



Effect of Carbon Emissions and Financial Performance of Nigerian Oil and Gas Firms

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ABSTRACT

The study examined the effect of carbon emission on financial performance of oil and gas manufacturing firms in Nigeria. *Ex Post Facto* research design was adopted for the study. A sample of seven (7) oil and gas firms was selected for the study using purposive sampling technique. Regression analysis was employed to test the hypotheses. From the analysis, the study discovered that emissions disclosure has a statistically significant effect on returns on equity (ROE) of oil and gas firms in Nigeria. The study also confirms that environmental disclosure index has a statistically significant effect on return on equity (ROE) oil and gas firms in Nigeria. Based on these findings, the study recommended thus that consumers and shareholders are advised to take the ethical stand and boycott products or shares of non-green companies.

Keywords: Carbon emission disclosure, Environmental disclosure index and financial performance

Introduction

Although developed countries are mainly responsible for the increase in the atmospheric carbon stock, developing countries are gradually emerging as major polluters. Recently, emerging economies such as Brazil, Russia, India and China (the BRICs) have experienced rapid growth in GDP growth due to increased productivity and increased economic activity, requiring huge energy inputs to support the increasing economic growth (Mohammad, Rashedul & Mohammed, 2023). On the other hand, structural changes in the economy and GDP growth accelerated urbanization. Together, these effects lead to higher carbon dioxide emissions into the atmosphere (Appiah, Yeboah, & Appiah, 2019; Sadorsky, 2014). A report published by the International Energy Agency (2020) shows those emissions from advanced economies decreased by 10% in 2020 compared to 2019, mainly due to disruptive economic activity caused by the COVID-19 pandemic. However, the emissions of countries with developing economies decreased by only 4% on average in the same period. China, currently the largest emitter of carbon dioxide, experienced an increase in emissions in 2020 and the first two quarters of 2021 (Carbon Brief, 2021; Wen, Wu, & Gong, 2020). This means that the achievement of the emission reduction target depends to a large extent on the carbon dioxide reduction strategies of emerging market economies.

The first international response to climate change was seen in 1992 when several countries joined the United Nations Framework Convention on Climate Change. The framework envisioned international cooperation to fight climate change and study its effects. Several years later, the Kyoto Protocol was adopted, under which more than 150 countries committed to reducing carbon dioxide (CO₂) emissions (Ratnatunga and Balachandran, 2009). The first commitment period of the Protocol began in 2008 and ended in 2012; and the second started from January 1, 2013 to 2020 (Global Reporting Initiative, 2016). Carbon management has emerged in the business world to enable organizations to strategically respond to climate change and move to lower carbon business models (Alrazi, de Villiers, & van Staden, 2015). Concepts such as the carbon footprint model have been developed to measure the impact (in CO₂ equivalents) of a product, service or organization on climate change (Boguski, 2010; Musanighe, 2010). Carbon reporting has also evolved from the broader spectrum of environmental accounting (Stechemesser and Guenther, 2012) as a strategic response to increased investment transparency (PriceWaterhouseCoopers, 2012). Both fields encompass and touch almost all aspects of human life and values, which require organizations, individuals and societies to change their production procedures, consumption patterns and lifestyles (Levy and Egan, 2003; Giddens, 2009). It is estimated that total carbon dioxide emissions must be reduced significantly and rapidly if the growing environmental, social and economic threats associated with climate change are to be halted (Cadez and Guilding, 2017).

Volberda, Van Der Weerd, Verwall, Stienstra, and Verdu (2012) argue that better company performance can only be achieved by matching the company structure and the external environment in which the company operates. Therefore, firms should consider climate change and climate change strategies to gain competitive advantage and improve market performance (Lee, 2012a).

