

Impact of Green Finance on Green Infrastructural Development in Nigeria (1995 – 2022)

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ABSTRACT

The study examined the impact of green finance on green infrastructure development in Nigeria for the period 1995 to 2022. The dynamic least square (DOLS) econometric technique was employed for the estimation of data for the study, and the findings indicate that green bond (GB) and all share index (ASI) have significant positive impact on green infrastructure development; while agricultural contribution to GDP (AGRIC/GDP) and market capitalization (MCAP) have significant negative impact on green infrastructural development in Nigeria. The study recommends among others that, the government should strengthen the current level of green financing in the country by initiating appropriate policy to reposition green bond market thereby making it more attractive to investors.

Keywords: Green Finance, Infrastructure, Development, Econometric and Statistical Methods

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1. Introduction

Green finance is fast emerging as a priority for public policy (Ranjan, Ghosh & Nath, 2021). Green finance refers to the financial arrangements that are specific to the execution of projects that are environmentally sustainable or projects that adopt the aspects of climate change (Iheanacho, 2016; Ferrara, 2020). Environmentally sustainable projects include the production of energy from renewable sources like solar, wind, biogas, clean transportation that involves lower greenhouse gas emission; energy efficient projects like green building; waste management that includes recycling, efficient disposal and conversion to energy, etc. Green financing is to increase level of financial flows (from banking, micro-credit, insurance and investment) from the public, private and not-for-profit sectors to sustainable development priorities (Kedge Education). Although penetration of green financing in the overall financial markets is increasing, it remains low, signifying that a lot of individuals, organisations and government have not yet planned fuller attention on the phenomenon, though, in the next few years coming, green financing shall be most predominant.

In this era where humans are struggling with their environment in the context of pollution and other atmospheric disorder, business organisations must have the responsibilities towards the turbulences aroused by human activities both commercial and personal. Humans are impounding all types of resources for business expansion and technological advancement which in return hampering the environmental properties (Sturup & Low, 2019). It is time to wake up and think about the solutions and measures to counter the negative outcomes of these advancements (Mohd, 2013). In this context, environmentalists, economists, business-experts, and educationists emphasize the concepts of financing which promote environmental protection and ensure sustainable development. Further, there is a need to cut finance

availability to such projects which may be harmful to sustainability. Environmental disorders and sustainability have got comprehensive attention globally and as a result, world leaders have an accord on important determining factor for further advancement and it must be decided based on global environmental issues (Mohd, & Khan, 2021).

According to Otali and Monye (2023). “green infrastructural development can be defined as long-term projects aimed at preserving, and protecting the natural environment, in addition to its economic and social benefits. Green development establishes a balance between the economic growth and sustainability of the earth (Mohd & Kaushal, 2018)”. Green finance is also regarded as a mechanism that syndicates financing and business with stakeholders including consumers, manufacturers, investors and financial financiers (Ferrara, 2020). Unlike old-style financial actions, green finance stresses the natural environs advantages and gives more consideration to the environmental protection business.

Although there is an urgent need to address environmental challenges of carbon footprint through green financing to attain green infrastructural development and by extension sustainable development among countries in the world (United Nations, 2015; Alghizzawi et al., 2023); and of which Nigeria is not left out being the largest and most populous black nation in Africa and globally. Nigeria has since domesticated the 2015 Paris Deal and has since taken proactive measures to incorporate the sustainable development goal. One of these measures include the Expo 2020 in Dubai, where Nigeria’s rolled out of 100 electric vehicles and the signing of a memorandum of understanding between The Infrastructure Corporation of Nigeria (InfraCorp), a US\$15 billion government- backed, privately managed infrastructure development, and African Green Infrastructure Investment Bank and Solarge International BV, a European manufacturer of lightweight solar panels, for establishing a solar panel manufacturing factory in Nigeria (Vanguard, 2023). In spite of this efforts, Nigeria is still behind in terms of green infrastructural development; this calls for urgent empirical investigation to ascertain the extent to which green financing has impacted on green infrastructure development in Nigeria overtime.

