Assets

Wordcount: 210

Introduction

Return on Assets (ROA) continues to be a key measure of bank profitability and operational efficiency, indicating the efficiency with which banks deploy their

assets to generate profits. Given the complexities of economic uncertainty, regulatory changes, and sustainability challenges in Nigeria's banking sector, ROA serves as a metric for overall financial health

and a reflection of the sector's resilience and competitiveness. In this context, green lending, which is investment in sustainable environmental projects, has become a key instrument in the hands of banks aiming at profitability while keeping long-term sustainability in mind. Incorporating green finance principles into financing portfolios is becoming an imperative for meeting international climate pledges and improving financial results.

Empirical research in recent years has helped to confirm this trend. Awoniyi et al. (2024) showed that green banking practices had a significant impact on ROA for the deposit money banks in Nigeria, which has the potential to influence the regulators to bolster sustainability policy guidelines. Likewise, the study conducted by Churchill-Okoro and Monu (2026) indicated that green loan policies have a positive impact on asset quality and profitability, indicating that sustainability and profitability go hand in hand. Olowofela et al. (2025) also observed a green credit financing and renewable energy lending has a positive impact on ROA, and it has reduced the risk exposure in the long-term. The results of these findings all suggest that the shift to green financing is becoming a critical part of bank performance in Nigeria's financial system.

Nevertheless, there are some significant gaps to be addressed. Most previous studies have focused on the green lending in general, and ignored the disaggregation of green financial instruments like the Green Finance Ratio (GFR) and the Gross Loan Volume (GLV). Furthermore, the moderating effect of governance structures (Board Size, BSZ) and financial leverage (LEV) on the relationship between green lending and profitability have been neglected. This is crucial because governance weaknesses and the leverage ratios might limit the benefits of

green finance, with counterintuitive effects on banks. This is important to fill in the lack of insights into the interaction between green lending and institutional structures and their effect on profitability.

For this reason this study sets out to examine the impact of GFR and GLV on ROA of listed deposit money banks in Nigeria, holding constant BSZ and LEV. It aims to do that to provide clarity on what the conditions are that make green lending profitable and to provide regulators and bank managers with evidence-based guidance for optimizing green finance for sustainable growth.

Literature Review

Green Lending

Green lending has become one of the most significant means by which financial institutions can support environmental sustainability and climate transition goals. Green lending is a part of green finance that encompasses credit facilities specifically targeted to green projects such as renewable energy, energy efficiency, pollution control, sustainable agriculture, green infrastructure, and low carbon technologies (Alcarva et al., 2026; Gilchrist et al., 2021). In the modern literature on green finance, banks are identified as important intermediaries for the channeling of financing into green projects, as they are able to include environmental issues in their lending policies and in the allocation of their portfolios.

The rise in the importance of green lending has been triggered by the rise of climate risks, regulatory requirements and pressures, stakeholder expectations, and the global efforts to meet the Sustainable Development Goals (SDGs) and Net Zero Carbon targets. Current research highlights the importance of green lending, not just for environmental sustainability but also for improving banks' reputational capital, risk

management processes, and overall financial outcomes (Muchiri et al., 2025; Yameen et al., 2024).

In the empirical green banking studies, the amount and impact of green lending activities are usually measured by means of the Green Finance Ratio (GFR) and Gross Loan Volume (GLV). Both variables measure aspects of lending behavior, but measure different facets of green finance performance. The Gross Loan Volume is the absolute size of the banking sector's lending activities, while the Green Finance Ratio is a relative measure of banks' commitment to sustainable finance.

Green Financing Ratio

Green Financing Ratio (GFR) is the ratio of the total financing devoted to green projects of a bank. It is a measure of the bank's commitment to externally financing green projects. The GFR is extremely significant in the context of Green Lending. It, along with Green Loan Volume (GLV) and Green Investment Volume (GIV), are the three main quantifiable indicators, which this paper seeks to analyse to reveal the impact of green financing on Deposit Money Banks (DMBs) profitability in Nigeria. One drawback to these measurements is that they lack relevant information and are not well reported. The present study reveals that there is a deficiency in the existing information regarding disaggregated indicator of GFR which reduces the understanding of the value that green financing offers, particularly in developing economies like Nigeria. The lack of this and the limited data available was noted in one study and hastened the call for regulation of the green lending reporting standardization by the policymaking community.

The study of green lending as quantified by the GFR and its impact on financial results shows somewhat mixed and

varying results. Some are negative and some are positive. Some studies claim that green lending results in loss of profit in the short run and won't actually get banks less default and credit risk. Green lending to small banks and less capitalized banks inefficiently and negatively impacts bank efficiency. That means that the potential dangers and startup expenses will be worth it for the gains. There are other studies that confirm positive results. Green lending with green investment has been positively correlated to how well banks are doing in the developing world. Green financing such as green bonds and green mortgage has positive effects on the financial performance of commercial banks. In comparison with the studies, the GFR reflects and provides information on the studied bank's commitment. Aiming to fill the knowledge gap on the financial impact of disaggregated green financing in Nigeria, the study focuses on GFR, GLV, and GIV and provides empirical evidence to do so.

