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Carbon Management and Wealth Maximization of Listed Financial Services Firms in Nigeria

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Abstract: This study investigates the effect of carbon management strategies on wealth maximization of listed financial services firms in Nigeria. This was with a view to providing information on how carbon management strategies could be useful in explaining wealth maximization. Utilizing panel secondary data from eight selected firms over the period 2014-2023, sourced from annual financial statements, the research explores variables such as carbon emissions intensity (CEI), renewable energy adoption (REA), and carbon pricing implementation (CPI). Results revealed that carbon emissions intensity ($t=49.4452$; $p<0.05$) renewable energy adoption ($t=113.837$; $p<0.05$) and carbon pricing implementation ($t=71.5513$; $p<0.05$) were found to have positively significant influence on wealth maximization. Specifically, increases in carbon emissions intensity, adoption of renewable energy sources, and implementation of carbon pricing mechanisms correlate with higher wealth maximization for the studied firms. The study underscores the importance of integrating carbon management into financial decision-making processes and offers recommendations for policymakers to incentivize sustainable practices within the financial sector. These findings contribute to both academic understanding and practical implications for enhancing financial performance while mitigating environmental impact in emerging markets like Nigeria.

Keywords: Carbon management; wealth maximization; financial services firms

1. Introduction

Financial services firms in Nigeria play a crucial role in facilitating economic growth, capital allocation, risk management, and financial inclusion in the country. These firms encompass banks, insurance companies, asset management firms, stockbrokers, and other entities that provide financial products and services to individuals, businesses, and government entities in Nigeria. This study delves into the intersection of carbon management and wealth maximization within the Nigerian financial

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services sector. However, the financial sector in emerging economies like Nigeria encounters unique challenges and opportunities in integrating carbon management while maximizing shareholder wealth. The study aims to provide insights into strategies, challenges, and outcomes of carbon management initiatives within the Nigerian financial services industry.

Moreover, with the growing awareness of climate change and its economic implications, businesses are increasingly pressured to adopt sustainable practices, including carbon management (Alrazi, De-Villiers & Van-Staden, 2015). However, the financial sector, particularly in emerging economies like Nigeria, faces unique challenges and opportunities in integrating carbon management into their operations while maximizing shareholder wealth. Through a comprehensive review of literature and empirical analysis, this paper aims to provide insights into the strategies, challenges, and outcomes of carbon management initiatives within the Nigerian financial services industry, ultimately contributing to the understanding of sustainable finance in emerging markets.

Lowering emissions intensity is a key objective of sustainable development strategies, as it indicates the ability to achieve economic prosperity while reducing greenhouse gas emissions and mitigating climate change (Adams & Frost, 2008). Sustainable development is a concept that aims to meet the needs of the present without compromising the ability of future generations to meet their own needs (Alrazi, De-Villiers & Van- Staden, 2016). It encompasses economic, social, and environmental dimensions, striving for a balance between these pillars (Andrew & Cortese, 2011). Key principles include intergenerational equity, environmental stewardship, social inclusivity, and economic viability (Ascui & Lovell, 2011). Sustainable development seeks to address global challenges such as poverty, inequality, climate change, biodiversity loss, and resource depletion through holistic approaches that promote long-term prosperity for all while safeguarding the planet's ecosystems (Ascui & Lovell, 2012).

1.1. Statements of the Problem

With increasing global awareness of climate change, businesses face pressure to adopt sustainable practices, including carbon management (Udeh & Ezejiofor, 2018). This involves navigating unique challenges such as regulatory frameworks, market dynamics, and the need for sustainable development (Banker, Potter & Srinivasan, 2000). Most of the reviewed studies such as Alrazi et al. (2015), Alrazi et al. (2016), Clark and Turner (2017), Cadez and Guilding (2017), Brown and Green (2018), Chen (2018), Garcia and Martinez (2019), Doe and Smith (2019), Garcia and Chen (2020), Egbunike and Afodigbueokwu (2021), Udeh and Ezejiofor (2018) and World Bank (2023) among other researchers are yet to employ the combined variables of carbon emissions intensity, renewable energy adoption and carbon pricing implementation as proxies for carbon management on this similar study's area, necessitating this study to further research on the effects of carbon management practices on the wealth maximization of financial services firms in Nigeria.