1.1. Research questions

Thus, the study seeks to provide answers to the following specific research questions:

- (i) how does green finance (measured by Green Bond) affect green infrastructural development in Nigeria?
- (ii) what is the impact of the ratio of Agriculture contribution to GDP on green infrastructural development in Nigeria?
- (iii) to what extent does all share index (ASI) affect green infrastructural development in Nigeria?
- (iv) how does Market Capitalization affect green infrastructural development in Nigeria?

1.2. Objectives of the study

The specific objectives of the study are to:

- (i) examine how green finance affect green infrastructural development in Nigeria.
- (ii) ascertain the impact of the ratio of Agriculture contribution to GDP on green infrastructural development in Nigeria.
- (iii) examine the extent to which all share index (ASI) affect green infrastructural development in Nigeria.
- (iv) determine how market capitalization affect green infrastructural development in Nigeria.

The rest of the paper is structured such that section two focuses on literature review, section three on methodology and model specification, section four deals with data analysis and presentation of results and while conclusion and recommendations are contained in section five.

2. Literature review

2.1. Concept of green finance

Simply put, green finance is a loan or investment that promotes environmentally-positive activities, such as the purchase of ecologically-friendly goods and services or the construction of green infrastructure (Shinde, 2023). As the hazards connected to ecologically destructive products and services rise, green finance is becoming a mainstream phenomenon. A green finance (green loan) is a form of financing that enables borrowers to use the proceeds to exclusively fund projects that make a substantial contribution to an environmental objective. A green loan or finance is similar to a green bond in that it raises capital for green eligible projects. However, a green loan is based on a loan that is typically smaller than a bond and done in a private operation. A green bond usually has a bigger volume, may have higher transaction costs, and could be listed on an exchange or privately placed. Green loans (finances) and green bonds also follow different but consistent principles: The Green Loan Principles (GLP) and the Green Bond Principles (GBP) of the international Capital Market Association (ICMA). Both instruments specify that 100% of the proceeds should be used only for green eligible activities (World Bank, 2021).

2.2. Why green financing?

Green finance delivers economic and environmental advantages to everybody. It broadens access to environmentally-friendly goods and services for individuals and enterprises, equalizing the transition to a low-carbon society, resulting in more socially inclusive growth. This results in a ‘great green multiplier’ effect in which both the economy and the environment gain, making it a win-win situation for everyone.

2.3. Types of green financing

Green financing comes in many shapes and forms. Green loans, green mortgages, green bonds, and other green financial products. However, let’s explore its different types:

(i) Green Loans: These are loans used to support environmental initiatives such as household solar panels, electric automobiles, energy efficiency projects and more.

(ii) Green Mortgages: They allow lenders to provide better terms to home purchasers of properties with a high environmental sustainability rating or if the buyer agrees to invest in enhancing the environmental performance of a property

(iii) Green Credit Cards: Green credit cards such as Aspirations’ Zero Card Plant a tree every time a customer makes a purchase. They enable customers to direct their expenditure toward green finance in order to have a lasting impact on the environment.

(iv) Green Banks: Green banks operate similarly to traditional banks, but they employ public funds to spur private investment in renewable energy and other environmentally friendly initiatives. According to a 2020 research the number of green banks in the US increased from one to twenty between 2011 and 2020, investing \$7 billion in renewable energy.

(v) Green Bonds: Green banks account for the vast bulk of green funding. They include bond investments, the earnings from which are used to support a variety of green initiatives such as renewable energy, clean transportation and conservation, among others.

2.4. Concept of green infrastructure

Green infrastructure or blue-green infrastructure refers to a network that provides the “ingredients” for solving urban and climatic challenges by building with nature (Wikipedia). The main components of this approach include storm water management, climate adaptation, the reduction of heat stress, increasing biodiversity, food production, better air quality, sustainable energy production, clean water, and healthy soils, as well as more anthropocentric functions, such as increased quality of life through recreation and the provision of shade and shelter in and around towns and cities (Wikipedia).

Green infrastructure also serves to provide an ecological framework for social, economic and environmental health of the surroundings. Green infrastructure can also mean “low-carbon infrastructure” such as renewable energy infrastructure and public transportation systems. Blue-green infrastructure can also be a component of “sustainable drainage systems” or “sustainable urban drainage to manage water quantity and quality, while providing improvements to biodiversity and amenity. However, green infrastructure is considered a subset of “sustainable and resilient infrastructure”, which is defined in standards such as SuRe, the standard for sustainable and resilient infrastructure.