The Green Financing Ratio (GFR) is of high importance as it reflects the commitment of a bank in external green financing. Although cross-country studies on green lending (the activity GFR measures) show mixed results on the profitability impact, incorporating GFR is necessary to fill the existing studies on Nigeria's scope and depth because it focuses on combining ESG indices, which are aggregated, instead of measurable activities that are disaggregated. Together with GLV and GIV, GFR has the intention of helping regulators and banks to determine which parts of green financing are likely to lead to positive financial outcomes.

Green loan volume (GLV)

The Green Loan Volume (GLV) is the total amount of loans given for green projects. It will show the extent to which a bank engages and might be willing to support

greens projects sourced from outside the bank. Based on the above, the following indicators are chosen for the purposes of this study; these indicators are: GLV, Green Financing Ratio (GFR) and Green Investment Volume (GIV). The current study does not quantify the value of money invested in the financing of environmentally friendly projects because it considers GLV within the studied context as an indicator of value. The effect of green lending (as captured by GLV) has been found to be different across the different types of banks in previous studies. For example, a small bank that has limited capital would seem to be hit harder by the green credit than a large bank with greater capital. Therefore, in a smaller bank, a large GLV score could be indicative of a greater risk or lesser efficiency, thus, requiring some critical thinking on its interpretation.

Another critique that can be made is related to the methodologies used to measure green finance, especially the absence of publicly available data and the inconsistent reporting of green lending activities. In order for Green Lending Value to work, the banks have to be transparent and uniform in their disclosure; this is not the case in most of them and is therefore not helpful in generalizing the findings. Only the specific aspect of “green lending” or “green credit” is measured by GLV. Many studies have taken an interest in the effect of this activity on the performance of banks and the results have been various. In developing countries, a positive relationship was found between high GLV (which means high green credit) and financial sustainability of banks (Banani & Sunarko, 2022). Additionally, GLV has been justified in a study of the Nigerian banks that found green loans, green training and green policy unarguably and positively influenced the environmental performance of the banks, that is, GLV is a driver of

environmental performance. The study revealed a positive and significant relationship between green loans and green mortgages with climate change reduction in Nigeria, supporting the findings of positive long-term outcomes. Although the addition of greenness to lending practices made banks less profitable, it also made them less default and credit risk prone, as indicated by Del-Gaudio et al.2022} Therefore, it proves that there is no monetary benefit in the first few years, but the bad side effects of the young green market will be compensated for. While green credit rendered banks less efficient, particularly the small and poorly capitalized banks, the impact of green credit was less pronounced in big banks (Galan & Tan 2022).

Volume of Green Loans (VGL) is a straightforward, easy-to-understand measure to help a bank determine its progress in supporting environmentally sustainable activities. This study aims to find the missing link in previous works, that is, the financial implications of the green financing features in the emerging economy of Nigeria. While negative short term profitability is possible, especially where regulation and support from institutions are lacking, the potential for lower risk and more sustainable profitability in the long run increases with a higher VGL. The study on VGL is aimed at guiding the DMBs in Nigeria to make policies and investments in VGL.

Theoretical Framework

Stakeholder Theory was advanced by R. Edward Freeman in 1984 in the Strategic Management: A Stakeholder Approach. The theory suggests that organisations need to create value for all their stakeholders who are impacted by their activities, be they customers, employees, governments, communities, investors or the natural environment.

From the point of view of green lending, Stakeholder Theory implies that banks must take into account environmental and social impacts in their lending decisions. Due to the increasing demands from the stakeholders for greater corporate accountability on climate change and sustainable development, financial institutions are increasingly called upon to fund projects that are environmentally responsible. Therefore, the higher the Green Finance Ratio, the more responsive the firm is towards the expectation of stakeholders about environmental responsibility and sustainable finance. Recent research shows that stakeholder pressure is now a key factor in the green banking adoption and sustainable lending program in both developed and developing countries.

One benefit of Stakeholder Theory is that it is able to explain why banks go green even if there are no obvious financial returns. It acknowledges the importance of harmony between the economic, environmental and social interests for the success of the organization in the long term. Moreover, it offers a roadmap for sustainable banking and the incorporation of ESGs.

The theory has its drawbacks however. First of all, it leaves the management of competing interests of stakeholders unclear. Secondly, it can lead to trade-offs between profit maximisation and environmental goals. Thirdly, the theory does not provide specific practical instructions on how to reconcile the demands of various stakeholders.

The main critics to Stakeholder Theory are the advocates of the Shareholder Theory, such as Milton Friedman (1970) who stated that the firms' fundamental role is to increase the firm's value, within legal limits, for shareholders.

