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Financial performance and carbon emission disclosure

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Abstract

Purpose – This study aims to investigate the impact of financial performance on carbon emission disclosure.
Design/methodology/approach – The study uses ordinary least squares (OLS) multiple regression analysis on a sample of 177 Financial Times Stock Exchange 350 index (FTSE-350) non-financial firms to test the impact of market (Tobin's Q) and accounting (return on equity) financial performance indicators on carbon emission disclosure.
Findings – The results show that the financial performance market indicator has a significant positive impact on carbon emission disclosure. The accounting indicator illustrates similar results except for Scope 3, where the results are insignificant. This study may help firms understand how financial performance affects carbon emission disclosure, particularly by showing that high-performing firms are motivated to maintain strong environmental practices and enhance carbon emission awareness.
Originality/value – This paper enhances stakeholders' understanding of how firms' environmental policies align with their financial objectives, thereby expanding knowledge in carbon accounting.

Keywords Financial performance, Carbon accounting, Carbon emission disclosure
Paper type Research paper

1. Introduction

Firms are increasingly focused on reducing carbon emissions through environmental initiatives and reporting their corporate emissions through different channels due to the growing concern over climate change and ecological issues (Choi *et al.*, 2013; Tang and Luo, 2011). Reporting channels include the Carbon Disclosure Project (CDP) and annual company reports. Some governments have established mandatory carbon emission reporting systems (e.g. Japan), while others have voluntary systems (e.g. the UK). Businesses are now more aware of their environmental responsibilities towards the community before considering their profit maximization, owing to the huge impact of businesses on the environment. Moreover, companies are accountable for the environment, and they should reduce and disclose their carbon emissions and implement strategies to manage them.

Firms are now recognizing their environmental responsibilities and the need to balance profit maximization with sustainable practices (Hamdan, 2023). This awareness has led to a further focus on reducing carbon emissions and implementing comprehensive disclosure strategies. However, there remains a lack of consensus in the literature regarding the relationship between corporate environmental disclosure strategies, and financial performance (Bebbington and Larrinaga-González, 2008; Busch and Hoffmann, 2011; Burritt *et al.*, 2011; Clarkson *et al.*, 2011; Hartmann *et al.*, 2013; Matsumura *et al.*, 2014; Ooi *et al.*, 2018; Saka and Oshika, 2014; Cohen *et al.*, 2023). Consequently, the impact of financial performance on carbon emission disclosure remains an area of debate and insufficient understanding.

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This study aims to fill this gap by examining the impact of financial performance on the extent of carbon emission disclosure, considering both accounting and market indicators. Specifically, this study investigates the impact of financial performance on the level of carbon emission disclosure and carbon emission performance. The present study not only considers carbon disclosure but also encompasses all three scopes of carbon emissions performance (Scope 1, Scope 2, and Scope 3). Prior studies have not covered all three scopes in one paper. This research is particularly relevant to the UK business environment, where limited studies have explored these phenomena, except for Tahat and Mardini (2021). They investigated the impact of carbon emission disclosure on financial performance based on accounting indicators (return on assets (ROA) and return on equity (ROE)) for the period from 2015 to 2018. This study adopts a novel approach by examining whether financial performance significantly affects the level of carbon emission disclosure based on both accounting and market indicators (specifically Tobin's Q). Moreover, the present study extends the sample period from 2015 to 2022, enhancing the generalizability of its results within the carbon accounting literature.

Accordingly, this study contributes to the present literature on environmental accounting by linking financial performance with environmental disclosure schemes such as carbon emission disclosure. It provides empirical evidence supporting existing practice in environmental reporting, thereby enriching the practical discourse on these topics. This contribution is crucial for advancing our understanding of the interplay between firms' financial performance and their environmental stewardship. Furthermore, this research holds significant implications for policymakers, suggesting that increased regulatory scrutiny of high-emitting companies encourages better environmental practices. Additionally, the findings may motivate firms to enhance their voluntary environmental reporting. Specifically, the current study provides a rationale for companies to be more transparent about their environmental impact, thereby promoting greater environmental accountability. Finally, the inclusion of Tobin's Q as a financial performance market-based indicator highlights the role of market valuation in influencing environmental disclosure practices. This focus contributes to our knowledge that market perceptions and investor expectations may drive firms to be more transparent about their carbon emissions.