Incorporating carbon management into traditional decision-making and reporting processes has done little to reduce the lack of research focusing on carbon accounting (Delmas, Nairn-Birch, & Lim, 2015; Hartmann, Perego, & Young, 2013; Hopwood, 2009). The study identified four gaps in the review

of related literature. First, few studies have used accounting and market-based measures to systematically test the hypothesis between GHG disclosure and financial performance. Previous studies have focused on one dimension of firm financial performance, and none of them have examined the two dimensions of firm financial performance, accounting performance and marketing performance. Addressing the methodological approach used in previous studies, the relationships between corporate social performance and corporate financial performance were thoroughly analyzed using three methodological approaches, which are case studies, portfolio analysis and econometric approaches (Busch and Hoffmann, 2011). The first two approaches are limited in practicality in developing countries, partly due to the nature of disclosure, which is generally ad hoc for non-binding information. A huge amount of corporate governance literature focuses on, among other things, the presence of an audit committee, remuneration and remuneration committee, and risk management committee. There is little evidence of a link between the Carbon Management Committee and GHG emissions reporting. The purpose of the research is therefore to fill the perceived gaps when looking at the impact of carbon management accounting on the organizational performance of manufacturing companies in the oil and gas sector. Against this background, this study examines the impact of carbon emissions management on the financial performance of oil and gas companies in Nigeria. The aim of the research was mainly:

- i. *Examine the effect of Emissions disclosure on returns on equity (ROE) of oil and gas firms in Nigeria.*
- ii. *Investigate the effect of Environmental disclosure index on return on equity (ROE) oil and gas firms in Nigeria.*

Conceptual Framework

Environmental disclosure index

The existence of environmental committees responsible for carbon dioxide issues at the board level indicates that the company has an active strategic stance in carbon dioxide management (Michelon and Parbonetti, 2012). Such committees typically guide the implementation of environmental management systems (EMS) to facilitate communication with external stakeholders (Malmborg, 2002). Another reason for the inclusion of environmental commissions in boards is that environmental commissions are much more suitable to respond to institutional pressures to reduce carbon emissions (Berrone and Gomez-Mejia, 2009). An environmental committee can also increase employees' awareness of the environmental aspects of their work and their responsibility to reduce negative impacts (Liao, Luo, & Tang, 2014). On the other hand, Peters and Romi (2012) found that the existence of an environmental committee and a chief sustainability officer (CSO) is positively related to the probability of risk disclosure and the quality of disclosure. Additional analyses show that the expertise of environmental committee members and NGOs is associated with GHG disclosure quality, while larger committees tend to be associated with lower disclosure quality. Climate change affects the operational and financial results of companies (Wittneben and Kiyar, 2009). Studies by Griffin and Sun (2012), Ziegler, Busch, and Hoffmann (2011) found a positive relationship between disclosure of carbon reduction initiatives and climate change information on stock development.

Greater awareness of climate change and environmental sustainability presupposes a low-carbon economy. The importance of reducing carbon dioxide (CO₂) emissions has been emphasized following recent initiatives such as the 26th United Nations Climate Change Conference (COP26), 1 the Paris Climate Change Act, 2 the Energy Code, 3 (Shahzad, Raazia, Sabeeh, Abdul, Muhammad, 2023). During COP26, participants agreed that money is an essential tool to achieve these goals. However, the transition to carbon neutrality and environmental sustainability is impossible without improving financial services, resources and markets (Zhao and Yang, 2023). However, financial and economic development should be well aligned with the goals of sustainable development; otherwise it can increase carbon dioxide emissions and environmental pollution (Sharif, Raza, Ozturk & Afshan, 2019).

Research has been done on the factors affecting economic efficiency. Among them, Dasuki (2016) in Turkey reported that long-term debt and total debt have significant negative effects on financial performance of ROA, while they were statistically insignificant of ROE. Mirza and Javed (2013) in Pakistan showed that debt-equity ratio has a positive effect on earnings, while long-term debt to total assets and short-term debt have a negative effect on firm earnings. Onaolapo and Kajola (2010) in Nigeria found that debt capital structure had a significant negative impact on a company's financial measures in terms of return on investment and return on equity. Return on equity (ROE) is a measure of profitability defined as the ratio of net income to equity. Studies have shown differential effects of reporting greenhouse gas (GHG) emissions on ROE. A study by Mildawat, Agustia and Soewarno (2018) using a sample of 266 Indonesian companies found a positive effect of a proactive and responsive climate change strategy on ROE. However, other studies such as Busch and Hoffmann (2011) using companies listed in the Dow Jones Global Index and the OLS procedure showed an insignificant effect of carbon intensity (output-based CEP) on ROE.