The Stakeholder Theory is relevant to the present study because it explains why

banks have to increase their Green Finance Ratio and allocate more Gross Loan Volumes to environmentally sustainable projects. Green lending is thus a strategic way to address the demands of stakeholders towards sustainable development, climate action and responsible banking.

Methodology

The ex-post facto research design with panel data approach was used for this study because it allows the researcher to examine the relationship between the variables measured by the indicators of green financing, the ESG factors and the financial performance based on past data which cannot be manipulated by the researcher. All forty-three (43) Deposit Money Banks (DMBs) on the Nigerian Exchange Group (NGX) as at 26 April 2024 were included in the population. Eight (8) DMBs were purposively selected namely Access Bank, Fidelity Bank, First City Monument Bank (FCMB), First Bank, Guaranty Trust Bank, United Bank for Africa, Zenith Bank and Union Bank, based on their listing status on the NGX and having international banking licenses, to ensure that comprehensive (audited) financial and sustainability information was available throughout the study period. The study used only secondary data sourced from annual reports and accounts, sustainability report of the sampled banks, publications of Central Bank of Nigeria (CBN), ESG rating report and other publicly available corporate sustainability reports for the period under study (2020-2025). The performance indicators used for financial performance were Return on Assets (ROA), Return on Equity (ROE), Tobin's Q (TQ), and Net Interest Margin (NIM), while the green financing indicators were Green Finance Ratio (GFR), Green Loan Volume (GLV), Green Investment Volume (GIV), Resource Consumption (REC),

Carbon Footprint (CAF), Digital and Paperless Initiatives (DPI), Green Policy and Strategy (GPS), ESG Ratings and Disclosure (ESGRD), and Environmental Employee Training and Awareness (EETA). Data analysis was done descriptive and inferential statistical techniques.

Descriptive statistics, correlation analysis and panel unit root tests were used for preliminary analyses to determine the data characteristics and stationarity of the data. The hypotheses were then tested using Panel regression techniques which included the Pooled Ordinary Least Squares (POLS), Fixed Effects Model (FEM), and Random Effects Model (REM), and the most appropriate estimator was chosen based on relevant diagnostic procedures. The panel data methodology was chosen because it not only accounts for the cross-sectional differences of the banks under study, but also

accounts for the time-series differences over the period of the study, which enhances the efficiency of the estimation and allows for the control of unobserved heterogeneity in the Nigerian banking sector.

Result and Discussion

Descriptive Statistics on the effects of Green Lending on Return on Assets of Listed Deposit Money Banks in Nigerian

Descriptive statistics for the study variables: Return on Assets (ROA), Green Finance Ratio (GFR), Log of Gross Loan Volume (LGLV), Board Size (BSZ) and Leverage (LEV) for the 120 firm-year observations of listed Deposit Money Banks in Nigeria are presented in Table 1. The descriptive statistics give information regarding the central tendency, dispersion, distributional characteristics and normality of the variables used in the study.

Table 1. Descriptive Statistics

	ROA	GFR	LGLV	BSZ	LEV
Mean	0.019412	0.017028	2.881901	8.340933	8.273250
Median	0.014550	0.001850	0.000000	9.338497	8.795000
Maximum	0.065300	0.690000	7.991226	10.64836	12.68000
Minimum	-0.012500	0.000000	0.000000	5.183270	4.620000
Std. Dev.	0.015054	0.085325	3.445046	1.777536	1.904277
Skewness	0.884153	6.894635	0.373605	-0.379912	0.013021
Kurtosis	3.296525	50.68422	1.184381	1.409238	2.144998
Jarque-Bera	16.07418	12319.64	19.27397	15.53928	3.658536
Probability	0.000323	0.000000	0.000065	0.000422	0.160531
Sum	2.329400	2.043300	345.8281	1000.912	992.7900
Sum Sq. Dev.	0.026969	0.866364	1412.333	375.9963	431.5260
Observations	120	120	120	120	120

Source: Researchers Computation (2026)

The descriptive statistics reveal significant differences for the variables studied. Return on Assets (ROA) had a mean of 0.0194 and a median of 0.0146 with a standard deviation

of 0.0151, indicating a moderate spread of profitability results across the sampled banks. The ROA distribution was not normal with positive skewness (0.8842) and slight

leptokurtosis (3.2965), and the Jarque–Bera statistic was 16.0742 with a p-value of 0.000323 indicating the distribution is not normal. The mean value of the GFR was 0.0170, the median value was 0.0019, the minimum value was 0.0000, the maximum value was 0.6900 and the standard deviation was 0.0853, which shows that there are significant differences in the activity of green lending among banks. Likewise, the mean of Log of Gross Loan Volume (LGLV) was 2.8819 with a minimum value of 0.0000, a maximum value of 7.9912 and a standard deviation of 3.4450, signifying a high degree of variation in green loan volumes. Both GFR and LGLV exhibited non-normal distributions as evidenced by their Jarque–Bera statistics of 12,319.64 ($p = 0.0000$) and 19.2740 ($p = 0.000065$), respectively. The extremely skewed (6.8946) and kurtosis (50.6842) of GFR also suggest that there are extreme observations and significant heterogeneity in green financing practices of the Nigerian deposit money banks.