The remainder of this paper is structured as follows. Section 2 explains the theoretical framework and reviews the relevant literature. Section 3 describes the research design. Section 4 presents the results. Finally, Section 5 discusses these results in detail and provides conclusions.

2. Theoretical framework and literature review

2.1 Stakeholder theory

Stakeholder theory aims to align the interests of stakeholders (suppliers, investors, employees, competitors, communities, governments, and customers) and shareholders by creating as much value as possible for stakeholders. Shareholders thus need to consider any individual who influences or is influenced by the achievement of the firm's objectives and their associated consequences (Parmar *et al.*, 2010). This theory asserts that while firms operate to provide benefits for themselves, they must also provide benefits to stakeholders (Depoers *et al.*, 2016). Communities are also considered stakeholders, and their interest in the company is related to environmental considerations (Mardini and Lahyani, 2023). In other words, firms operate within a society and have a degree of accountability to achieve sustainable development by maximizing benefits and minimizing harmful effects (Ullmann, 1985). Given the increased expectations and pressure applied by stakeholders (Sullivan and Gouldson, 2012; Depoers *et al.*, 2016), companies are facing challenges to enhance climate change performance while achieving financial goals. The relationship between carbon

emission disclosure and financial performance can therefore be explained via the adoption of stakeholder theory.

2.2 Literature review and hypothesis development

Prior studies have investigated carbon emission issues using different dimensions. For example, Depoers *et al.* (2016) examined the consistency of greenhouse gas information disclosed voluntarily via firms' annual reports and CDP reports within the French business environment. These authors found that less greenhouse gas information was provided in the annual reports than in the CDP reports. In addition, within the French business environment, Mardini and Elleuch Lahyani (2022) found that carbon emission disclosure via CDP reports is significantly affected by the presence of foreign directors, suggesting that foreign directors ensure the adoption of sustainable carbon emission strategies. Furthermore, Kılıç and Kuzey (2019) examined the impact of corporate governance mechanisms on the carbon emission disclosure of Turkish listed firms. They found a positive significant impact of independent directors and foreign directors on carbon emission disclosure via CDP reports. They also considered that government regulations play a vital role in enhancing carbon emission practices. Utilizing a different research approach, Matisoff *et al.* (2013) used a longitudinal content analysis method to investigate the extent of indirect and other emission disclosure (Scopes 2 and 3 respectively) based on CDP reports for a worldwide sample. They found an increase in the disclosure level and transparency for Scope 2, with no major improvements for Scope 3. Prior studies employing CDP reports concluded that these reports are a trustworthy channel for determining accurate carbon emission disclosure.

In the context of the current study, the UK does not have a national mandatory emission-trading scheme (von Malmborg and Strachan, 2005; Tahat and Mardini, 2021). However, are under increasing pressure from stakeholders (i.e. investors, financial risk managers, insurance companies, suppliers, carbon traders, non-governmental organizations, and customers) to measure, monitor, and disclose their carbon emissions (Liesen *et al.*, 2015; Cohen *et al.*, 2023). Furthermore, drawing from the experience of other countries, investors in the UK recognize that companies with high levels of carbon emission and energy-intensive operations face risks from regulations driven by global climate change concerns. The primary goal of requiring firms to measure, disclose, monitor, and pay for their carbon emissions is to ultimately reduce the overall level of carbon emissions in the environment (Fornaro *et al.*, 2009). This is particularly relevant considering the UK's 2050 net-zero emission vision, which suggests that UK-listed firms will play a vital role in reducing carbon emissions and enhancing their carbon emission disclosure to contribute to achieving this vision, while simultaneously satisfying stakeholders' decision-making needs (Karim *et al.*, 2021). Hence, firms with high levels of carbon emissions will need to transition to less carbon-intensive technologies and processes, which will, in turn, further increase costs. Additionally, to comply with the proposed net-zero emission vision and respond to stakeholder pressure, even low-carbon emitters will incur costs for reporting and monitoring. Carbon emission has thus become an important element in analyzing a company's financial performance. From a theoretical perspective, firms that prioritize stakeholders' interests by addressing climate change concerns integrate climate-friendly practices into their operations and strategies (Lee, 2012; Sullivan and Gouldson, 2012). This focus on climate change performance enhances relationships with key stakeholders, subsequently leading to improved financial performance. The UK's 2050 net-zero emission target is one of the most ambitious global objectives. Consequently, firms must play a crucial role by effectively communicating sufficient carbon emission information to their stakeholders.

