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STATISTICAL ANALYSIS TO MEASURE THE ROLE OF ACCOUNTING DISCLOSURE ON CARBON NEUTRALITY IN THE RELATIONSHIP BETWEEN AUDIT COMMITTEES AND FINANCIAL REPORTING QUALITY: EVIDENCES FROM THE SAUDI STOCK MARKET

Abstract: *This study investigates the relationship between audit committee characteristics and financial reporting quality (FRQ) among non-financial firms listed on the Saudi Exchange, while examining the moderating role of carbon neutrality disclosure. The analysis relies on a balanced panel dataset covering 160 firms over the period 2019–2024, resulting in 800 firm-year observations. Data are obtained from annual reports, sustainability reports, and the Mubasher database. Audit committee characteristics are measured through committee independence, size, and meeting frequency, whereas FRQ is proxied by accounting conservatism using the market-to-book ratio. Carbon neutrality disclosure is captured using a disclosure-based index reflecting the extent of firms' carbon-related and carbon-neutrality reporting. The empirical models control for firm size, leverage, profitability, and sector classification. Overall, the study highlights the importance of effective audit committee structures and sustainability transparency in shaping the quality of financial reporting, and it contributes to the governance and sustainability literature by providing evidence from the Saudi market.*

Keywords: *Accounting Disclosure on Carbon Neutrality, Audit Committees, Financial Reporting Quality*

1. Research Background

Financial reporting quality (FRQ) plays a central role in the corporate information environment because it affects how well published financial statements reflect a firm's economic performance and financial position. Contemporary accounting frameworks and recent empirical research describe FRQ as a multidimensional concept that includes relevance, faithful representation, comparability, verifiability, timeliness, and

understandability (Jim-Suleiman & Ibiamke, 2021; Ayagi & Salisu, 2023). From this perspective, higher quality reporting limits bias and reduce measurement error in accounting numbers, which helps users interpret outcomes as performance-driven rather than accounting-driven. Integrative reviews also note that FRQ is often discussed using signaling and agency perspectives, credible reporting can signal a commitment to transparency and can reduce conflicts of interest between managers and capital

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providers by lowering information asymmetry (Abiodun et al., 2024).

Recent studies suggest that financial reporting quality (FRQ) is not just an accounting issue; it can affect how firms are viewed and financed. When reporting quality is higher, outsiders have a clearer basis for evaluation, so the market tends to attach less information risk to the firm. This often shows up in outcomes such as lower financing costs and tighter market pricing, because investors are more willing to rely on the numbers they see (Ayagi & Salisu, 2023; Lisboa et al., 2025). Evidence from emerging economies, including Jordan and Egypt, points to similar patterns, linking higher FRQ to stronger earnings quality and a more efficient use of capital (Hamour et al., 2024). More recent work also suggests that firms that follow more conservative strategies often report higher FRQ, which is consistent with stronger internal controls and a more disciplined reporting process (Lisboa et al., 2025; Janakiraman et al., 2025). Overall, the literature indicates that FRQ is closely connected to financing conditions, investment choices, and long-term value creation.

Methodologically, present FRQ research is mainly reliant on accrual based and outcome based measurements based on the earnings-quality paradigm. Recent studies are increasingly supplementing these traditional measures with indicators of real earnings management, audit report lag, restatements, and disclosure-quality indices, reflecting the broader view that FRQ includes both recognition and measurement practices, as well as the overall reporting process (Mlawu et al., 2025; Li & Liu, 2024). In parallel, the literature has increasingly focused on FRQ in corporate governance and regulatory reform situations. Cross-country evidence on board reforms and IFRS implementation indicates that improvements in governance structures and reporting standards are generally associated with lower accrual-based earnings management and higher accrual quality, though the magnitude of these effects varies

by institutional setting (Lam et al., 2023). Further international data suggests that high FRQ is critical for decreasing information risk and promoting more efficient financing and investment policies, particularly in emerging and bank-oriented capital markets (Anagnostopoulou, 2024; Chen et al., 2024). These findings combine position FRQ as both a result of governance and regulatory arrangements and a mechanism by which such arrangements lead to better market outcomes.

Audit committees are widely seen as a key monitoring mechanism in corporate governance because they oversee the financial reporting process and the external audit. Evidence, including recent Saudi-focused studies, suggests that more effective audit committees especially those with independent members and financial expertise are associated with higher FRQ, less earnings management, more timely reporting, and stronger audit oversight (Alhumoudi, 2024; Kateb, 2024; Algrady et al., 2025; Al-Aamri et al., 2021; Alomair & Al Naim, 2025). These findings imply that committees with solid accounting and auditing competence can improve the credibility of financial statements by limiting opportunistic accrual choices and reducing information gaps. At the same time, professional guidance increasingly notes that audit committees are now expected to look beyond financial statements and pay closer attention to non-financial reporting, including sustainability-related information that is becoming part of annual reports and management commentary.