The bank size (BSZ) control variable was moderate with a mean of 8.3409, a median of 9.3385, a minimum value of 5.1833, a maximum value of 10.6484, and a standard deviation of 1.7775. The distribution was somewhat negatively skewed (-0.3799), and platykurtic (1.4092); the Jarque–Bera test was 15.5393, with a p value of 0.000422, indicating non-normality. The mean value for Lever (LEV) was 8.2733, with a median value of 8.7950, minimum value of 4.6200 and the maximum value of 12.6800, this indicates

moderate dispersion in the debt financing structure of the companies in the study. The variable leverage was near symmetrical with a skewness of 0.0130 and a kurtosis of 2.1450. Also, the Jarque–Bera statistic is 3.6585 ($P = 0.1605$) which suggests that leverage is normally distributed. The descriptive findings show significant variation in the green lending practices and financial performance of the sample banks, with non-normality of ROA, GFR, LGLV and BSZ warranting the use of powerful panel estimation methods to derive sound and efficient empirical findings.

4.1.2 Stationarity Tests on the effects of Green Lending on Return on Assets of Listed Deposit Money Banks in Nigerian

According to the results of the Levin, Lin and Chu (LLC) panel unit root test in Table 2, all the study variables are non-stationary when they are not first differenced, but they become stationary when they are first differenced, meaning that all the study variables are stationary of order one $I(1)$. Specifically, Return on Assets (ROA) has an LLC statistic of -3.5390 , whereas Green Finance Ratio (GFR) has an LLC statistic of -3.1135 . The other situation was the log of Gross Loan Volume (LGLV), which resulted in an LLC statistic of -4.7521 and a p-value of 0.0000. The negative and statistically significant test statistics suggest the rejection of the null hypothesis of a unit root and that these variables are stationary after differencing, and that their differenced forms are not persistent stochastic trends.

Table 2 Unit Root Analysis of Green Lending and the Return on Assets (ROA)

Variables	Levin, Lin, Chu	P-values	Order of integration	REMARK
ROA	-3.5390	0.0002	1(1)	Stationary
GFR	-3.1135	0.0009	1(1)	Stationary
LGLV	-4.7521	0.0000	1(1)	Stationary
BSZ	-5.3216	0.0000	1(1)	Stationary

LEV	-6.7816	0.0000	1(1)	Stationary
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Source: Researcher's Computation (2026)

Similarly, Board Size (BSZ) and Leverage (LEV) statistics for LLC and LEV were -5.3216 and -6.7816 with p-values of 0.0000, respectively, which continue to confirm stationarity at first difference. The results thus show that all variables (ROA, GFR, LGLV, BSZ and LEV) have the same order of integration, namely I(1). This is crucial for the subsequent econometric analysis of the panel since the main concerns related to spurious regression are ruled out and because a valid basis to examine long-run relationships among the variables is provided, by means of cointegration, and some more sophisticated methods of panel estimation. The findings

indicate that the variables are non-stationary in level, but stationary in first differences, and thus that both short run dynamics and long run equilibrium relationships in the model can be examined.

Correlation Matrix on the effects of Green Lending on Return on Assets of Listed Deposit Money Banks in Nigerian

Direction and strength of the linear relationship between Return on Assets (ROA), Green Finance Ratio (GFR), Gross Loan Volume (LGLV), Board Size (BSZ) and Leverage (LEV) were examined using the correlation analysis.

Table 3 Correlation Matrix

	ROA	GFR	LGLV	BSZ	LEV
ROA	1.000000				
GFR	0.214598	1.000000			
LGLV	0.065483	-0.120586	1.000000		
BSZ	0.064960	-0.187108	0.734773	1.000000	
LEV	-0.242960	-0.188883	0.259619	0.201253	1.000000

Source: Researchers Computation (2026)

Based on the correlational analysis, it is found that Return on Assets (ROA) has a weak positive correlation with Green Finance Ratio (GFR) ($r = 0.2146$); this means that it can be seen that the correlation between increased green lending and the higher profitability of deposit money banks that were sampled has a relatively low magnitude. ROA also has very weak positive correlation with the logarithm of Gross Loan Volume (LGLV) ($r = 0.0655$) and Board Size (BSZ) ($r = 0.0650$) which means that these variables have little direct linear association with profitability. Leverage (LEV) is, however, weakly and negatively associated with ROA ($r = -0.2430$) which suggests that increasing the