Empirical review

Shahzad, Raazia, Sabeeh, Abdul, and Muhammad (2023) ascertained the relationship between carbon dioxide emissions and economic inclusion in a panel of 74 countries from 2004 to 2020 based on the Environmental Kuznets Curve (EKC). Using the Driscoll-Kraay advanced panel analysis framework, a general linear model, and the Prais-Winsten test for the full sample and heterogeneous subsamples; we document an inverted U-shaped relationship between carbon emissions and the comprehensive financial system. In particular, an inverted U-shaped relationship develops in developed, emerging and frontier economies, except in independent economies. Furthermore, analysis of regional subsamples shows that the non-linear relationship varies between regions. The heterogeneous response of economic inclusion to curbing environmental pollution offers important policy insights. Mohammad, Rashedul and Mohammed (2023) determined the impact of carbon dioxide emissions on accounting and market-based operations of financial and non-financial firms in developing countries. The Dataflow database collected data on 104 financial and 328 non-financial companies from 2011 to 2020, representing 2,591 observations in 22 emerging economies. We used OLS and 2SLS regression techniques to analyze the data. The results show that financial firms

emit less carbon dioxide than their non-financial counterparts. The results also show that carbon dioxide emissions reduce companies' return on equity, Tobin's Q and Z scores, and credit ratings. Robin, Rytis and Wim (2021) examine the relationship between carbon reduction and firm financial performance (CFP) using a cross-country dataset of 9,265 observations of 1,785 firms in 53 countries between 2004 and 2019. The study used OLS regressions with fixed effects. The study found that reducing carbon emissions increases return on assets, return on equity and sales revenue, but has no effect on Tobin's Q and the flow ratio. The positive relationship with return on assets is stronger in companies with higher liability scores. Their results show that a country's carbon dioxide emissions and the presence of carbon dioxide emission legislation are related to both corporate carbon reduction and the CFP. Aggregate country emission reduction effects and the presence of carbon dioxide emission legislation do not affect the relationship between carbon dioxide reduction and GDP. Arjan, Machiel and Bert (2020) examine the impact of carbon efficiency on various financial outcomes. Using an international sample of 1,572 companies between 2009 and 2017, we find excellent financial performance for low-carbon companies (best practices). On average, 0.1 higher carbon efficiency is associated with 1.0% higher profitability and 0.6% lower systemic risk. Although carbon efficiency is closely related to resource efficiency, it also has clear economic implications, especially reducing systemic risk. Taken together, the findings suggest that carbon efficient production can be valuable from both operational and risk management perspectives. Mildawati, Agustia, and Soewarno (2018) investigated the impact of climate change strategy on firm performance and the role of climate change information broker in Indonesia. The sample included 266 company years from the Indonesia Stock Exchange from 2010 to 2016. The study was based on secondary data obtained from annual reports, sustainability reports and company websites. The results showed that both proactive and reactive climate change strategies have a positive effect on firm performance (ROA, ROE and Tobin's Q), secondly, climate change strategy has a positive effect on climate change disclosure and thirdly, climate change information. it has a positive effect on the company's profits. Finally, climate change communication mediated the impact of climate change strategy on firm performance. Egbunike and Emudainohwo (2017) investigated the role of carbon accounting in corporate governance systems in Nigeria. The study used a descriptive survey and follow-up survey design. The research was based on both primary and secondary sources. Primary data were obtained from questionnaires given to auditors; secondary data was obtained from annual reports. Hypotheses were tested using t-test and OLS regression. The results showed that carbon disclosure had a negative and significant effect on ROE; while the second hypothesis asserted that auditors have a role in establishing a company's carbon management system. Rokhmawati, Gunardi and Rossi (2017) examine the impact of greenhouse gas (GHG) emissions on return on sales (ROS) moderated by customer response to specific measures to reduce greenhouse gas emissions in Indonesia. The final sample consisted of 102 listed industrial companies from 2010 and 2011. The study was based on secondary data from 2011 and 2014 financial statements. The study used moderated regression with cross-sectional data to analyze the data. The