2.5. Green financial instruments

Green finance instruments are those products and services that provide a channel for financial capital to be channeled to green projects or green industrial sectors whose activities are environmental friendly and aid in the transition to a low carbon economy. Examples of various types of green finance instruments and services provided by the finance sector include the financial products like green bonds, green funds (green mutual funds), green certificate of deposits etc. however for the purpose of the study, emphasis shall be on green financial instruments like green bonds; green funds or green mutual funds; green loans and not other financial instruments. See Table 1 below:

Table 1.

Green Financial Instruments

S/N	Financial Products	Instruments
1	Traditional banking products	Loan, equity
2	Green finance	Green bond, Green funds (Green funds) etc
3	Co-investment	Public & institutional investors private funds

Source: Ministry of Economic Affairs and Employment of Finland (2020)

2.6. Green assets financing in Nigeria

These include financing of green assets (green infrastructures) with the green finance. In Nigeria, one of the developing nations of the world, this phenomenon is gradually waking-up as governments and other private investors (individuals and corporates) are giving priorities and attentions to environmentally-friendly projects and new energies technologies that will have positive economic impact on both the people and society. Thus, in the near future, green financing of green infrastructure or assets will become all over the place affairs.

The first conspicuous green bond in Nigeria was issued in 2017 and worth N10.69b (\$29M). Since then, the Nigerian green bond market has continued to gain considerable traction

(Olajide, 2019). This year alone, we have seen North South Power Company (“NSP”) Limited, a pan African power generation company, issue its first N8.5 billion 15-year 15.6 percent series 1 Guaranteed Fixed Rate Senior Green Infrastructure Bonds, due 2034; through NSP-SPV Power Corp Plc – a special purpose vehicle for raising funds from the capital market to finance capital expenditure and optimize the capital structure of NSP. This is the first series of a N50 billion senior green infrastructure bond and it was oversubscribed by 60 percent (Olajide, 2019). Even more recently in 2019, Access Bank Plc listed its N15 billion (\$41M) 5-year 15.5 percent Fixed Rate Senior unsecured Green Bond, on the FMDQ OTC securities exchange and the Nigerian Stock Exchange (NSE) now Nigerian Exchange Group, due in 2024.

Since 2018, Access Bank has played an influential role in stimulating the growth of the green bond market in Nigeria, through their co-launch of the Nigerian Green Bond Market Development Programme. They have continued to support the financial market to enhance its depth and diversification for the benefit of issuers and investors alike, by bringing new structures to the market and encouraging progressive dialogue. Additionally, their NGN15 billion inaugural green bond, issued in March 2019, has seen the allocation of a total amount equal to the net proceeds of the offering, to fund eligible green assets. Access Bank, in Nigeria, has been at the forefront of sustainable finance, leading in innovative growth and the adoption of global best practices. In 2009, in light of the establishment of the Environmental and Social Risk Management (ESRM) framework for banks, Access Bank became a signatory of the Equator Principles (Wigwe, 2022).

2.7. Theories of green (sustainable) finance

Some of the important theories of green finance are discussed below:

2.7.1. Priority theory of green finance

This theory argues that the rate at which economic agents make every effort to achieve sustainable or green finance goals in a country or region is a true reflection of the priority given to the green finance agenda (Wilson 2010). The priority can be assessed from three dimension, such as (i) the coordinated, independent and collaborative efforts put together by economic agents towards achieving green finance goals; (ii) how quickly or slowly a census is reached and (iii) how quickly or slowly actions are taken towards achieving green finance goals. Generally, economic agents have different priorities. These priorities can be ranked from the least important to the most important

Thus, the link between the priority theory and green infrastructural development in this study is that, if the government and the respective regulatory agencies place priority attention on green finance (loan financing, green bond or investment) to fund projects that are environmentally-positive activities, such as purchase of ecologically-friendly goods and services that make substantial contribution to environmental objective, then green infrastructural development for solving urban and climatic challenges would be achieved. This will further results to low-carbon infrastructure such as renewable energy infrastructure and public transportation systems, storm water management, climate adaptation, the reduction of heat stress, increasing biodiversity, food production, better air quality, sustainable energy production, clean water, and healthy soils among others (Shinde, 2023). This will eventually impact positively on the overall market value of shares of those companies engaged in the production of environmentally friendly goods and services, thereby enhancing their market capitalization rate.