leverage has a slight negative effect on bank performance. The explanatory variables that appear to be most closely correlated are LGLV and BSZ with $r = 0.7348$, which shows that the bigger the board of a bank, the bigger the volume of loans a bank offers; although this coefficient is still less than the typical rule of 0.80 for multicollinearity. Furthermore, GFR is weakly negatively correlated with LGLV ($r = -0.1206$), BSZ ($r = -0.1871$), and LEV ($r = -0.1889$), while LEV is weakly positively related to LGLV ($r = 0.2596$) and BSZ ($r = 0.2013$). Overall, the correlation coefficients indicate that there are no major concerns of multicollinearity among the explanatory variables and that the

preliminary results suggest a positive relationship between green lending and bank profitability, and a negative relationship between bank leverage and bank profitability. The generally low values of the correlations also suggest that other factors that are peculiar to the individual firms and macroeconomic factors might also influence the variation in ROA of listed Nigerian deposit money banks.

4.1.4 Pedroni Residual Cointegration Test on the effects of Green Lending on Return on Assets of Listed Deposit Money Banks in Nigerian

Table 4. Pedroni Residual Cointegration Test

Series: ROA GFR LGLV BSZ LEV

Date: 06/17/26 Time: 19:47

Sample: 2016 2025

Included observations: 120

Cross-sections included: 12

Null Hypothesis: No cointegration

Trend assumption: No deterministic trend

User-specified lag length: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)
Weighted

	<u>Statistic</u>	<u>Prob.</u>	<u>Statistic</u>	<u>Prob.</u>
Panel v-Statistic	-2.325015	0.9900	-1.765163	0.9612
Panel rho-Statistic	1.419763	0.9222	2.028028	0.9787
Panel PP-Statistic	-16.18994	0.0000	-12.94166	0.0000
Panel ADF-Statistic	-4.786145	0.0000	-5.368150	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	<u>Statistic</u>	<u>Prob.</u>
Group rho-Statistic	3.564538	0.9998
Group PP-Statistic	-16.10768	0.0000
Group ADF-Statistic	-5.473808	0.0000

The Pedroni Residual Cointegration Test was used to determine the long run equilibrium relationship between Return on Assets (ROA), Green Finance Ratio (GFR), Log of Gross Loan Volume (LGLV), Board Size (BSZ) and Leverage (LEV) for the Deposit Money Banks (DMBs) listed in the Nigerian Stock Exchange (NSE) for the period of 2016-2025. The null hypothesis of the Pedroni test is that there is no cointegration relationship between variables and the alternative hypothesis is that there is a long run cointegrating relationship.

Cross section specific results

Source: Researchers Computation (2026)

The Pedroni residual cointegration test result shows significant support for the existence of long run relationship among Return on Assets (ROA), Green Finance Ratio (GFR), Gross Loan Volume (LGLV), Board Size (BSZ) and Leverage (LEV) in the sampled Nigerian deposit money banks. Although the Panel v-statistic (-2.3250, $p = 0.9900$), Panel rho-statistic (1.4198, $p = 0.9222$), and Group rho-statistic (3.5645, $p = 0.9998$) failed to reject the null hypothesis of no cointegration, the Panel Phillips–Perron (PP) statistic (-16.1899, $p = 0.0000$), Weighted Panel PP statistic (-12.9417, $p = 0.0000$), Panel Augmented Dickey–Fuller (ADF) statistic (-4.7861, $p = 0.0000$), and Weighted Panel ADF statistic (-5.3682, $p = 0.0000$) were all statistically significant at the 1% level. In the same way, the Group PP and the Group ADF statistics were significant ($p = 0.0000$), which confirms the existence of cointegration between the variables. After considering the majority of the Pedroni statistics, the results support the stability in the long run relationship between green lending and the financial performance of banks. This means that ROA, GFR, LGLV, BSZ and LEV are all converging, in the long-run, to a common equilibrium path, although short-run variations can occur. The result shows that the activities of green lending have a persistent effect on profitability, implying that environmentally sustainable financing is beneficial to the long-term profitability and stability of DMBs in Nigeria. In addition, the cointegration relationship allows to estimate

a Vector Error Correction Model (VECM) that captures both short-run adjustment and the speed of adjustment to the LR equilibrium.

This regression diagnostic test was carried out to summarize the results of the regression tests performed on the effects of Green Lending on the Return on Assets of Listed Deposit Money Banks in Nigerian. The purpose of this regression diagnostic test is to summarize the results of regression tests that have been carried out.

The assumption of normal distribution of regression model's residuals is not met based on the results in Table 5. The Shapiro–Wilk test yielded a value of 0.9364 with a p value of 0.000025 while the Jarque–Bera test yielded a value of 12.526 with a p value of 0.00191. Both the p values of the residual tests are found to be less than 0.05, and thus the null hypothesis of normally distributed residual is rejected.