results showed that CO₂e intensity had a significant positive effect on ROS. Customer responses to GHG mitigation measures had a positive and significant impact on ROS. Finally, customer responses confirm the impact of CO₂e intensity on ROS. Liu, Zhou, Yang, and Hoepner (2016) examine the relationship between corporate carbon emissions and UK financial performance. The sample included 62 FTSE 100 companies between 2010 and 2012. They use secondary data from annual reports and separate CSR reports. Data were analyzed using mediational path analysis and structural equation modeling. The results showed that carbon dioxide emissions are negatively related to financial performance; However, it is positively related to the level of carbon dioxide emissions (higher carbon dioxide emissions result in more disclosure), which is significantly and positively related to economic results (more carbon dioxide disclosure leads to an increase in company stock returns). Gatimbu and Wabwire (2016) investigated the impact of corporate environmental disclosures on the financial performance of Kenyan firms. The study used a randomized survey design to determine the cause-effect relationship between corporate environmental disclosure and financial performance. The sample included 32 companies listed on the Nairobi Stock Exchange. The research was based on secondary data from annual reports and financial statements of listed companies. Data were analyzed using content analysis and linear regression models. The results showed that firm size and financial leverage had a positive but non-significant effect on environmental information. Also, that there was a significant difference in the average economic performance of companies with a high or low environmental rating. Delmas, Nairn-Birch, and Lim (2015) examine the relationship between environmental (GHG) and economic performance in the United States. They used longitudinal data from 1,095 US firms from 2004 to 2008. They examine the impact of corporate environmentalism on economic performance in the early stages of climate change policy, characterized by high legislative and regulatory uncertainty. The results showed that GHG emissions have a positive and significant effect on ROA; but they have a negative effect on Tobin's q. Rahman, Rasid and Basiruddin (2014) investigated the relationship between carbon emissions, carbon reporting and firm performance in Malaysia. The sample was taken from manufacturing companies listed on the board of Bursa Malaysia. The study was based on 2007-2012. On secondary data obtained from the financial statements of the year. The results confirm fact that there is a relationship between carbon emissions, carbon reporting and company performance. The study also reports a moderating effect of corporate governance quality on the relationship between carbon reporting and corporate performance. Luo and Tang (2014) investigate whether voluntary reporting of carbon emissions reflects firms' actual carbon emissions. The level of carbon footprint was measured based on the content analysis of Carbon Disclosure Project (CDP) reports, and the carbon emission index focused on both the carbon intensity of emissions and carbon reduction. They used an OLS regression model to analyze the data. Based on a sample of 474 observations from companies in the US, UK and Australia, the results showed a significant positive relationship between carbon reporting and performance, suggesting that companies' voluntary carbon reporting in the CDP reflects their actual carbon emissions. . Saka and Oshika (2014) investigated the effect of corporate carbon emissions and disclosures on firm value for Japanese firms that reported carbon emissions in 2006, 2007, and 2008. They used corporate CDP survey responses instead of carbon management disclosures. While carbon dioxide emissions were measured by the amount of carbon dioxide emissions per unit of sales during that period. Based on findings from 1,094 firms responding to the CDP survey and OLS regression analysis, they found that carbon emissions are negatively related to market value of equity, while carbon management disclosure is positively related to market value. of equity, and the positive relationship between carbon management disclosure and market value of equity is stronger for high-carbon firms. Hassan and Kouhy (2014) examine the relationship between environmental disclosure and performance in the Nigerian oil and gas industry. First, they examine the relationship between environmental protection of gas and its volume data to provide empirical evidence of vulnerability. Secondly, the relationship between environmental protection and disclosure of gas flaring to provide empirical support for usability. The study population and sample were 11 oil and gas companies. Content analysis was used to measure the content and volume of disclosure. An envelope analysis model based on the mathematical technique