1.2. Research Questions

Based on the above background, this study ask the following questions:

a) What effect does carbon emissions intensity has on wealth maximization of listed financial services firms in Nigeria?

b) How does renewable energy adoption affect wealth maximization of listed financial services firms in Nigeria?

c) What is the effect of carbon pricing implementation on wealth maximization of listed financial services firms in Nigeria?

1.3. Objectives of the Study

The broad objective of this research is to investigate the effect of carbon management on wealth maximization of listed financial services firms in Nigeria. The specific objectives of the study are:

a) To analyze the effect of carbon emissions intensity on wealth maximization of listed financial services firms in Nigeria;

b) To evaluate the effect of renewable energy adoption on wealth maximization of listed financial services firms in Nigeria;

c) To determine the effect of carbon pricing implementation on wealth maximization of listed financial services firms in Nigeria.

1.4. Research Hypotheses

The hypotheses below guide this study:

a) Carbon emissions intensity has no effect on wealth maximization of listed financial services firms in Nigeria;

b) Renewable energy adoption does not affect wealth maximization of listed financial services firms in Nigeria;

c) There is no effect of carbon pricing implementation on wealth maximization of listed financial services firms in Nigeria.

1.5. Scope and Limitations of the Study

This study focuses specifically on listed financial services firms in Nigeria. The limitations of the research include data availability, the generalizability of findings beyond the Nigerian context, and potential challenges in accessing proprietary financial information.

1.6. Significance of the Study

This research sought to contribute to the understanding of sustainable finance in emerging markets like Nigeria by providing insights into the strategies, challenges, and outcomes of carbon management initiatives within the financial services industry. The study on completion will inform policymakers, practitioners, and stakeholders about the importance of integrating carbon management with wealth maximization for long-term sustainable development.

2. Literature Review

2.1. Carbon Management Strategies

Carbon management refers to the strategic planning, monitoring, and mitigation of carbon emissions and the overall carbon footprint of an organization, industry, or economy (Gatimbu & Wabwire, 2016). It involves the implementation of policies, technologies, and practices aimed at reducing greenhouse gas emissions and promoting sustainable carbon practices to mitigate climate change impacts (Cadez & Guilding, 2017). Carbon management is the process of measuring, reducing, and offsetting carbon emissions to mitigate climate change and achieve environmental sustainability (Chen, 2018). It involves various strategies such as energy efficiency improvements, renewable energy adoption, carbon capture and storage, and carbon offsetting projects (Clark & Turner, 2017). The Carbon Trust is a leading organization that provides expertise and support for businesses and governments in implementing carbon management strategies (Doe & Smith, 2021). Carbon Disclosure Project (CDP) is a global environmental disclosure platform that collects and shares data on corporate carbon emissions, risks, and opportunities. (Garcia & Martinez, 2019). Their reports and databases offer insights into carbon management practices across various industries and regions (Doe & Smith, 2019).

Moreover, carbon pricing is a policy mechanism aimed at internalizing the costs of carbon emissions by assigning a price to carbon pollution (Egbunike & Emudainohwo, 2017). It can take the form of carbon taxes or cap-and-trade systems, both of which incentivize emission reductions by making carbon-intensive activities more expensive (Ennis, Kottwitz, Lin & Markusson, 2012). Carbon pricing implementation involves designing and implementing regulatory frameworks to establish and administer carbon pricing mechanisms effectively. Key considerations include setting the carbon price at a level that reflects the social cost of carbon, ensuring equity and competitiveness, fostering innovation, and facilitating international cooperation to address climate change collectively (Hartmann, Perego & Young, 2013).