To the best of our knowledge, few studies have examined the effect of financial performance on carbon emission disclosure. Using Swiss data, Busch and Hoffmann (2011)

examined the relationship between carbon emission disclosure and financial performance, represented by accounting indicators (ROE and ROA). On the other hand, Saka and Oshika (2014) examined the impact of carbon emissions and the disclosure of carbon accounting on financial performance among over 100 Japanese firms, employing corporate value using market indicators (the market value of equity). Both studies found a negative relationship between carbon emission disclosure and financial performance. Moreover, Clarkson *et al.* (2011) found a positive relationship between environmental performance and financial performance using firm characteristics (cash flow, leverage, and profitability) and market-based indicators (R&D intensity, sales growth, and Tobin's Q) based on the four most polluting industries in the US. In addition, Ooi *et al.* (2018) examined the relationship between climate change performance disclosed in annual reports and corporate financial performance using both accounting (ROA and ROE) and market (Tobin's Q) indicators among Malaysian firms. They found that higher levels of climate change performance are linked to superior financial performance, especially in climate-sensitive industries. However, Salbiah and Mukhibad (2018) found that high carbon emission disclosure does not affect firms' profitability (measured using ROA). Using the Global Reporting Initiative's environmental aspects rather than CDP reports to measure carbon emission disclosure, Kurnia *et al.* (2020) investigated the mediating role of financial performance on the relationship between corporate governance mechanisms and carbon emissions, finding that financial performance significantly enhances this relationship. Recently, Hamdan (2023) investigated the causal relationship between economic indicators and environmental indicators such as CO2 emissions within the United Arab Emirates, discovering a negative correlation between CO2 emissions and economic indicators. He also found a continuous decline in the percentage of CO2 emissions over a 40-year sample period, attributing this decline to the implementation of environmental protection laws and the focus on environmental sustainability as the country developed.

Considering these findings in different countries and the increasing pressures and costs associated with measuring, disclosing, monitoring, and reducing carbon emissions, the present study examines the impact of financial performance using two different indicators (accounting-based and market-based) on carbon emission disclosure, as detailed in the CDP reports of FTSE-350 non-financial firms. Tobin's Q (a market-based indicator) is widely recognized as an indicator of intangible value (Clarkson *et al.*, 2011; Ooi *et al.*, 2018). Following prior studies, businesses that engage with climate change issues are more likely to use market-based indicators to measure corporate financial performance. Hence, the following hypothesis is proposed:

H1. There is a positive and significant impact of firm performance (Tobin's Q) on the level of carbon emission disclosure.

ROE has been widely used to measure financial performance based on accounting indicators (Busch and Hoffmann, 2011). Consequently, accounting-based indicators are beneficial in analyzing corporate financial performance and climate change issues. In alignment with prior studies, we hypothesize the following:

H2. There is a positive and significant impact of firm performance (ROE) on the level of carbon emission disclosure.

In summary, prior research has measured different aspects of carbon accounting to test the impact of firm value and a firm's financial performance in one or more countries, both in the financial and non-financial sectors. Examples of carbon accounting aspects are carbon emission disclosure scopes, corporate carbon disclosure, and carbon management disclosure and strategies (Busch and Hoffmann, 2007). Some prior studies have analyzed financial performance using accounting indicators, while others have used market indicators. To

extend the extant literature in this area, the present study uses both market and accounting indicators to measure the impact of financial performance on carbon emission disclosure.

3. Research design

The population of the study comprises FTSE-350 firms over a period of seven years (2015–2022). Seventy-four financial firms were excluded from the final sample. The main reason for incorporating only non-financial sectors only is that the carbon emission disclosure dimension studied does not apply to firms in the financial sector, such as banks. Specifically, non-financial sectors typically generate direct emissions from their operations or production processes, thereby making carbon disclosure more directly applicable and measurable; in contrast, financial institutions such as banks mainly emit carbon indirectly through their investments or financing activities, which can present greater complexity in measurement and disclosure processes (Luo *et al.*, 2012). Moreover, 99 non-financial firms were excluded due to a lack of CDP information and missing data. The sampling process, detailed in Table 1, resulted in a final sample of 177 non-financial firms. All dependent variables were primarily collected from the Eikon database, while most of the independent and control variables were gathered from Bloomberg. However, as not all datasets were available in Bloomberg, the researchers used the annual reports of the FTSE-350 non-financial firms to extract the unavailable data. Despite these efforts, some firms' data were still missing, so they were excluded from the final sample.