of linear programming is used to measure carbon emissions. The results show a significant negative relationship between disclosure content and performance. Amran, Periasamy, and Zulkafli (2014) investigated some common factors between company attributes and governing variables and whether they have a relationship with climate change strategy reporting. They studied companies operating in 10 industrial sectors in 13 developed countries and emerging countries in Asia Pacific. The study uses content analysis to construct weighted and un-weighted disclosure indices. Several variables, namely, firm size, industrial membership, country of domicile, environment certification, board size, independent non-executives, the CEO duality structure and gender were selected and their influence on the level of climate change disclosure was tested empirically. The results revealed that by increasing the proportion of independent non-executives on the board of directors, encouragement of firms' practice to separate the CEO-board chair role, and firm practices in obtaining and maintaining environment certification would directly increase the climate change disclosure in their sustainability reports. Matsumura, Prakash, and Vera-Muñoz (2013) find a significantly negative relationship between carbon emissions and firm value using carbon emissions data from a sample of S and P 500 firms. They collected data on the carbon emissions of S and P companies from CDP questionnaires and used the market value of equity to measure the value of the company. They find that, on average, for every thousand new tons of carbon dioxide, the value of the company decreases by 212,000 USD, while the average emission of the tested companies is 1.07 million tons. They also examine the impact of managers' carbon decisions on firm value. They find that the median of firms that disclose their carbon emissions is about \$2.3 billion higher than their non-disclosing counterparts. Luo, Lan, and Tang (2012) investigate how Global 500 firms respond to climate change in terms of their carbon strategies. They consider the influence of social, financial market, economic, regulatory and institutional factors on the motivation to voluntarily participate in the 2009 Carbon Disclosure Project. They find that financial pressure is significantly related to the decision. Companies in greenhouse gas-intensive sectors have the same tendency. In addition, large companies have a greater propensity to go public, suggesting that social pressure plays an important role. Overall, it appears that the main driver of climate change disclosure is the public and government rather than other important stakeholders such as shareholders and debt holders. Clarkson, Li, Richardson, and Vasvari (2011) seek insight into the question "is it worth being green?" The sample included 242 companies from the four most polluting industries in the United States between 1990 and 2003. The level of environmental protection of a company was measured using a toxic emissions inventory per pound of cost of goods sold. The results showed that companies with better environmental performance benefit from Tobin's Q, profitability, liquidity and sales growth in subsequent periods.

METHODOLOGY

Research Design

The study adopted a retrospective research design. It includes events that have already happened in the past. As part of the design of the following study, the researcher adopted a cross-sectional and time-series analysis of the financial statements of manufacturing companies listed on the Nigerian Exchange Group (NGX). The base population of the study is the listed industrial companies of the Nigerian Exchange Group (NGX) in the financial year 2023. According to the Nigerian Exchange Group, the number of companies from different sectors that make up the study is 12. The study was limited to seven oil and gas companies selected using a purposive sampling method; The decision was based on the classification of companies as oil and gas companies (based on the nature and description of operations) as seen on the Nigerian Exchange Group (NGX) website. These companies are; Ardova Plc (Forte Oil), Conoil, Eternal oil, Japaul Gold and Ventures Plc, MRS (Texaco Chevron), Oando and TotalEnergies Marketing Nigeria.

Sources of information

The information in this study is taken from secondary sources. Secondary data is data or information that has been previously collected and stored for other purposes. The information is collected from the annual reports and accounts of companies. In particular, the financial position and the statement of comprehensive income provide information for the calculation of the selected ratios; and statement of cash flows.

Data analysis method

The study used both descriptive and inferential statistical techniques to analyze the data under study. The following descriptive statistics were calculated such as mean, median, standard deviation, minimum and maximum values, and skew-kurtosis statistics, etc. A correlation matrix was also constructed to identify the correlation between the dependent and independent variables. Finally, fixed or random effect and pooled OLS regression were used to test the hypotheses. Considering the dependent, independent and control variables of the study, the following model was developed to examine the relationship between Carbon emission management and performance of selected oil and gas companies in Nigeria. This approach is consistent with Hair, Black, Babin, Anderson, and Tatham (2006).

$$ROE = f(EMD, EDI, FLEV) \dots \dots \dots i$$

Equations 1-2 can be written econometrically as presented in equations 3-4 as follows:

$$ROE_{(i,t)} = \alpha_{(1)} + EMD_{(1)} + EDI_{(2)} + FLEV_{(3)} + \mu \dots \dots \dots ii$$

Where:

ROE = Returns on equity
EMD = Emission disclosure

EDI	=	Environmental disclosure index
FLEV	=	Firm leverage
t	=	Time dimension of the variables
η_0	=	Constant or Intercept.
η_{1-2}	=	Coefficients to be estimated or the Coefficients of slope parameters.

The expected signs of the coefficients (a priori expectations) are such that $\eta_2, \eta_3 > 0$; while, η_1 , and $\eta_4 < 0$

Decision rule

The decision rule is based on the sign and significance of the computed *t*-statistic from the regression output. The level of significance was set at $p < 0.05$. Hence, if the *p* value of the *t* statistic < 0.05 (the chosen alpha level) the null hypothesis is rejected; and the variable is postulated to have a significant effect.