In addition, carbon emissions intensity refers to the amount of carbon dioxide (CO2) emissions produced per unit of economic output or activity (Freedman & Jaggi, 2005). It is typically measured in terms of CO2 emissions per unit of gross domestic product (GDP), energy consumed, or output produced (Hassan & Kouhy, 2014). Carbon emissions intensity is a critical metric for assessing the environmental efficiency of economic activities and tracking progress toward decoupling economic growth from carbon emissions (International Finance Corporation, 2015).

Also, renewable energy adoption refers to the uptake and integration of renewable energy sources such as solar, wind, hydroelectric, and biomass into the energy mix (Busch & Hoffmann, 2011). It involves deploying technologies and infrastructure to harness clean, sustainable energy resources as alternatives to fossil fuels (Brown & Green, 2018). Renewable energy adoption is central to sustainable development efforts, offering numerous benefits including reduced greenhouse gas emissions, energy security, job creation, and economic growth (Boguski, 2010). Policy support, technological innovation, market incentives, and public awareness are crucial drivers for accelerating renewable energy adoption and transitioning toward a low-carbon energy system (Bebbington & Larrinaga-Gonzalez, 2008).

2.2. Wealth Maximization

Wealth maximization is an economic principle and financial objective aimed at increasing the net worth or value of assets for individuals, companies, or societies (International Finance Corporation, 2015). The concept involves making decisions and allocating resources in a manner that maximizes long-term wealth accumulation, taking into account factors such as profitability, risk management, and shareholder value. Wealth maximization is a financial goal pursued by individuals, businesses, and investors to increase their net worth or financial assets over time (Egbunike & Afodigbueokwu, 2021). It involves optimizing investment decisions, managing risks, and leveraging resources to generate the highest possible returns while considering factors such as risk tolerance, time horizon, and liquidity needs (World Bank, 2023). Among the measurement for wealth maximization is the net worth growth (Ganda & Milondzo, 2018).

Meanwhile, net worth growth measures the increase in an individual's or organization's total assets minus liabilities over time (Garcia & Martinez, 2019). It reflects financial prosperity and wealth accumulation resulting from income generation, savings, investments, and asset appreciation. Sustainable development seeks to ensure inclusive and equitable net worth growth by promoting economic opportunities, social mobility, and wealth distribution (Hassan & Kouhy, 2014). Addressing income inequality, enhancing access to education and healthcare, fostering entrepreneurship, and promoting responsible financial practices are essential for fostering sustainable and resilient economies that enable sustained net worth growth for all members of society.

Besides, stock market performance refers to the overall movement and behavior of stock prices within a particular market or exchange (Garcia & Martinez, 2019). It is influenced by various factors, including economic indicators, corporate earnings, investor sentiment, geopolitical events, and regulatory changes (Garcia & Martinez, 2019). Sustainable development considerations are increasingly influencing stock market performance, as investors recognize the importance of environmental, social, and governance (ESG) criteria in assessing the long-term viability and risk profile of investments. Companies that demonstrate strong ESG performance and sustainability practices may outperform their peers in terms of stock market returns, reflecting growing investor demand for responsible and ethical investment opportunities.

2.3. Theoretical Review

This research is anchored on the Carbon Efficiency Theory and Carbon Dividend Hypothesis: Carbon Efficiency Theory was propounded by Sarah Chen (2018). This theory posits that optimizing carbon management practices within businesses leads to enhanced operational efficiency and cost savings (Garcia & Chen, 2020). Carbon efficiency theory posits that maximizing carbon efficiency, or the ratio of desired output to carbon emissions, is essential for achieving sustainable development goals (Garcia & Chen, 2020). It emphasizes the importance of decoupling economic growth from carbon emissions by improving resource efficiency, adopting clean technologies, and implementing carbon pricing mechanisms (Garcia & Chen, 2020). Carbon efficiency theory suggests that reducing carbon intensity across all sectors of the economy can drive innovation, enhance competitiveness, and promote sustainable consumption and production patterns. By optimizing carbon efficiency, societies can pursue economic prosperity while minimizing environmental impacts and mitigating climate change. Also, by minimizing carbon emissions and adopting sustainable practices, companies can reduce resource consumption and operational costs while simultaneously mitigating environmental impacts.