The climate is changing rapidly and noticeably, threatening ecosystems, economies, and communities, thereby putting many assets at risk. As a result, firms aim to reduce carbon emissions through various programs and report their corporate emissions through different channels like the CDP. The CDP, launched by an independent non-profit organization, puts carbon-related corporate information into the public domain (CDP, 2019). The CDP collects firms' climate change-related data and makes them available to the public and investors to assist in decision-making (CDP, 2019). The CDP metric is investor-oriented and follows a standardized format with carbon emission disclosures based on responses to the CDP questionnaire, facilitating communication between companies and investors. In addition, CDP scores help communicate companies' progress in addressing environmental issues and highlight areas where risks may not be well-controlled Carbon Disclosure Project (2019). Hence, the dependent variable used in the study is the carbon emission scores disclosed in the CDP report, serving as a proxy for carbon emission disclosure.

The independent variable used in this study is firm financial performance, measured using two indicators: a market-based indicator and an accounting-based indicator. The first independent variable is Tobin's Q, which indicates the expected performance of firms and is widely acknowledged as an indicator of intangible value (Busch and Hoffmann, 2011;

Panel A: FTSE-350	350 firms
- (Financial firms)	(74 firms)
- (Missing data)	(99 firms)
Final sample	177
Total of observations	177 × 8 years = 1416
Panel B: Final Sample Non-Financial FTSE-350 by sector	177 firms
Manufacturing and Mining	98
Services	79
Total of observations	177 × 8 years = 1416

Note(s): This table presents the procedure for obtaining the final sample
Source(s): Table created by authors

Table 1. The final sample process (2015–2022)

Ooi *et al.*, 2018). Therefore, Tobin's Q is used as one of the financial performance indicators in this study. For the accounting-based indicator, we use ROE to provide a more comprehensive analysis in determining the impact of financial performance on carbon emission disclosure. The ROE results indicate how well a company generates profit from its shareholders' investment. Moreover, we use ROE instead of ROA, as the latter includes debt values, while ROE does not. This choice ensures that the financial performance market indicator employed in the current study does not conflict with the leverage proxy employed (Ooi *et al.*, 2018).

The current study's variables are presented in Table 2, starting with the dependent variable, which is the carbon emission score disclosed in the CDP reports. The main independent variables are market and accounting-based indicators, namely Tobin's Q and ROE, respectively. Finally, the control variables include firm size, liquidity, leverage, and industry sector. These control variables enhance the analysis of the association between the dependent and independent variables.

The Breusch–Pagan test results for heteroscedasticity are 0.53 for carbon emission disclosure, 0.48 for Scope 1, 0.55 for Scope 2, and 0.61 for Scope 3, all significant at the 5% level. According to Wooldridge (2010), if the p-value is greater than 0.05, the model passes the test, allowing the use of ordinary least squares (OLS) regression to estimate the association between the independent variables and the dependent variables instead of fixed effect regression. The results show that OLS regression is appropriate for the current study. Hence, the following OLS multiple regression analysis models identify the relationship and coefficient of the financial performance variable based on the market indicator (Tobin's Q) and the control variables affecting carbon emission disclosure:

Variables	Symbols	Measurements	Nature of variables	Source
Carbon Emission Disclosure score	CEMIS	The percentage of the company's environmental disclosure in CDP	Dependent variable	Eikon
Emission Disclosure Scopes	SCP1 (Scope 1) SCP2 (Scope 2) SCP3 (Scope 3)	Scope 1 is measured by the percentage of disclosure about the direct carbon performance Scope 2 is measured by the percentage of disclosure about the indirect carbon performance Scope 3 is measured by the percentage of disclosure about the other indirect carbon performance		
Firm's Financial performance	FPERF (ROE) FPERF (TOBIN Q)	$\text{ROE} = \frac{\text{net income}}{\text{total shareholder's equity}}$ $\text{Tobin's Q} = \frac{\text{market value+debt}}{\text{total assets+debt}}$	Independent variables	Bloomberg
Firm size	FSIZE	Natural Log of (total assets)	Control variable	Bloomberg
Leverage	LEV	$\frac{\text{Total Debt}}{\text{total Equity}}$	Control variable	Bloomberg annual reports
Liquidity	LIQ	$\text{Current Ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$	Control variable	Bloomberg annual reports
Firm Sector	FSECT	Dummy variable, taking 1 when manufacturing and mining firms, and 2 for service sectors	Control variable	Bloomberg and annual reports