Over the past few years, global capital markets have expanded requirements for disclosures on greenhouse gas emissions, decarbonization plans, and carbon-neutral commitments. Investors and regulators increasingly rely on sustainability and climate information alongside financial reporting when judging a firm's credibility and risk profile. This shift is especially relevant in Saudi Arabia. Under Vision 2030, capital market reforms and strengthened governance expectations have encouraged listed firms to

improve transparency in (ESG) reporting, including clearer disclosure of carbon neutrality targets and progress. Evidence from the Saudi market also suggests that ESG disclosure is becoming more important for firm performance evaluation, investor decisions, and perceived transparency (Hussain et al., 2024; Sharawi, 2024; Basali, 2025). In addition, recent regulatory initiatives and ESG guidance indicate that Saudi listed firms are expected to provide more informative reporting on sustainability and greenhouse-gas related issues.

Within the broader ESG agenda, carbon neutrality disclosure has shifted from mostly voluntary messaging to a more structured form of reporting with technical requirements. Recent standards and protocols ask firms to be clearer about where emissions are measured, how greenhouse gas totals are calculated, what reduction plans look like, and how carbon-neutral claims are checked. At the same time, recent research shows that the quality of carbon accounting still varies widely across firms. Common problems include inconsistent measurement, incomplete coverage of emission scopes, weak data reliability, and limited comparability (Gipper et al., 2025; Glenk, 2025; Carrión et al., 2025). Systematic reviews also report mixed findings on the economic effects of carbon disclosure and raise concerns that nonstandard indicators and limited assurance can reduce the usefulness of carbon neutrality claims for decision making (Sitompul et al., 2023; Setiawan et al., 2025; Liu et al., 2023; Stachelscheid & Dutzi, 2025).

Although carbon neutrality disclosure is becoming more common, relatively little is known about how it connects with traditional financial reporting and governance. Prior studies often link carbon disclosure in general to firm value, risk, and the cost of capital (Sitompul et al., 2023; He & Zeng, 2025; Siddique et al., 2021). However, much less is known about whether carbon neutrality related accounting disclosure changes how audit committee effectiveness relates to

financial reporting quality (FRQ). This issue is particularly important in Saudi Arabia. While evidence suggests that broader sustainability disclosure among Saudi firms is associated with stronger accrual quality and higher investor confidence (Sharawi, 2024; Rohendi et al., 2024), most studies do not separate ESG disclosure to examine carbon-neutrality accounting as its own construct, nor do they test how it interacts with audit committee characteristics.

From a theoretical standpoint, agency theory and information asymmetry frameworks predict a strong link between audit committee effectiveness and FRQ, as effective monitoring reduces managerial opportunism and enhances reporting credibility. In settings where firms also issue carbon-neutrality disclosures, however, the monitoring environment becomes more complex. On one hand, high-quality carbon-neutrality accounting disclosure may increase reputational stakes and reinforce incentives for accurate financial reporting by signaling commitment to transparency and rigorous measurement (Gipper et al., 2025; He & Zeng, 2025). On the other hand, the technical complexity and discretionary elements of carbon accounting may introduce new avenues for opportunistic behavior if governance mechanisms are insufficient, potentially weakening the traditional audit committee and FRQ linkage (Glenk, 2025; Setiawan et al., 2025; Azmi et al., 2025).

Evidence from Saudi Arabia and the wider MENA region indicates that (AC) effectiveness, especially independence and financial expertise is associated with better financial reporting outcomes. In Saudi listed firms, (Alhumoudi, 2024; Attia et al., 2025) reports that ACs with a higher presence of financial experts are more likely to be linked with higher reporting quality, proxies by the likelihood of receiving an unqualified audit opinion. Also, Related evidence (Kateb, 2024) suggests that ACs with a higher proportion of independent, financially literate members are better able to constrain earnings management and improve earnings

informativeness under IFRS. Extending this evidence beyond a single country setting, Furthermore Algrady et al. (2025), using a joint Saudi and UAE sample, find that AC independence and expertise jointly reduce accrual based earnings manipulation and improve overall financial information quality. Taken together, these studies support the view that AC independence is relevant governance features for improving FRQ in Gulf markets.

Simultaneously, previous research warns that the influence of audit committee characteristics on financial reporting quality may be non-linear and dependent on the level of monitoring. Initial enhancements in independence, size, or meeting frequency substantially diminish discretionary accruals; however, incremental advantages wane when committees become overly large or encumbered (Attia et al., 2025). Consistent evidence from Saudi Arabia indicates that the efficacy of audit committees correlates with audit quality, implying that these committees function within a more extensive governance and assurance structure (Kateb, 2024; Algrady et al., 2025). Research from other emerging countries, such as Jordan, Nigeria, and Iraq, corroborates the strength of this association, consistently associating more effective audit committee arrangements with enhanced financial reporting quality across various institutional contexts (Yahaya, 2024; Ghabranious & Ismail, 2024).