2.7.2. Peer emulation theory of green finance

This theory argues that economic agents take similar actions or adopt similar policies and strategies of the peers they emulate in pursuit of green finance goals. It provides an opportunity for economic agents to share the same societal, economic and political ideas on green finance with the peers they emulate. Peer emulation theory is faster to adopt the green finance policies and actions already adopted by peers as only few adjustments need to be made before adopting it. The peer emulation theory of green finance suggests that, when there are no uniform standards to guide action towards green financing, economic agents resort to adopting similar policies or actions taken by the peers they admire or emulate. This implies that economic agents will pursue specific green finance goals because the peers they emulate are doing so or have already done so in the past. Emulating one's peers makes sense when economic agents share similar perspectives and views on sustainability (Cowett, 2008). For example countries that share the same ideas on climate change will most likely adopt similar sustainable green financial policies and actions towards achieving their individual sustainable green financial goals.

Therefore, given the idea behind peer emulation theory, it is obvious to state that for Nigeria (being the economic agent) to effectively actualize its green infrastructural development goal (proxied by gross fixed capital formation), she should emulate or follow the footsteps of other countries by adopting similar policies. For instance, if peer countries have employed the model for this study (green bond financing, ratio of agriculture to GDP, all share index and market capitalization rate) to successfully achieve high level of green infrastructural development; then Nigeria could simply adopt same with or without any variations and will also achieve similar fit. Thus, this model could be stated in its functional form as:

$$GID = f(GB, Agric/GDP, ASI, MCAP) \quad (1)$$

Where: GID is green infrastructure (measured by green bond); Agric/GDP is % of agriculture contribution to GDP; ASI represents all share index; MCAP is market capitalization. (Both ASI and MCAP related to capital market where green bonds and most other green financing are sourced).

The main advantages for peer emulation theory is that it is cheaper and faster to copy and implement already successful existing policies and actions similar countries to achieve the same goal without wasting resources. Besides, it also provides an opportunity for economic agents to share the same societal, economic and political ideals on sustainable finance with the peers they emulate (Ozili, 2023).

2.8. Empirical literature

Several empirical studies across the globe have established significant positive impact of green finance on green infrastructures or assets. For instance, Wang and Zhi (2016) also examined the role of green finance in environmental protection: two aspects of market mechanism and policies. They found that market mechanism of green finance is rational, green finance can guide the flow of funds and achieve effective management of environmental risk and optimal allocation of environmental resources and social resources. They further recommended the construction of environmental protection should consider setting up the mechanism of efficient green finance system coordinating the relationship between ecology and finance.

Ojo-Fafare, Aigbavboa, Thwala and Remaru (2019) investigated global growth: costs and benefits of green buildings compared with conventional buildings. In their investigation of cost differences between traditional and greenhouse construction, came up with the findings that

green buildings are more expensive than traditional buildings but have an overall better return in the long run than that the traditional buildings.

Similarly, Lavrinenko, Ignatjeva, Ohotina, Rybalkin and Lazdans (2019) in an empirical study, “the role of green economy in sustainable development (case study: the EU states)” examine the role of green banking towards environmental protection. The results shows that the green economy plays a significant role in balancing economic growth and environmental degradation (green infrastructures).

HU, Jiang and Zhong (2020) in a study on the impact of green credit on the industrial structure in China, found that green credit mainly influences the industrial structure through capital and funding channels of enterprises. In a related study, Yatim, Ngam and Lamb (2017) analyzed enabling conditions for the development and growth of Malaysia’s green economy, focusing on the current financing policies, initiatives such as the Green Technology Financing Scheme (GTFS), issues and challenges in financing the green industry. Their findings proved that there is improve existing policies to support the green growth in Malaysia.

Eftichios (2020) examines the role of green bonds in financing the transition to the low carbon economy; it was found that providing a viable instrument for substantial financial support for the transition to the low carbon economy such as the green bond is crucial. Miroshniche and Mostovaya (2019) in their work on green loan as a tool for green financing, found that the main factors that affect green lending include credit profiles, capital requirements, the organisations’ reputation, and the regulatory pressure.