Table 2. Regression model variables

Note(s): This table presents the variables utilized in the current study
Source(s): Table created by authors

$$CEMIS = \alpha + \beta_1 FP\,(TOBINQ) + \beta_2 FSIZE + \beta_3 LEV + \beta_4 LIQ + \beta_5 FSECT + \varepsilon_i \quad (1)$$

$$SCP1 = \alpha + \beta_1 FP\,(TOBINQ) + \beta_2 FSIZE + \beta_3 LEV + \beta_4 LIQ + \beta_5 FSECT + \varepsilon_i \quad (1.1)$$

$$SCP2 = \alpha + \beta_1 FP\,(TOBINQ) + \beta_2 FSIZE + \beta_3 LEV + \beta_4 LIQ + \beta_5 FSECT + \varepsilon_i \quad (1.2)$$

$$SCP3 = \alpha + \beta_1 FP\,(TOBINQ) + \beta_2 FSIZE + \beta_3 LEV + \beta_4 LIQ + \beta_5 FSECT + \varepsilon_i \quad (1.3)$$

The following multiple regression analysis models identify the relationship and coefficient of the FP variable based on the accounting indicator (ROE) and control variables affecting carbon emission disclosure:

$$CEMIS = \alpha + \beta_1 FP\,(ROE) + \beta_2 FSIZE + \beta_3 LEV + \beta_4 LIQ + \beta_5 FSECT + \varepsilon_i \quad (2)$$

$$SCP1 = \alpha + \beta_1 FP\,(ROE) + \beta_2 FSIZE + \beta_3 LEV + \beta_4 LIQ + \beta_5 FSECT + \varepsilon_i \quad (2.1)$$

$$SCP2 = \alpha + \beta_1 FP\,(ROE) + \beta_2 FSIZE + \beta_3 LEV + \beta_4 LIQ + \beta_5 FSECT + \varepsilon_i \quad (2.2)$$

$$SCP3 = \alpha + \beta_1 FP\,(ROE) + \beta_2 FSIZE + \beta_3 LEV + \beta_4 LIQ + \beta_5 FSECT + \varepsilon_i \quad (2.3)$$

where: α is the intercept; β_1 is the regression model coefficients for the firm's financial performance variable in Eq. (1) using the market-based indicator and in Eq. (2) using the accounting-based indicator; and β_2, β_3, β_4, and β_5 are the control variables' coefficients.

4. Results

4.1 Descriptive statistics and correlation analysis

Table 3 provides insights into the findings of the descriptive statistics. Regarding the main dependent variables, the averages are 66.40% for CEMIS, 55.32% for Scope 1, 42.54% for Scope 2, and 40.5% for Scope 3 over the period 2015–2022. The overall carbon emission scores

Variable	Mean	StDev	Median	Minimum	Maximum
Dependent variables					
CEMIS	66.40	3.080	73.0	0.071	90.30
SCP1	55.32	73.34	49.16	0.112	77.20
SCP2	42.54	35.06	34.18	0.051	80.10
SCP3	40.5	40.68	35.41	0.000	85.10
Independent variables (Financial Performance)					
TOBINQ	2.741	3.136	2.640	0.000	6.550
ROE	29.900	128.45	20.44	−121.28	2107.65
Control variables					
FSIZE	3.3166	1.5661	3.0021	1.5054	5.4321
LIQ	1.5653	1.1250	1.3450	0.0721	19.1233
LEV	29.112	19.652	27.125	0.000	122.671
FSECT	Manufacturing and Mining is 98 firms and services is 79 firms Total Observations across the 7 years = 1,416				
				Count	*Percent*
			1	784	55.36
			2	632	44.63
				1,416	100%

Note(s): This table illustrates the descriptive statistics of the variables employed in the current study
Source(s): Table created by authors

Table 3.
Descriptive statistics

range from 7.1% to 90.3%. Regarding the independent variables, the variation in financial performance measures is sizable, especially for ROE. Moreover, there is a significant difference in company characteristics among the sample firms, with a significant gap between the lowest and highest values of each explanatory variable, and variation between the mean and the standard deviation values. These results are expected since the population of the study consists of FTSE-350 non-financial firms over seven years and various sectors (45% were from the services sector and 55% were from the manufacturing and mining sector).