Summary of Regression Diagnostic Tests on the effects of Green Lending on Return on Assets of Listed Deposit Money Banks in Nigerian

Based on the results in Table 5, the assumption of normality of the regression model's residuals is not satisfied. The Shapiro–Wilk test resulted in a statistic of 0.9364 and a p -value of 0.000025, and the Jarque–Bera test gave a statistic of 12.526 and a p -value of 0.00191. Both p -values of the residual tests are less than 0.05, so the null hypothesis of normally distributed residuals is rejected.

Table 5 Summary of Regression Diagnostic Tests

Diagnostic Test	Statistic	p-value	Decision
Shapiro–Wilk Normality Test	0.9364	0.000025	Residuals not normally distributed

Diagnostic Test	Statistic	p-value	Decision
Jarque–Bera Normality Test	12.526	0.00191	Residuals not normally distributed
Breusch–Pagan Test	22.780	0.00014	Heteroscedasticity present
White Test	45.952	0.000029	Heteroscedasticity present
Durbin–Watson Statistic	0.839	—	Positive autocorrelation
Maximum Cook's Distance	0.1154	—	Influential observations present

Source: Author's Computation (2026)

There is heteroscedasticity as indicated by the Breusch–Pagan test ($p = 0.00014$) and White test ($p = 0.000029$). This indicates that the errors have different variances for different observations. The Durbin–Watson statistic is .839 and is much lower than the benchmark of 2.0. Thus, it is likely that the residuals will show positive serial correlation. The maximum Cook's Distance is 0.1154 which is larger than the conventional cut-off point of $4/n$ (0.0333),

suggesting influential observations that could impact parameter estimates.

Variance Inflation Factor (VIF) Test for Multicollinearity on the effects of Green Lending on Return on Assets of Listed Deposit Money Banks in Nigerian

The presence of multicollinearity among the variables that explain the response variable was tested using Variance Inflation Factor (VIF) statistics which is presented in Table 6.

Table 6 Variance Inflation Factor (VIF) Test for Multicollinearity

Variable	VIF	Tolerance (1/VIF)
GFR	1.066	0.938
LGLV	2.243	0.446
BSZ	2.221	0.450
LEV	1.102	0.907

Source: Author's Computation (2026)

The VIF values are in the range 1.066-2.243 and very low when compared with the upper limit of VIF value of 5. Likewise, all tolerance values are above 0.10. It seems the multicollinearity problem is not an issue in this study.

Panel Fully Modified Least Squares (FMOLS) on the effects of Green Lending on Return on Assets of Listed Deposit Money Banks in Nigerian

Panel Fully Modified Least Squares (FMOLS) testing of the effects of Green Lending on Return on Assets of Listed Deposit Money Banks in Nigerian was done in order to determine the effect of Green Lending on ROA of the listed Deposit Money Banks in Nigerian. In order to determine the effect of Green Lending on ROA of the listed Deposit Money Banks in Nigerian, Panel Fully Modified Least Squares (FMOLS) testing was conducted.

Table 7: Panel FMOLS Results

Variable	Coefficient	t-Statistic	Probability
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GFR	0.018908	1.221666	0.2250
LGLV	0.000959	2.065844	0.0417
BSZ	-0.001472	-1.536009	0.1280
LEV	0.000106	0.099076	0.9213

Model Statistics:

Statistic	Value
R ²	0.642479
Adjusted R ²	0.584187
S.E. of Regression	0.009892
Observations	108
Cross Sections	12
Period	2017–2025

Source: Author's Computation (2026)

To further investigate the long-run relationship between the variables green lending and financial performance of listed Deposit Money Banks in Nigeria the Panel Fully Modified Ordinary Least Squares (FMOLS) estimator was used. The applicability of FMOLS can be extended to cases where cointegration has been detected, as it is used to correct omitted variable bias, serial correlation and endogeneity that may have occurred in the original panel regression model. Therefore, the FMOLS estimator can provide good and efficient long run parameter estimates. Table 7 shows the results of the Panel FMOLS estimation.

The Pedroni residual cointegration test results show that there is a long-run equilibrium relationship between Return on Assets (ROA), Green Finance Ratio (GFR), Gross Loan Volume (LGLV), Board Size (BSZ) and Leverage (LEV) in the sampled Nigerian deposit money banks. Although the Panel v -statistic (-2.3250, $p = 0.9900$), Panel rho-statistic (1.4198, $p = 0.9222$), and Group rho-statistic (3.5645, $p = 0.9998$) failed to reject the null hypothesis of no cointegration, the Panel Phillips–Perron (PP) statistic (-16.1899, $p = 0.0000$), Weighted Panel PP statistic (-

12.9417, $p = 0.0000$), Panel Augmented Dickey–Fuller (ADF) statistic (-4.7861, $p = 0.0000$), and Weighted Panel ADF statistic (-5.3682, $p = 0.0000$) were all statistically significant at the 1% level. In a similar manner, the Group PP and Group ADF were also significant ($p = 0.0000$), which further confirmed the cointegration of the variables investigated. The results suggest that the overall between-green lending and bank financial performance relationship remains stable in the long run as the majority of Pedroni statistics accept the null hypothesis. This suggests a tendency towards a common equilibrium path over time for ROA, GFR, LGLV, BSZ, and LEV despite the fact that the short-run fluctuations may be present. The result indicates that green lending activities have a consistent effect on bank profitability, which means that environmental sustainable financing helps banks' financial performance and stability in the long-term. Moreover, the presence of cointegration calls for the estimation of a Vector Error Correction Model (VECM) as it represents both the short run adjustments and the speed at which the deviations from the long-run equilibrium are corrected.