Mghnam and Rahman (2021) empirically investigated the effect of green finance on sustainable development in Jordan. They used the ARDL technique and found that green finance variables such as green investments and environmental taxes significantly impact sustainable development indicators of renewable energy consumption and CO₂ emission in Jordan.

In a related study by Atan et al. (2022a) on the role of green finance in sustainable development employed the panel data analysis technique. The outcome of the findings revealed that green finance such as green bond issuance and green investment significantly and positively impact sustainable development in emerging economies.

Adeleye et al (2022) examined the effect of green financing on environmentally friendly financing programs in BRICS countries. Using the panel data analysis among others, found that efficiency of green finance was not necessarily consistent among the BRICS countries, which revealed that some country-specific factors and policies could be the disparity.

Al-Afeefa, et.al (2024) investigate the impact of green finance initiatives on achieving sustainable development goals in Jordan for the period 1970 to 2022. The Autoregressive Distributed Lag (ARDL) method was employed in the analysis of data and the results indicate that green finance positively contributes to sustainable development in Jordan, and in the short- and long-term perspectives. Green finance and sustainable development have been a tightly connected two-way causality between them according to Dik and Panchenko's test, which implies that a virtuous cycle existed in Jordan

3. Methodology

The research design for this study is the longitudinal (ex-post facto) research, where the variables in question are deemed that have already occurred such that the researcher cannot manipulate them. The population of the study which is also the sample size is the Nigerian

economy, and the sampling technique adopted for the study is the census sampling technique where population equals sample size.

Sources of Data: The data for the study were sourced from the World Bank Data and the Central Bank of Nigeria Statistical Bulletin (2022). Specifically, data on gross fixed capital formation, green bond and agriculture contribution to GDP (%) were sourced from the World Bank database; while those of all share index and market capitalization were sourced from the Central Bank of Nigeria Statistical Bulletin (2022).

3.1. Model specification

The model for this study follows a linear combination of several green finance variables hypothesized to influence green infrastructural development, which is also linked to the works of Lavrinenko, Ignatjeva, Ohotina, Rybalkin and Lazdans (2019); Hu, Jiang and Zhong (2020) with slight modifications. Therefore, the model for this study is specified as follows:

$$GFCF = f(GB, \frac{AGrc}{GDP}, ASI, MCAP) \quad (2)$$

The econometric form of the model is specified as:

$$GFCF = \alpha_0 + \alpha_1 GB + \alpha_2 \frac{AGrc}{GDP} + \alpha_3 ASI + \alpha_4 MCAP + U_t \quad (3)$$

Where:

GFCF = Gross Fixed Capital Formation in Nigeria

GB = Green Bond in Nigeria

$\frac{AGrc}{GDP}$ = Agriculture contribution to GDP (%) or Agriculture percentage of GDP in Nigeria

ASI = All Share Index

MCAP = Market Capitalization

U_t = Stochastic error term

Apriori Expectation = $\alpha_1, \alpha_2, \alpha_3, \alpha_4 > 0$

In the model, gross fixed capital formation “GFCF” (which is used to proxy green infrastructure or assets development) is shown to be determined by the principal determinant, green bond, and other control variables (determinants) such as agriculture contribution to Gross Domestic Product (GDP) (%), all share index, and market capitalization. However, the green bond is the main proxy for the green finance. Each of these variables is expected to have positive effect on green infrastructure development (proxy by gross fixed capital formation) in Nigeria.

3.2. Measurements of variables

The specific measurements of the variables used in the study are defined in Table 2.

Table 2.
Definition of variables

Acronym	Variable	Measurement	Source	Apriori Sign
GFCF	Gross Fixed Capital Formation	Measured by the total value of a producer's acquisitions, less disposals, of fixed assets during the accounting period	Olajide, 2019); Otali and Monye (2023)	
GB	Green Bond	Measured as debt securities designed to finance environmentally friendly projects	Adeleye et al (2022); Atan et al. (2022a)	+
AGRIC/GDP	Ratio of Agriculture to Gross Domestic Product	Measured as the percentage of Agriculture contribution to GDP	Sasu, 2023), Olajide, Akinalabi and Tijani (2012)	+
ASI	All Share Index	Market value divided by the base market capital multiplied by the base value of 1,000. That is; Index Value = Current Market Value / (1000 * Base Market Capital)	Maxwell, et. al (2018)	+
MCAP	Market Capitalization	The number of outstanding shares multiplied by the price	Maxwell, et. al (2018); UNCTAD (2022); Olusegun Ajao (2024)	+