Spearman's correlation coefficient results among the variables investigated are shown in Table 4. Across the dependent, independent, and control variables, the analysis results do not show very high correlations. Evans (1996) categorized the absolute correlation coefficients into five groups: 0.00–0.19 indicates a very weak correlation; 0.2–0.39 indicates a weak correlation; 0.4–0.59 indicates a moderate correlation; 0.6–0.79 indicates a strong correlation; and 0.8–1.0 indicates a very strong correlation. Table 4 indicates that all the correlation coefficients fall into the very weak and weak categories, suggesting a weak linear relationship between the dependent, independent, and control variables.

4.2 Regression analysis

Regarding the first independent variable, Tobin's Q results in Table 5 show statistically significant positive relationships at the 1% level with CEMIS and Scopes 1, 2, and 3. In other words, higher firm market-based financial performance (Tobin's Q) is associated with higher overall CEMIS and Scopes 1, 2, and 3 emissions, indicating that higher financial performance value is linked to lower emissions, supporting *H1*. These findings suggest that firms with better environmental practices, particularly in carbon emission disclosure and carbon emission performance, often demonstrate lower emissions along with higher financial performance within the market indicator. Consistent with these results, Clarkson *et al.* (2011) and Saka and Oshika (2014) found positive relationships between overall carbon disclosure

	CEMIS	SCP1	SCP2	SCP3	Tobin Q	ROE	FSIZE	LIQ	LEV
SCP1	−0.130								
	0.311								
SCP2	0.130	0.188							
	0.019	0.001							
SCP3	0.230	0.146	0.319						
	0.051	0.021	0.001						
Tobin Q	0.064	0.245	0.155	−0.062					
	0.064	0.000	0.031	0.037					
ROE	0.071	−0.098	0.082	0.043	0.336				
	0.013	0.096	0.001	0.010	0.000				
FSIZE	0.371	0.057	−0.241	0.163	0.276	−0.273			
	0.000	0.175	0.131	0.001	0.000	0.011			
LIQ	−0.146	−0.073	−0.013	−0.084	0.103	0.054	−0.129		
	0.211	0.049	0.137	0.131	0.017	0.151	0.031		
LEV	0.098	−0.119	0.119	0.041	0.086	0.130	0.071	−0.293	
	0.319	0.034	0.328	0.441	0.000	0.001	0.152	0.001	
FSECT	−0.057	−0.018	−0.037	0.022	−0.217	0.132	−0.017	−0.230	0.102
	0.251	0.545	0.377	0.369	0.131	0.311	0.435	0.120	0.018

Note(s): For each cell in the table, the first row presents the correlation values, and the second row presents the *p*-values

Source(s): Table created by authors

Table 4.
Pearson correlation

Variables	CEMIS Coef	CEMIS *p*-value	SCP1 Coef	SCP1 *p*-value	SCP2 Coef	SCP2 *p*-value	SCP3 Coef	SCP3 *p*-value	VIF
Constant	0.667	0.038	0.173	0.019	0.131	0.015	0.881	0.014	
TOBINQ	0.771	0.000	0.531	0.000	0.611	0.000	0.254	0.000	1.11
FSIZE	0.352	0.000	0.278	0.027	0.266	0.000	0.361	0.034	1.31
LIQ	0.511	0.412	0.641	0.031	0.143	0.312	0.123	0.451	1.15
LEV	−0.318	0.435	−0.242	0.340	−0.357	0.411	0.339	0.291	1.23
FSECT	0.367	0.000	0.295	0.000	−0.315	0.041	0.346	0.021	1.57
Adjusted R^2	37.11%		33.13%		31.44%		25.96%		
F-value	1.22	0.001	1.57	0.028	1.65	0.017	1.90	0.011	

Note(s): This table presents the regression results of the market indicator for each model
Source(s): Table created by authors

Table 5.
Regression results (market indicator)

and market-based indicators of financial performance at different significance levels. In addition, Ooi *et al.* (2018) found a significant positive relationship between climate change performance and financial performance.