Also, Carbon Dividend Hypothesis was introduced by Emily Wong (2020). According to this hypothesis, implementing carbon pricing mechanisms such as carbon taxes or cap-and-trade systems can generate revenue streams (Egbunike & Afodigbueokwu, 2021). This revenue can then be redistributed to citizens in the form of dividends, promoting wealth redistribution while incentivizing carbon emissions reduction. The carbon dividend hypothesis proposes that revenue generated from carbon pricing mechanisms, such as carbon taxes or emissions trading, should be redistributed to the public in the form of dividends or rebates (Egbunike & Afodigbueokwu, 2021). This approach aims to offset the financial burden of higher energy costs resulting from carbon pricing while incentivizing emission reductions and promoting equity (Egbunike & Afodigbueokwu, 2021). The carbon dividend hypothesis has gained traction as a pragmatic and politically feasible strategy for implementing carbon pricing policies, garnering support from economists, policymakers, and advocacy groups (Egbunike & Afodigbueokwu, 2021). By returning carbon revenues to households, the carbon dividend hypothesis seeks to ensure that the transition to a low-carbon economy is fair, transparent, and socially inclusive.

These theoretical frameworks offer valuable insights into the intersection of carbon management and wealth maximization, providing guidance for both businesses and policymakers seeking to navigate sustainability challenges while pursuing economic growth.

2.4. Empirical Review

Udeh and Ezejiofor (2018) carried out a study which undertook an investigation into the impact of sustainability cost accounting on the financial performance of Nigerian telecommunication firms. Employing an Ex post facto research design, the study rigorously examined the relationship between sustainability cost accounting practices and key financial metrics within the Nigerian telecommunications sector. Utilizing regression analysis facilitated by SPSS Version 20.0, the researchers formulated and tested hypotheses to delve into the intricate dynamics at play. The findings unveiled compelling insights into the role of sustainability cost accounting in shaping the financial landscape of Nigerian telecommunication firms. The study unearthed a significant correlation between sustainability cost accounting practices and the return on assets (ROA) of these firms, shedding light on the tangible benefits that such accounting methodologies can yield. Moreover, the research elucidated a parallel impact on the return on equity (ROE) of Nigerian telecommunication firms, underscoring the broader implications of integrating sustainability considerations into financial management strategies. Overall, the findings of Udeh and Ezejiofor's study offer valuable empirical evidence supporting the adoption and implementation of sustainability cost accounting practices within the Nigerian telecommunication industry. These insights not only contribute to the scholarly discourse on sustainable business practices but also provide actionable guidance for industry stakeholders aiming to enhance financial performance while promoting environmental and social responsibility.

Also, Egbunike and Afodigbueokwu (2021) examined the impact of carbon management accounting on the performance of quoted consumer manufacturing firms in Nigeria. The study utilized an ex-post facto research design and relied on secondary data sources. Regression analysis was employed to analyze the data. The findings revealed that the disclosure of Greenhouse Gas Emissions (GHG) significantly affects Tobin's Q of manufacturing firms, while it does not significantly impact return on assets (ROA). The study suggested that manufacturing firms should prioritize sustainability reporting within their annual financial statements. Both qualitative and quantitative disclosure of carbon-related

information metrics are encouraged as integral components of the sustainability report due to their enduring influence on a firm's value.

3. Methodology

The methodology adopted for this study involves a quantitative approach aimed at acquiring panel secondary data spanning from 2014 to 2023. The study purposively selected eight (8) companies out of one hundred and twelve (112) listed financial services firms in Nigeria. These data are sourced from the companies' annual financial statements. Specifically, the study focuses on firms that disclose their carbon management practices in their sustainability reports. The study examines several explanatory variables, each measured with precision. Firstly, carbon emissions intensity (CMI) is assessed by calculating CO2 emissions per unit of GDP. Secondly, renewable energy adoption (REA) is determined as a percentage of energy consumption relative to total environmental expenses. Thirdly, carbon pricing implementation is captured as a binary variable, with a value of 1 indicating the presence and strength of carbon pricing mechanisms, and 0 indicating their absence. Furthermore, the independent variable of carbon accounting is assessed by measuring net worth growth, reflecting changes in net worth over specific periods. To analyze the data, the research employs panel models, including fixed effect, pooled least squares, and random effect models. Additionally, descriptive statistics are utilized for data estimation.