Source: Author's Compilations (2024)

3.3. Method of data analysis

The method employed for the analysis of data for this study is the dynamic least squares (DOLS). The dynamic least squares (DOLS) technique is a simple and efficient approach to estimating the coefficients of a cointegrating relationship. It is an estimator suggested to solve the finite sample bias of OLS caused by endogeneity issue when estimating regression models based on cointegrated variables. It is superior to OLS as it is able to avoid serial correlation, endogeneity and multicollinearity problems by incorporating relevant corrections into the standard OLS model (Stock and Watson, 1993; Masih and Masih, 1996). The advantage of the dynamic least squares technique is that, it is not only computationally simpler but it reduces bias better than FMOLS. The t statistic from DOLS approximates the standard normal density much better than the statistic from OLS or FMOLS.

4. Data analysis and interpretation of results

In this section, the method of data analysis in relation to the impact of green finance on green infrastructure development in Nigeria as stated in the preceding section are carried out. First, in order to ascertain the background characteristic among the data set, the correlation coefficient was carried out. Thereafter, the Engle and Granger cointegration test was used to ascertain the existence or otherwise of cointegration among the variables; while the dynamic least square (DOLS) method was used for the main estimation of the model.

4.1. Correlation analysis

In order to observe the pattern of relationship among green finance variables and green infrastructure development in the model, the correlation matrix for the data is computed.

Moreover, the result from the analysis provides a guide in the estimation since highly correlated independent variables will cause multicollinearity problem in the model. The result of the correlation tests is presented in Table 3. In the result, green infrastructure development (GFCF) is seen to have a strong positive correlation with green bond in Nigeria (GB) (0.686575) and market capitalization (MCAP) (0.621234); and a strong negative correlation value of -0.602913 with agricultural contribution to GDP (AGRIC/GDP), as well as a weak positive correlation value of 0.237230 with all share index (ASI). Also, there is a strong negative correlation value of -0.532085 between agricultural contribution to GDP (AGRIC/GDP) and market capitalization (MCAP). However, the results of the rest variables are weakly correlated. Therefore, based on the above results, it is clear that there is actually no indication of the problem of multicollinearity amongst the variables used in the model.

Table 3.

The Pairwise Correlation Matrix

	GFCF	GB	AGRIC/GDP	ASI	MCAP
GFCF	1				
GB	0.686575	1			
AGRIC/GDP	-0.602913	-0.207271	1		
ASI	0.237230	0.168576	-0.045862	1	
MCAP	0.621234	0.184526	-0.532085	0.300345	1

Source: Author's Compilations 2024.

4.2. Engle and granger cointegration test

The Engle-Granger cointegration test considers the case that there is a single cointegrating vector. The test follows the very simple intuition that if variables are cointegrated, then the residual of the cointegrating regression should be stationary. The result of the Engle-Granger cointegration test is reported in Table 4 below; and when the residual was tested at level using the Augmented Decay Fuller test (see Table 5), it was observed that the residual was stationary at levels. This suggests that there is a significant cointegrating vector between green infrastructure development and green finance variables in Nigeria. This implies that a long run relationship exists among these variables. Hence, the results of the cointegration tests are summarized in Table 4 & 5 below.

Table 4.

Cointegration Test - Engle-Granger Result

Variable	Value	Prob.
Engle-Granger tau-statistic	-2.929064	0.6566
Engle-Granger z-statistic	-12.54487	0.7044
Rho – 1	-0.482495	
Rho S.E.	0.164727	
Residual variance	2.65E+08	

Source: Author's Compilations 2024

Table 5.

Unit Root Test for Residual in Level.

Variable	ADF Test Statistic	95% Critical ADF Value	Remark
Residual	-5.161609	-2.998064	Stationary

Source: Author's Compilations 2024

4.3. The Dynamic Least Square (DOLS) estimation

The effect of green finance on green infrastructure development in Nigeria may be analyzed by the dynamic least square (DOLS) estimation. The result in Table 6 has an impressive

goodness of fit information. The R squared value of the green infrastructure development (GFCF) equation is about 0.98 percent showing that the explanatory variables in the model effectively tract the long run variations in the dependent variable. Even the adjusted R squared value of 0.94 is also very high, indicating that the model possesses a good predictive ability.