Research indicates that companies with more comprehensive carbon emission disclosures demonstrate reduced discretionary accruals and enhanced earnings quality, especially in high pollution industries (Tan et al., 2022). Data from Vietnam suggests that FRQ mediates the connection between management power and carbon disclosure, underscoring the significant interrelation between financial reporting systems and the reliability of carbon-related information (Khuong et al, 2025). Further research considers earnings management as an inverse indicator of (FRQ) and consistently demonstrates that more extensive carbon

disclosure correlates with reduced accrual-based and real earnings management (Maretha & Ginting, 2025). Capital market research indicates that transparent carbon reporting decreases the cost of equity and credit spreads while enhancing investor trust, especially when the quality of disclosure interacts with accrual characteristics (Liu et al., 2023; Xiang et al., 2024) . Also, recent data underscores that robust carbon accounting systems significantly improve the reliability and consistency of carbon information, hence strengthening its association with overall reporting quality (Velte, 2025; Wahyuningrum et al., 2024). Despite these conceptual arguments, prior research has not directly tested whether carbon neutrality accounting disclosure moderates the relationship between AC effectiveness and FRQ in Saudi capital market. Existing Saudi studies typically examine either AC effects on FRQ or the impact of ESG disclosure on firm outcomes, without modeling whether carbon-neutrality accounting disclosure changes the established AC and FRQ link (Alhumoudi, 2024; Kateb, 2024; Algrady et al., 2025; Basali, 2025; Bamahros et al., 2022; Hamdouni & Smaoui, 2025).

Taken together, prior literature provides consistent though largely indirect evidence that audit committee effectiveness, carbon-related accounting disclosure, and financial reporting quality are jointly determined within an integrated reporting environment. While audit committees enhance both FRQ and the quality of sustainability or carbon disclosure, and carbon disclosure is systematically linked to earnings quality and market credibility, no prior study has explicitly examined carbon neutrality accounting disclosure as a moderating variable in the audit committee FRQ relationship, particularly in the Saudi capital market. This unresolved gap motivates the present study. So, current study examines the ambiguity around the impact of carbon neutrality accounting disclosure on the relationship between AC and FRQ in the

Saudi equities market. This issue needs to be made clear so that regulators and standard-setters can make rules for governance and reporting that work together, boards and audit committees can check both financial and carbon related disclosures, and investors can figure out how reliable combined financial and sustainability information.

Also, current study aims to enrich Saudi and global literature by focusing on the moderating role, while also informing ongoing reforms in corporate governance, financial reporting, and climate-related disclosure norms. The subsequent sections of the study are structured as follows: Section 2 examines the methodology, Section 3 summarizes the results of the statistical analysis, and Section 4 finished in a discussion and conclusion.

2. Research Design

2.1 Sample construction

This study examines the influence of audit committee features on financial reporting quality, while also analyzing the moderating effect of carbon disclosure within publicly listed companies in Saudi Arabia. A balanced panel dataset consisting of 800 firm-year observations (160 firms $\times$ 5 years) is created for the period 2019–2024, utilizing data gathered from annual reports, sustainability

reports, and the Mubasher database, which offers comprehensive details on corporate governance characteristics, financial performance, and firm-specific financial information. The sample comprises all non-financial entities listed on the Saudi Exchange, excluding banks and insurance businesses due to divergent regulatory contexts and financial reporting standards that could hinder comparability. To make sure that the measurements of the variables are consistent, firm-year observations with missing information on financial reporting quality (FRQ), audit committee characteristics (independence, size, and meeting frequency), or carbon disclosure are not included. The final sample of 160 firms is chosen based on set criteria for inclusion, such as being listed continuously during the study period, having all study variables and control variables available for each year, having a consistent fiscal year-end and reporting format, and having enough information available to accurately measure the characteristics of the audit committee and carbon disclosure practices. Using these criteria creates a fully balanced panel with no time gaps, which is necessary for a strong estimation of the relationship between audit committee characteristics, financial reporting quality, and the moderating effect of carbon disclosure. Table 1 shows how firms are grouped by industry sector.