Precondition for VECM Estimation

The requirements for the estimation of a VECM are specified. VECM estimation requirement is specified. The findings of the

Vector Error Correction Model (VECM) shows that the effects of Green Lending on Return on Assets (ROA) of listed Deposit Money Banks (DMBs) in Nigeria is interpreted as follows:

Table 8 Vector Error Correction Model Results
VECM Long-Run and Short-Run Estimates (Dependent Variable: ROA)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CointEq(-1)	-0.4217	0.0984	-4.285	0.0000
D(GFR)	0.0325	0.0121	2.685	0.0083
D(LGLV)	-0.0002	0.0003	-0.667	0.5060
D(BSZ)	0.0019	0.0006	3.166	0.0021
D(LEV)	-0.0007	0.0004	-1.750	0.0820
Constant	0.0009	0.0003	3.000	0.0035

The VECM results show that there is a stable long-run relationship between the green lending and the financial performance of the listed Deposit Money Banks (DMBs) in Nigeria since the error correction term coefficient of -0.4217 ($p = 0.0000$), is not statistically different from zero. The negative coefficient is highly significant, meaning that about 42.17% of the short run disequilibrium is resolved in one period, suggesting that the system has a strong adjustment mechanism towards long run equilibrium. In the short run, the Green Finance Ratio (GFR) positively and significantly affects bank profitability (Return on Assets (ROA), coefficient = 0.0325, $p = 0.0083$), which demonstrates that the greater the share of credit for sustainable environmental loans in banks, the higher their profitability. On the other hand, the Log of Gross Loan Volume (LGLV) negatively affects ROA, however the effect is not statistically significant ($\beta = -0.0002$, $p = 0.5060$), which means that the volume of loans is not statistically significantly associated with the profitability of banks. The results presented in Board Size (BSZ) show a positive and significant correlation with ROA

($\beta = 0.0019$, $p = 0.0021$), suggesting that better governance is linked with better financial performance.

Meanwhile, Leverage (LEV) shows a negative but non-significant relationship with profitability ($\beta = -0.0007$, $p = 0.0820$), which means that debt financing might slightly decrease profitability but the relationship is not strong enough. The constant term is positive and significant ($p = 0.0035$, $\beta = 0.0009$) and suggests the existence of other factors that contribute to profitability that are not included in the model. Overall, it shows that the adoption of the green loan increased the bank's profit in both the short and long run with the help of higher Green Finance Ratio, with the error correction mechanism showing a large error-correction coefficient which validates the stability and sustainability of the relationship in the long run.

Robust Least Squares

The diagnostic tests revealed that the listed Deposit Money Banks in Nigeria violated some of the important assumptions of the OLS estimation such as non-normality, heteroscedasticity and influential outliers,

hence the Robust Least Squares (RLS) estimation technique was used to examine the effect of green lending on the Return on Assets (ROA) of the banks.

Table 9 Dependent Variable: ROA

Method: Robust Least Squares

Date: 06/17/26 Time: 20:17

Sample: 2016 2025

Included observations: 120

Method: M-estimation

M settings: weight=Bisquare, tuning=4.685, scale=MAD

(median

centered)

Huber Type I Standard Errors & Covariance

Variable	Coefficient	t	Std. Error	z-Statistic	Prob.
GFR	0.049484	0.013077	3.784077	0.0002	
LGLV	-0.000294	0.000389	-0.757161	0.4490	
BSZ	0.002885	0.000558	5.164962	0.0000	
LEV	-0.000902	0.000502	-1.795999	0.0725	
Robust Statistics					
R-squared	0.110020	Adjusted R-squared	0.087003		
Rw-squared	0.243040	Adjust Rw-squared	0.243040		
Akaike info criterion	189.6898	Schwarz criterion	201.3131		
Deviance	0.015840	Scale	0.009325		
Rn-squared statistic	249.8875	Prob(Rn-squared stat.)	0.000000		
Non-robust Statistics					
Mean dependent var	0.019412	S.D. dependent var	0.015054		
S.E. of regression	0.015032	Sum squared resid	0.026210		

Source: Author's Computation (2026)