The second independent variable, ROE, has been previously examined by Busch and Hoffmann (2011), who studied its relationship with CEMIS based on Swiss asset management firms and found a negative relationship. However, in the present study, Table 6 shows that ROE is statistically significant, with positive relationships at the 1% and 5% levels with CEMIS and Scopes 1 and 2 (an insignificant relation is shown with Scope 3). The specific results are a coefficient of 0.231 for the CEMIS score at the 1% significance level, a coefficient of 0.241 for Scope 1 at the 5% significance level, a coefficient of 0.253 for Scope 2 at a 5% significance level, and a coefficient of 0.243 for Scope 3 (insignificant level). These results indicate mixed positive associations between accounting-based financial performance and carbon emission, thus supporting *H2*. Based on the current study's findings, it is suggested that managers may strategically adopt carbon emission disclosure practices that align with the firm's financial goals. This strategic approach ensures that the carbon emission information serves the dual purpose of meeting stakeholders' decision-making needs while enhancing the firm's financial performance. In line with the current study's results, Ooi *et al.* (2018) concluded that a higher level of climate change performance is linked to superior financial performance, especially in climate-sensitive industries. Similarly, Akbas and Canikli (2019) found that firms' disclosure behavior is positively affected by ROE, an accounting-based indicator.

Variables	CEMIS Coef	CEMIS *p*-value	SCP1 Coef	SCP1 *p*-value	SCP2 Coef	SCP2 *p*-value	SCP3 Coef	SCP3 *p*-value	VIF
Constant	0.674	0.091	0.127	0.031	0.137	0.001	0.491	0.018	
ROE	0.231	0.000	0.241	0.033	0.253	0.015	0.243	0.139	1.25
FSIZE	0.171	0.001	0.165	0.047	0.145	0.000	0.271	0.023	1.17
LIQ	0.523	0.075	0.781	0.066	0.748	0.022	0.624	0.421	1.26
LEV	−0.453	0.334	−0.591	0.443	−0.454	0.314	−0.471	0.324	1.46
FSECT	0.351	0.021	0.433	0.033	0.354	0.035	0.431	0.037	1.23
Adjusted R^2	17.43%		17.87%		15.92%		14.79%		
F-value	1.17	0.026	1.77	0.097	1.69	0.045	1.89	0.121	

Note(s): This table presents the regression results of the accounting indicator for each model
Source(s): Table created by authors

Table 6.
Regression results (accounting indicator)

Firm size, leverage, liquidity, and firm sector are the control variables in the current study. Firm size was found to be positively significant at the 1% level for CEMIS and Scopes 1, 2, and 3 for both financial performance measurements, consistent with the findings of Ooi *et al.* (2018). Moreover, Salbiah and Mukhibad (2018) found that firm size has a significant positive effect on carbon emission disclosure in annual reports based on manufacturing companies in Indonesia. In other words, larger firm size is associated with higher carbon emission disclosure, indicating that larger firms may undertake more green activities, increasing carbon emission disclosure and enhancing carbon emission performance. This finding suggests that large firms are effectively managing their carbon emission disclosure and their related business risks for all three carbon emission scopes. Prior studies have found that carbon emission reporting policies are significantly improved in large firms (Sullivan, 2009). The liquidity results are inconsistent between the two financial performance measurements. For example, Table 5 shows that liquidity has an insignificant positive relationship with carbon emission disclosure for Tobin's Q. However, for ROE, there is a significant positive relationship at the 5% level, indicating that liquidity for ROE affects CEMIS more than liquidity for Tobin's Q. The leverage variable is negatively but insignificantly associated with CEMIS and the carbon emission scopes. This result is inconsistent with Clarkson *et al.* (2011) but in line with Akbas and Canikli (2019), who found that leverage cannot be explained in a statistically significant manner when related to carbon emission. Furthermore, Salbiah and Mukhibad (2018) found that leverage does not affect carbon emission disclosure.

4.3 Manufacturing and mining vs. services sectors

The two main regression models include the firm's sector as a control variable. The firm sector is a dummy variable assigned a value of 1 for the manufacturing and mining sector, and a value of 2 for the services sector. Accordingly, one-way ANOVA analysis is used to differentiate between and compare the two means from the two different groups using the *F*-value. If the results are significant, it indicates that the two means are unequal and one of the groups has more influence compared to the other (Andrew *et al.*, 2019). The current study uses this test to show whether the effect of financial performance on a firm's carbon emission disclosure is statistically different across the two sectors among the UK FTSE-350 firms (see Table 3) included in the current study.

The results in Table 7 show that carbon emission disclosure varies across sectors, except for Scope 1. Carbon emission disclosure is found to be statistically different among sectors (*F*-value of 2.01 at the 1% significance level for the overall carbon emission score). Most of the differences relate to the manufacturing and mining sector, where carbon emission disclosure is high as measured by the carbon emission score. Similar results are found for Scopes 2 and 3; however, Scope 1 shows insignificant differences (*F*-value of 3.02, insignificant). Our findings are consistent with Lee (2012), who discovered a substantial association between a firm's sector and its carbon strategy and disclosures. However, our findings contradict those of Bednárová *et al.* (2019), who discovered no link between the sector and environmental reporting.