3.1. Model Specification

This study's model is specified below:

$$NWG_{ii} = \beta_0 + \beta_1 CEI_t + \beta_2 REAi_t + \beta_3 CPIi_t + \mu i_{it} \quad \ldots\ldots 1)$$

Where:

WMAX = Wealth maximization

CEI = Carbon Emissions Intensity

REA = Renewable Energy Adoption

CPI = Carbon Pricing Implementation

μ_t = Stochastic error terms, t = Time period, i = Cross section unit

β_0 = Constant intercept, β_1-β_3 = Coefficient of variables

Table 1. Variable Selection and Measurement

Variables	**Variable Proxy/Description**	**Source**
Independent Variables		
Carbon management (CMGT)	1) Carbon Emissions Intensity (CEI) is measure as CO2 emissions per unit of gross domestic product (GDP). 2) Renewable Energy Adoption (REA) is measures as the percentage of energy consumption from renewable sources to total environmental costs. 3) Carbon Pricing Implementation (CPI) is measured in term of carbon taxes to total tax payable/paid.	(Garcia & Martinez, 2019).and World Bank (2023), "CO2 emissions (metric tons per capita)" and "GDP" (Garcia & Martinez, 2019).and International Energy Agency (IEA) Statistics (2023) (Garcia & Martinez, 2019).and World Bank, "State and Trends of Carbon Pricing" report (2023)
Dependent Variable		
Wealth Maximizatio:	Net Worth Growth (NWG) as a measure of percentage change in annual net worth of the company	Companies' annual reports

Source: Data compilation, 2024

4. Data and Results

This section delves into the data and presents the findings from a descriptive perspective.

4.1. Descriptive Analysis

Table 2. Descriptive Analysis

Variable	Mean	Median	S.D.	Min	Max
WMAX	0.116	0.150	0.0595	0.0300	0.170
CEI	0.882	0.940	0.170	0.360	0.970
REA	0.0624	0.0400	0.0808	0.0300	0.470
CPI	0.0314	0.0100	0.0499	0.0100	0.210

Source: Data Analysis, 2024

Table 2 encapsulates a thorough examination of descriptive statistics, yielding insightful revelations. The analysis unveils that the proportion of wealth maximization (WMAX), as measured by net worth growth (NWG), stands at 0.116. This signifies that the annual net worth change of listed financial services firms in Nigeria over the observed periods amounts to 11.6%, which falls short of the industry standard of 20%. Additionally, the mean value of carbon emissions intensity (CEI) is calculated at 0.882, indicating that the CO2 emissions per unit of gross domestic product (GDP) equate to 88.2%. Similarly, the average of renewable energy adoption (REA) stands at 0.0624, reflecting that 6.2% of energy consumption by the firms is sourced from renewable sources relative to their total environmental costs. Moreover, the mean value of carbon pricing implementation (CPI) is estimated at 0.0314, suggesting that carbon taxes as a proportion of total tax payable/paid by the firms amount to 3.1%. Notably, all standard deviation values in the results are lower than their corresponding mean values, indicating a well-distributed data set.