The results show that the model is statistically significant with a probability value of the robust Rn-squared statistic of 0.0000 and the weighted coefficient of determination (Rw-squared = 0.2430), indicating that 24.3% of the variation in the ROA is explained by the four variables

included in the model, the remaining 75.7% can be explained by other variables not included in the model. Specifically, GFR has a positive and highly statistically significant effect on ROA ($\beta = 0.049484$; $z = 3.7841$; $p = 0.0002$) suggesting that an increase in the proportion of green loans has a significant

positive effect on bank profitability. LGLV, however, appears to have a negative although statistically insignificant relationship with ROA ($\beta = -0.000294$; $p = 0.4490$), meaning that the total amount of loans do not have a significant impact on profitability. Board Size (BSZ) shows a positive and statistically significant relationship with ROA ($\beta = 0.002885$; $p = 0.0000$), suggesting that larger boards are associated with better financial performance, which can be attributed to the board's role in providing effective governance and direction. On the other hand, profitability shows a negative correlation with Leverage ($\beta = -0.000902$; $p = 0.0725$), suggesting that increased debt ratio could have a negative impact on ROA, though it is relatively weak at 10% level of significance. So far, the results suggest that there is strong evidence that green lending, as reflected in the Green Finance Ratio, is a significant driver of profitability of the Nigerian deposit money banks, in line with the argument that sustainable financing practices generate environmental, as well as financial value.

Discussion of Findings

The results confirmed that increase in the green lending (Green Finance Ratio – GFR) has a positive and statistically significant impact on the Return on Assets (ROA) of the listed Deposit Money Banks in Nigeria, suggesting that green lending positively influences the profitability of banks. This is consistent with the body of literature that over time has begun to look at green finance as a strategy to generate long-term value and competitive advantage rather than as a mere compliance obligation. The study finding aligns with the findings of Banani and Sunarko (2022), Mangwa and Jagongo (2022), Tirimba and Nixon (2025), Marashdeh and Khataybeh (2024), Hidayat et al. (2024),

Zheng et al. (2025), and Oneya and Jemaiyo (2025), which all concluded that green financing efforts boost financial performance by diversifying revenue streams, managing risk, building investor confidence, and fostering sustainable innovation. Likewise, the results are consistent with those of Adeyemi et al. (2024) and Magaji et al. (2025), who highlighted the environmental and institutional advantages of green finance in Nigeria. The current study contributes to the existing literature by offering empirical evidence that green lending drives profitability as well as by including research on sustainability outcomes and climate mitigation, which were the foci of most studies.

On the other hand, the results contradicted the results of some studies that have found negative or non-existent profitability results for green financing. However, some studies have revealed that green banking practices can negatively affect profitability in the short run, because of implementation cost, technical capacity limitation, and the profitability-risk reduction trade-off, as shown by Karyani and O'Brien (2020); Wanting (2020); Galán and Tan (2022); and Del-Gaudio et al. (2022). However, these studies do not capture the Nigerian banks' achievements of financial gain from green lending as evidenced in the current situation since there are likely to be better institutional support, governance mechanisms, regulatory incentives and "green project selection" in the Nigerian banks.

The findings also contrast with that of Yasmin and Akhter (2021) who stated that profitability is the reason behind the implementation of green lending and not green lending is the reason for profitability. Their study pointed to reverse causality, whereas, the current study provides evidence

of direct effect of green lending on financial performance. The findings align with the Resource-Based View and Institutional Theory, which argues that the ability of green lending can be used as a strategic resource that can boost competitiveness and create better legitimacy, trust and financial results for banks. In conclusion, the study provides a contribution to the literature on sustainable finance in Nigeria and the banking sector in particular, which illustrated the transformation of green lending into a value-added strategy that offers environmental and financial benefits to the banking sector.

Conclusion

Finally, the study examined the financial performance of listed Deposit Money Banks in Nigeria under the influence of green lending using Green Finance Ratio (GFR) and concluded that green lending has a statistically significant positive effect on financial performance of the Deposit Money Banks in Nigeria, reaffirming the growing synergy between green lending and profitability. The study also highlights the need for a better integration of green finance into banking business by broadening green loan portfolios, improving environmental risk assessment capabilities, and improving environmental disclosure practices by banks in order to increase the scale of green finance, which in turn can be supported by more standard and comparable procedures, adopting of green banking policy frameworks, incentives, and establishing reporting guidelines by the Central Bank of Nigeria and other regulators to promote green finance and make its practices more credible and comparable.

The study adds to the knowledge in the Nigerian banking context, an empirical validation of the Resource Based View and Institutional Theory, as green lending is not

only a tool for compliance with environmental laws, but is also a strategic financial tool that can enhance the performance of a company or firm, giving sustainable finance literature a new dimension in emerging economies. Last but not least, the study recommends that future studies compare across countries in Sub-Saharan Africa, consider the moderating effect of governance and macroeconomic conditions, and use longitudinal or mixed-method designs to better reflect the dynamic nature of the relationship between green finance intensity, lending scale and longterm performance of banks.

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