DATA ANALYSIS

Descriptive Statistics

Table 1: Descriptive statistics of variables employed in the study

	ROE	EMD	EDI	LEVERAGE
Mean	-5.014231	0.012821	0.022949	3.458077
Median	6.870000	0.000000	0.000000	2.300000
Maximum	872.2000	1.000000	0.630000	47.35000
Minimum	-1099.680	0.000000	0.000000	-1.990000
Std. Dev.	169.8445	0.113228	0.083481	5.914821
Skewness	-1.887097	8.661004	5.463162	5.705229
Kurtosis	32.46773	76.01299	37.75811	40.92486
Jarque-Bera	2868.423	18300.58	4314.411	5097.605
Probability	0.000000	0.000000	0.000000	0.000000
Sum	-391.1100	1.000000	1.790000	269.7300
Sum Sq. Dev.	2221230.	0.987179	0.536622	2693.853
Observations	78	78	78	78

Source: E-Views 9.0

The observation row shows the number of cases included in the analysis of each study variable, seventy-eight for both dependent and independent variables. From the table above, the average of each variable shows the average trend, which represents the average of the variables; while the standard deviation is a measure of the average distance between the values of a data set and the mean. A small standard deviation (SD1) indicates that the data points are spread over a large range of values. A large standard deviation indicates bias and outliers in a data set.

Summary statistics also describe the skewness and kurtosis of all variables, which indicates the normality of the data. The skewness and kurtosis threshold asserts that values between -2 and 2 and -7 and 7 are represented by a normal distribution. The skewness and kurtosis values therefore indicate that the independent variables are fairly normally distributed when clustered towards the center and are also peaked.

Correlation Matrix

Table 2: Covariance and Correlation analysis of variables

	ROE	EDI	EMD	LEVERAGE
ROE	1.000000	-0.090801	0.030750	-0.722446
EDI	**	1.000000	0.834052	0.121608
EMD	**	**	1.000000	0.010897
LEVERAGE	**	**	**	1.000000

Source: E-views, ver. 9.0 *Significant @ 5%

Correlation analysis reveals the nature of the relationship between the variables used in the study. The correlation matrix also showed the absence of multicollinearity, since none of the independent variables (EMD, EDI) and the control variable showed a perfect correlation. This supports the unbiased inclusion of all independent and control variables in the model developed for the study. Another interesting insight into the correlation matrix is the relationship between ROE and EDI and EMD. However, the result showed a negative relationship between return on equity and the environmental

information index. This negative relationship is said to be due to the huge environmental management costs of the oil industry, which greatly affect corporate profits.

Test of Hypotheses

Hypothesis One

H₀₁: Emissions disclosure has no statistically significant effect on returns on equity (ROE) of oil and gas firms in Nigeria.

Table 3: Random Effect Regression

Dependent Variable: ROE
 Method: Panel Least Squares
 Date: 03/27/23 Time: 21:30
 Sample: 2012 2021
 Periods included: 10
 Cross-sections included: 8
 Total panel (unbalanced) observations: 78

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-22.54942	73.32737	-0.307517	0.7596
EMD	230.8169	292.0811	0.790249	0.0043
EDI	-360.6223	414.2032	-0.870641	0.0038
LEVERAGE	-21.94281	2.955205	-7.425138	0.0000

Effects Specification

Cross-section fixed (dummy variables)			
Period fixed (dummy variables)			
R-squared	0.610920	Mean dependent var	-5.014231
Adjusted R-squared	0.474400	S.D. dependent var	169.8445
S.E. of regression	123.1343	Akaike info criterion	12.68923
Sum squared resid	864236.9	Schwarz criterion	13.32373
Log likelihood	-473.8800	Hannan-Quinn criter.	12.94323
F-statistic	4.474964	Durbin-Watson stat	2.246885
Prob(F-statistic)	0.000004		

Source: E-views 9.0

The table 3 revealed results specifically for emission disclosure (EMD) which is the variable of interest for hypothesis three regressed against return on equity (ROE). The *coefficient* of the variable of interest: ROE was (230.8169) and *t-statistic* (0.790249) positive and statistically significant as P-value = 0.0043 (*p*-value < 0.05). Therefore, the null hypothesis is rejected and alternate, accepted. The study therefore concludes that Emissions disclosure has a statistically significant effect on returns on equity (ROE) of oil and gas firms in Nigeria.