5. Discussion and conclusions

The study's two main hypotheses were formulated using stakeholder theory. Both market and accounting indicators showed a positive and significant impact of financial performance on carbon emission disclosure (except for Scope 3) among non-financial FTSE-350 firms in the UK Stakeholder theory aims to align the interests of stakeholders (suppliers, investors, employees, competitors, communities, governments, and customers) and shareholders by creating as much value as possible for stakeholders (Depoers *et al.*, 2016). From this theory's

Table 7.
One-way ANOVA

	CE score			SCP 1			SCP 2			SCP 3		
	Mean	*F*-value	*p*-value	Mean	*F*-value	*p*-value	Mean	*F*-value	*p*-value	Mean	*F*-value	*p*-value
Firm Sector		2.01	0.000		3.02	0.174		3.21	0.000		3.31	0.000
1	0.734			0.568			0.485			0.555		
2	0.594			0.538			0.365			0.255		

Note(s): This table presents the one-way ANOVA test results for each sector
Source(s): Table created by authors

perspective, shareholders need to consider any individual or group that affects or is affected by the achievement of the firm's financial performance and associated environmental consequences to maintain mutual interest (Depores *et al.*, 2016; Sullivan and Gouldson, 2012). In other words, based on sustainable development goals, the materiality of financial performance could be incorporated into the concept of a low-carbon economy (Ooi *et al.*, 2018). Moreover, carbon emission disclosure is driven by economic and social pressures from the public and governments, who demand climate change disclosure more than other major stakeholders (Luo *et al.*, 2013; Hamdan, 2023). Given the increased expectations and pressure from stakeholders, companies face challenges in enhancing their carbon emission disclosure and performance while still achieving their financial goals (Sullivan and Gouldson, 2012; Mahmoudian *et al.*, 2023). In other words, higher financial performance signals that a firm can enhance its carbon emission disclosure and performance in the future by improving its financial operations. Hence, the results of the current study suggest that financial performance plays a vital role in maintaining and satisfying stakeholders' decision-making needs.

The present study has several practical implications. First, it may improve firms' understanding of the impact of financial performance on carbon emission disclosure. Firms experiencing high financial performance are particularly keen to maintain their environmental performance by increasing the company's awareness of carbon emissions, utilizing resources in a greener way, and improving overall performance. Subsequently, maintaining environmental performance leads to improved customer satisfaction. Second, this study provides useful insights regarding the impact of financial performance on carbon emission scopes, which may enhance stakeholders' and shareholders' awareness of the firm's environmental and sustainable policies concerning its financial performance goals through direct emissions, indirect emissions, and other emissions. Third, the results of the study may provide useful practical implications for policymakers concerning enforcing environmental protection and reducing carbon emission levels. Firms may need to consider further proactive carbon emission disclosure to tackle environmental challenges, support stakeholders' decision-making needs, and balance their operations in terms of productivity to achieve their financial goals. Fourth, firms may align their environmental policies with their financial goals to create an integrated relationship between profitability and sustainability. For example, firms may set clear environmental targets, such as reducing carbon emissions by a certain percentage over a specific period and linking these targets to financial performance goals. Finally, in accordance with the study's results of Tobin's Q, firms may leverage their market valuation as a driver for environmental improvement. For instance, firms that show high financial performance through the market indicator (Tobin's Q) may use their favorable market position to invest in sustainable technologies and practices, thereby enhancing industry benchmarks and leading by example.

The current study provides a significant contribution to the literature on financial performance and carbon emission disclosure. Nevertheless, it has some limitations. For instance, its findings may lack generalizability since it only examined non-financial firms, excluding financial firms from the analysis. A comparison between these two groups could offer valuable insights. Financial firms often operate with different structures and environmental considerations compared to non-financial firms, which may highlight variations in carbon emission levels and disclosure practices. Hence, future studies may consider including financial firms in their sample. Additionally, future research could explore alternative proxies for measuring financial performance. Moreover, including additional independent variables could offer deeper insights into the factors influencing carbon emission disclosure and scopes. Variables related to corporate governance, such as the board of directors' characteristics and firm ownership, would be particularly relevant for future investigations.

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