A close examination of the coefficients of the variables in terms of their signs and significance level revealed that the coefficient of green bond in Nigeria (GB) has significant positive impact on green infrastructure development. Indeed, a unit increase of the level of green bond financing leads to a 1553.779 percent increase in green infrastructure development in Nigeria within the investigating period. That presupposes that, with every increases in green bond financing, there is a corresponding increase in terms of provision of “ingredients” for solving urban and climatic challenges by building with nature, whose main components include storm water management, climate adaptation, the reduction of heat stress, increasing biodiversity, food production, better air quality, sustainable energy production, clean water, and healthy soils, as well as more anthropocentric functions, such as increased quality of life through recreation and the provision of shade and shelter in and around towns and cities. Thus, the finding aligns with those of Ojo-Fafare, et al (2019), Lavrinenko, et al (2019), HU, et al (2020) and Eftichios (2020), Mghnam and Rahman (2021), Al-Afeefa, et.al (2024) who found that green bonds/financing significantly and positively impact green infrastructure development. It is also in line with the priority theory of green finance and green infrastructural development as advocated by Wilson (2010).

The coefficient of agricultural contribution to GDP (AGRIC/GDP) is negative and has significant negative impact on green infrastructure development in Nigeria, and it was significant at the 1 percent level. This suggests that the contribution of agriculture in relation to GDP is a significant determinant of green infrastructure development in the country. However, the negative sign is an indication that any increases in AGRIC/GDP reduces green infrastructure development by -7844.301 percent. The finding disagrees with the findings of Stevens (2018), Musvoto, et al (2018) and Najafabadi, et al (2022) who submitted that agricultural contribution to GDP has significantly positive impact on green growth and green infrastructure development.

The coefficient of all share index (ASI) has a significant positive relationship with green infrastructure development; the variable passes the 1 percent significance level. This means that all share index (ASI) is a veritable factor in determining the level of green infrastructure development in Nigeria overtime. Thus, for every unit improvement in ASI, there is a corresponding increase in the level of green infrastructural development in Nigeria. Thus, this finding does not seems to align with those of Heckert and Rosan (2016), Mushafiq and Prusak (2023); who submitted that positive shocks of stock market indices increases environmental deterioration and negative shocks decrease the environmental deterioration, and hence, green infrastructural development. However, the study corroborate those of Zhao and Yang (2020) and Mhadhbi et al. (2021) who found that growth of financial markets and stock market indices often have contrasting effect on environmental sustainability across countries

On the other hand, market capitalization (MCAP) being a proxy for stock market development has a significant negative impact on green infrastructural development, it was significant at the 1 percent level. This means that, in the determination of green infrastructural development in Nigeria, MCAP is a relevant factor that must not be ignored. However, the negative signs suggests increases in MCAP reduces overall green infrastructural development in the country overtime. This finding does not agree with those of OECD (2013) and UNCTAD (2022) that capital market significantly contributed to green infrastructural development. It also does not agreed with submissions of earlier studies like Claessens and Feijen (2006) and Tamazian et

al. (2009) that “stock market growth and by extension market capitalization rate, provides both developed and developing countries with cutting-edge and eco-friendly technologies that can boost energy efficiency and aid in the transition to more sustainable and environmentally friendly production methods”.

Table 6.

Green Finance and Green Infrastructure Development in Nigeria (DOLS)

Variable	Coefficient	T-Ratio	Prob.
Constant	246693.8	8.387589	0.0001
GB	1553.779	2.815664	0.0259*
AGRIC/GDP	-7844.301	-8.309376	0.0001**
ASI	1.715474	5.525085	0.0009**
MCAP	-1.139358	-3.957543	0.0055**
$R^2 = 0.98$	$\bar{R}^2 = 0.94$		

Source: Author's Compilations (2024). Note: *at 5% level of sig; **at 1% level of sig.