Hypothesis Two

H₀₂: Environmental disclosure index has no statistically significant effect on return on equity (ROE) oil and gas firms in Nigeria.

Table 4: Random Effect Regression

Dependent Variable: ROE
 Method: Panel Least Squares
 Date: 03/27/23 Time: 21:30
 Sample: 2012 2021
 Periods included: 10
 Cross-sections included: 8
 Total panel (unbalanced) observations: 78

Variable	Coefficient	Std. Error	t-Statistic	Prob.
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LEVERAGE	-21.94281	2.955205	-7.425138	0.0000

Effects Specification

Cross-section fixed (dummy variables)			
Period fixed (dummy variables)			
R-squared	0.610920	Mean dependent var	-5.014231
Adjusted R-squared	0.474400	S.D. dependent var	169.8445
S.E. of regression	123.1343	Akaike info criterion	12.68923
Sum squared resid	864236.9	Schwarz criterion	13.32373
Log likelihood	-473.8800	Hannan-Quinn criter.	12.94323
F-statistic	4.474964	Durbin-Watson stat	2.246885
Prob(F-statistic)	0.000004		

Source: E-views 9.0

From Table 4, the following were considered in model validation: F-statistics and overall R² were used. The total R-squared is 0.6109 and the adjusted R-squared is 0.4744. The p-value of the F-statistic is (0.000004). That is, below 0.05, that confirms the statistical significance of the model. Additionally, Durbin-Watson showed a value of 2.2. Therefore, we conclude that our model one is completely free of autocorrelation. In particular, the four variables of interest in the hypothesis are EDI. The coefficient of the variable of interest: EDI was (-360.6223) and the t-statistic (-0.8706) was negative and statistically significant as P-value = 0.0038 (p-value < 0.05). Therefore, the null hypothesis is rejected and the alternative is accepted. Thus, we conclude that the environmental disclosure index has a statistically significant effect on the return on equity (ROE) of oil and gas companies in Nigeria.

DISCUSSION AND CONCLUSION

The study examines the accounting and carbon management performance of listed oil and gas companies in Nigeria. An Ex Post Facto investigation plan was launched. The study was limited to seven oil and gas companies that were selected using a purposive sampling method. Regression analysis was used to test the hypotheses. Based on the analysis, the study found that emissions disclosure has a statistically significant effect on the return on equity (ROE) of oil and gas companies in Nigeria. This is consistent with Busch and Hoffmann (2011), whose results showed that the effect of carbon intensity (output-based CEP) on ROE was not significant. Prado-Lorenzo, Rodríguez-Domínguez, Gallego-Alvarez, and García-Sánchez (2009) also found that ROE had a statistically insignificant negative effect on the GHG disclosure rate. A South African study by Ganda and Milondzo (2018) using a sample of 63 South African CDP companies found a negative significant relationship between ROE and ROI with carbon intensity (Scope 1); and a negative non-significant relationship of ROE, ROI and ROS with carbon emission intensity (scales 1 and 2) [ROE, ROI and ROS were negative but not significant for dirty industries]. The results are also consistent with the study by Egbunike and Emudainhwo (2017) using OLS for Nigeria, which showed that carbon disclosure had a significant negative impact on ROE.

Finally, the research hypothesis confirms that the environmental disclosure index has a statistically significant effect on the return on equity (ROE) of oil and gas companies in Nigeria. Similarly, a Malaysian study by Rahman, Rasid and Basiruddin (2014) reported a moderating effect of corporate governance quality on the relationship between carbon reporting and firm performance. This is consistent with Busch and Hoffmann (2011); Clarkson, Li, Richardson and Vasvari (2011) who discussed the relationship between carbon and financial performance.

Based on these results, the study makes the following recommendations:

1. Consumers and shareholders are encouraged to take an ethical stance and boycott the products or stocks of non-green companies.
2. Nigerian regulatory bodies e.g. SEC, NGX, CAC, FRCN etc., Should develop policies and frameworks consistent with the Kyoto Protocol to address issues relevant to the Nigerian situation such as global warming and carbon reporting by manufacturing companies.

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