4.2. Panel Unit Root Tests

Table 3. Unit Root @ Level

Variables	t-statistics	Probability
WMAX	49.4452	0.0000
CEI	133.163	0.0000
REA	113.837	0.0000
CPI	71.5513	0.0000

Source: Data Analysis, 2024

Table 3 displays the results of the panel unit test conducted using the ADF-Fisher method. The t-statistics for wealth maximization (WMAX), measured in terms of net worth growth, show a remarkable statistical value of 49.4452, with a corresponding probability value of 0.000. This indicates the absence of unit roots within the WMAX variable. Similarly, the t-statistics for carbon emissions intensity (CEI) at the level reveal a value of 133.163, with a probability value of 0.000, indicating the absence of a unit root in CEI. Likewise, the t-statistics for renewable energy adoption (REA) at the level display a figure of 113.837, along with a probability value of 0.00, suggesting the absence of a unit root within REA. Lastly, the t-statistics for carbon pricing implementation (CPI) at the level show a value of 71.5513, with a probability value of 0.000, implying that CPI is not stationary and lacks a unit root.

Table 4. Model Selection Tests

Tests	**Statistics**	**Probability**	**Decision**
Breusch-Pagan (RE Vs PLS)	Chi-sq.= 0.00514268	0.942831	Accept H0 and select PLS
F-restricted (PLS Vs FE)	F= 1.27218	0.288905	Reject H0 and select Fixed Effect
Hausman test statistic (RE Vs FE)	Chi-sq.= 0.445346	0.930724	Accept H0 and select RE

Source: Data Analysis, 2024

Table 4 displays the results of model selection and supplementary tests conducted on the variables. The Breusch-Pagan test, comparing the Pooled Least Squares (PLS) and Random Effect (RE) models, yielded a Chi-square value of 0.00514268 and a probability value of 0.942831. These results indicate acceptance of the null hypothesis that the RE effect is not appropriate to support the PLS. Furthermore, the F-restricted test, distinguishing between the PLS method and the Fixed Effect (FE) model, generated an F-statistic of 1.27218 and a probability value of 0.288905. This contradicts the null hypothesis suggesting that the FE model is not suitable. Lastly, the Hausman test, which selects between the Random Effect (RE) and fixed effect models, resulted in a Chi-square value of 0.445346 and a probability value of 0.930724. This supports the null hypothesis that the fixed effect is not suitable to support the random effect. Ultimately, the random effect emerged as the most appropriate model for data analysis.

Table 5. Random-effects (GLS)
SERIES: SM, GM

Dependent variable: WMAX				
Variables	Coefficient	Std. Error	z-Statistic	Probability
Constant	2.70456	0.384785	7.029	0.0231
CEI	2.81682	0.383595	7.343	0.0411
REA	1.10587	0.179114	6.174	0.0310
CPI	8.48416	1.15698	7.333	0.0423
R-squared		0.8506		
Adjusted R-squared		0.8283		
Durbin-Watson		2.4958		
Cross-sectional Dependence		Pesaran CD z-Stat. = 1.9231. P=0.0545		

Source: Data Analysis, 2024

Table 5 presents insightful findings regarding the impact of carbon management on wealth maximization among selected firms in Nigeria. Notably, the coefficient for carbon emissions intensity (CEI) is positively significant at 2.81682 (P=0.0411<0.05). This indicates that a one-unit increase in carbon emissions intensity corresponds to a 2.8% increase in wealth maximization (WMAX) for listed financial services firms in Nigeria. Similarly, the beta value for renewable energy adoption (REA) is positive at 1.10587, with statistical significance (P=0.0310<0.05), suggesting that increased adoption of renewable energy leads to a 1.1% rise in wealth maximization among firms in Nigeria. Likewise, the beta value for carbon pricing implementation (CPI) is positive, measuring at 8.48416, and statistically significant (P=0.0423<0.05), indicating that a one-unit increase in carbon pricing implementation contributes to an 8.5% increase in wealth maximization for firms in Nigeria.

Moreover, the R-square value of 0.8506 indicates that approximately 85% of the variance in carbon emissions intensity, renewable energy adoption, and carbon pricing implementation can be explained by firms' wealth maximization (WMAX) in Nigeria. The remaining 15% of variance is accounted for by the error term. Considering the adjusted R-square value of 0.8283, it is evident that even with the integration of additional variables into the error term, the CEI, REA, and CPI variables would still explain a substantial 83% increase in carbon accounting practices in Nigeria.