4.4. Normality test

To test for normality test, we employed the histogram normality test (HNT). According to this test, the null hypothesis is that the residual are normally distributed, while the alternative hypothesis is that the residual are not normally distributed. Thus, if the probability value of the Jarque-Bera statistics is greater than 0.05 (5%), then we accept the null hypothesis that the residual are normally distributed; but if the probability value of the Jarque-Bera statistics is less than 0.05 (5%), then we reject the null hypothesis that the residual are not normally distributed. Therefore, since the probability value (0.048) of the Jarque-Bera statistics in Figure 1 is less than 0.05 (5%), we conclude that the data set are not normally distributed.

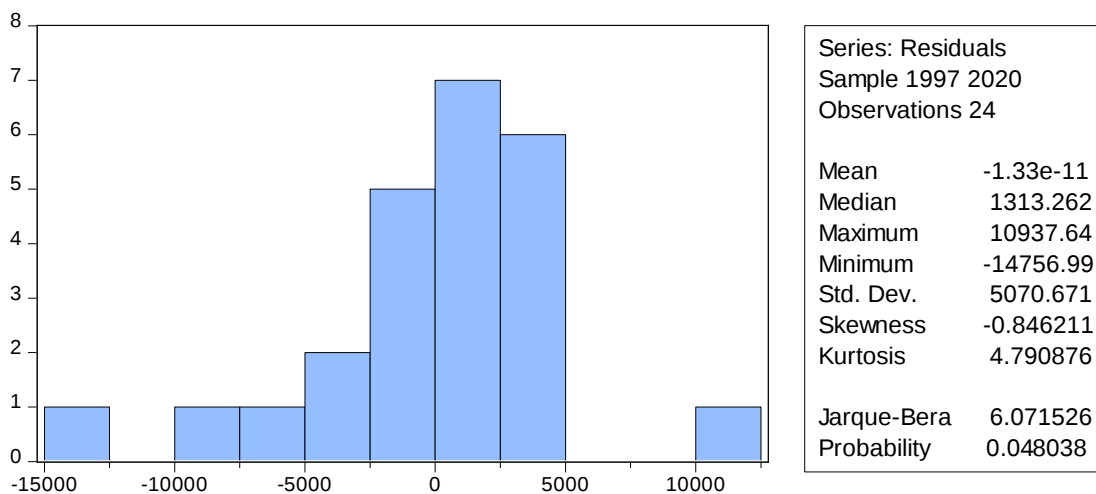


Figure 1. Histogram Normality Test

Source: Author Computation from Eview 10 output (2024)

5. Conclusion

The study examined the impact of green finance on green infrastructure development in Nigeria for the period 1995 to 2022. The rationale for the study was predicated on the realization of the role of green financing in green infrastructure development across the globe. The dynamic least square (DOLS) econometric technique was employed for the estimation of two (2) green finance related data and two (2) stock market variables such as green bond (GB), agricultural contribution to GDP (AGRIC/GDP), all share index (ASI) and market capitalization (MCAP).

These were regressed against green infrastructure development (proxied as GFCF). The results from the analysis indicate that green bond (GB) and all share index (ASI) have significant positive impact on green infrastructure development; while agricultural contribution to GDP (AGRIC/GDP) and market capitalization (MCAP) have significant negative impact on green infrastructural development in Nigeria. Hence, the study conclude that, in the determination of green infrastructure development in Nigeria, green bond, agricultural contribution to GDP, all share index and market capitalization are relevant factors to be considered and must not be ignored by the regulatory agencies and government.

5.1. Recommendations

Based on the findings from this study, the following recommendations for policy decisions are made:

First, with respect to green bond, government should intensify investment in green loans, open and operate green bank account where the earnings can be used to support various green initiatives such as renewable energy, clean transportation, solar panels, electric automobiles, energy efficiency projects, among others.

Secondly, the government should strengthen the current level of green financing in the country by initiating appropriate policy to reposition green bond market thereby making it to be more attractive to investors.

Thirdly, since the outcome of this study has shown that agricultural contribution to GDP negatively affect green infrastructure development, the Nigeria government should formulate appropriate policy for improving green growth and green infrastructure development, which must mainly consist of regulations, supports, research and development directed at enhancing environmentally-sound agricultural output.

Lastly, the capital market which is an effective conduit for mobilizing funds, especially green bonds market, should be strengthened so that it can constantly channel more resources for financing green infrastructural development in the country.

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