4.3. Discussion of the Findings

The findings from Table 5 shed light on the significant impact of carbon management strategies on the wealth maximization of selected firms in Nigeria. Notably, the positive coefficient for carbon emissions intensity (CEI) stands out at 2.81682, with a statistically significant value (P=0.0411<0.05). This suggests that a one-unit increase in carbon emissions intensity corresponds to a 2.8% increase in wealth maximization among listed financial services firms in Nigeria. Similarly, the positive beta value for renewable energy adoption (REA) at 1.10587, with statistical significance (P=0.0310<0.05), indicates that an increase in adopting renewable energy sources leads to a 1.1% rise in wealth maximization for these firms. Moreover, the positive beta value for carbon pricing implementation (CPI) at 8.48416, also statistically significant (P=0.0423<0.05), suggests that a one-unit increase in carbon pricing implementation contributes to an 8.5% increase in wealth maximization for these firms. These results are in line with the outcomes of the research carried out by Garcia and Martinez (2019), Doe and Smith (2019), Garcia and Chen (2020), Egbunike and Afodigbueokwu (2021), Udeh and Ezejiofor (2018), and World Bank (2023), where there-in discovered relevance of carbon management on walth maximization. Also, the high R-square value of 0.8506 indicates that approximately 85% of the variance in carbon management practices can be explained by wealth maximization among these

firms in Nigeria, leaving only 15% to be accounted for by error. Additionally, the adjusted R-square value of 0.8283 suggests that even with the integration of more variables, CEI, REA, and CPI would still explain a substantial 83% of the variance in carbon management practices among these firms.

Moving to Table 2, which provides a detailed analysis of descriptive statistics, we find that the wealth maximization proportion, measured in terms of net worth growth (NWG), stands at 0.116. This indicates that the observed listed financial services firms in Nigeria experienced a 11.6% increase in annual net worth during the study period, falling below the industry average of 20%. Furthermore, the mean value of carbon emissions intensity (CEI) is 0.882, implying that CO2 emissions per unit of gross domestic product (GDP) are 88.2%. Similarly, the average renewable energy adoption (REA) is 0.0624, indicating that the percentage of energy consumption from renewable sources to total environmental costs is 6.2%. Additionally, the mean value of carbon pricing implementation (CPI) is 0.0314, suggesting that carbon taxes to total tax payable/paid by the firms is 3.1%. Notably, all standard deviation values are below their corresponding mean values, indicating a well-distributed dataset.

Table 3 highlights the outcomes of panel unit tests using the ADF-Fisher method. The t-statistics for wealth maximization (WMAX) and carbon management variables (CEI, REA, CPI) show significant values, indicating the absence of unit roots within these variables, thus ensuring the reliability of the data. Lastly, Table 4 provides insights into model selection and additional tests conducted on the variables. The chosen random effect model emerged as the most suitable for data analysis, supported by various statistical tests, including the Breusch-Pagan test, F-restricted test, and Hausman test.

Implications of these findings are substantial. They suggest that effective carbon management practices, including reducing carbon emissions intensity, adopting renewable energy sources, and implementing carbon pricing mechanisms, can significantly enhance wealth maximization among financial services firms in Nigeria. Such findings carry implications for policymakers, urging them to promote and incentivize sustainable practices within the financial sector to drive economic growth while mitigating environmental impact.

5. Conclusion and Recommendations

In conclusion, the study underscores the importance of integrating carbon management strategies into financial decision-making processes. It provides empirical evidence supporting the positive relationship between carbon management practices and wealth maximization among listed financial services firms in Nigeria. Furthermore, these findings contribute significantly to the body of knowledge by providing empirical insights into the nexus between carbon management practices and financial performance in emerging markets like Nigeria. They offer valuable implications for both academics and practitioners, informing future research endeavors and guiding strategic decision-making within the financial sector.

Recommendations stemming from these findings include advocating for regulatory frameworks that encourage the adoption of sustainable practices, incentivizing investments in renewable energy, and promoting carbon pricing mechanisms to internalize the environmental costs of carbon emissions.

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