Table 1. Sectorial Distribution

	Sector	N	%
1	Energy	6	4%
2	Basic Materials	47	29%
3	Capital Goods	16	10%
4	Business and Professional Services	7	4%
5	Transportation	8	5%
6	Consumer Services	14	9%
7	Food Production	20	13%
8	Healthcare	13	8%
9	Pharmaceuticals	3	2%
10	Technology Applications and Services	6	4%
11	Telecommunications	4	3%
12	Real Estate Management and Development	16	10%
	Total	160	100%

2.2 Variables measurements

Audit committee characteristics constitute the independent variables, audit committee independence (AC.INDEP) is measured as the proportion of independent directors on the AC, audit committee meetings (AC.MEETING) are measured by the number of meetings held during the fiscal year (Al-Masawa et al., 2022) and audit committee size (AC.SIZE) is measured by the total number of committee members (Orazalin et al., 2025). Also, Financial Reporting Quality (FRQ) is the dependent variable in this study and is measured using accounting conservatism, measured by the market to book ratio (MB), calculated as the market value of equity divided by its book value, where higher values indicate higher financial reporting quality. Furthermore, Carbon neutrality disclosure is treated in this study as a moderating variable and is measured using a disclosure-based index reflecting the extent of firms' carbon related and carbon neutrality reporting. The index goes from 0 to 10, with higher numbers meaning more complete disclosure. This is in line with previous research that uses disclosure based carbon measures in moderation analyses to show how transparent companies (van den Burgwal & Vieira, 2014; Luo et al., 2013). Lastly, the control variables are firm size (the natural logarithm of total assets), financial leverage (total liabilities to total assets), return on assets (ROA), and sector type (a dummy variable). These variables are incorporated to account for firm-specific attributes that may affect the quality of financial reporting (Orazalin et al., 2025; Habib et al., 2022).

2.3 Hypotheses & Empirical Models

For analyzing the effect Accounting Disclosure on Carbon Neutrality in the Relationship between Audit Committees and Financial Reporting Quality, we can formulate models (1-3) to exam the direct relationship between Audit Committees and Financial Reporting Quality, taking into

account size, LEV, ROA, and sector. Also, the relationship between Accounting Disclosure on Carbon Neutrality and FRQ is depicted in model (4). Additionally, by incorporating interaction variables between Accounting Disclosure Carbon Neutrality, AC and FRQ, models (5-7) investigate the moderating influence Accounting Disclosure on Carbon Neutrality in the Relationship between Audit Committees and Financial Reporting Quality.

H₁ : Audit committee independence is positively associated with financial reporting quality in Saudi listed firms.

$$FRQ_{it} = \theta_0 + \theta_1 AC.INDEP_{it} + \sum_{k=1}^k \theta_{k+1} Z_{kit} + \varepsilon_{3,it} \quad (1)$$

H₂: Audit committee size is positively associated with financial reporting quality in Saudi listed firms.

$$FRQ_{it} = \theta_0 + \theta_1 AC.SIZE_{it} + \sum_{k=1}^k \theta_{k+1} Z_{kit} + \varepsilon_{3,it} \quad (2)$$

H₃: Audit committee meeting frequency is positively associated with financial reporting quality in Saudi listed firms.

$$FRQ_{it} = \theta_0 + \theta_1 AC.MEETING_{it} + \sum_{k=1}^k \theta_{k+1} Z_{kit} + \varepsilon_{3,it} \quad (3)$$

H₄: Carbon-neutrality accounting disclosure is positively associated with financial reporting quality in Saudi listed firms.

$$FRQ_{it} = \theta_0 + \theta_1 DIS.CARPONE_{it} + \sum_{k=1}^k \theta_{k+1} Z_{kit} + \varepsilon_{3,it} \quad (4)$$

H₅: Carbon-neutrality accounting disclosure effect on the relationship between audit committee independence and financial reporting quality in Saudi listed firms

$$FRQ_{it} = \theta_0 + \theta_1 AC.INDEP_{it} + \theta_2 DIS.CARPONE_{it} + \theta_3 AC.INDEP_{it} * DIS.CARPONE_{it} + \sum_{k=1}^k \theta_{k+1} Z_{kit} + \varepsilon_{3,it} \quad (5)$$

H₆: Carbon-neutrality accounting disclosure effect on the relationship between audit committee size and financial reporting quality in Saudi listed firms

$$FRQ_{it} = \theta_0 + \theta_1 AC.SIZE_{it} + \theta_2 DIS.CARPONE_{it} + \theta_3 AC.SIZE_{it} * DIS.CARPONE_{it} + \sum_{k=1}^k \theta_{k+1} Z_{kit} + \varepsilon_{3,it} \quad (6)$$

H₇: Carbon-neutrality accounting disclosure effect on the relationship between audit committee meetings and financial reporting quality in Saudi listed firms

$$FRQ_{it} = \theta_0 + \theta_1 AC.MEETING_{it} + \theta_2 DIS CARPONE_{it} + \theta_3 AC.MEETING_{it} * DIS CARPONE_{it} + \sum_{k=1}^k \theta_{k+1} Z_{kit} + \varepsilon_{3,it} \quad (7)$$

Where:

- **FRQ_{it}** : Financial Reporting Quality of firm *i* in year *t*.
- **AC . INDEP** : Audit Committee independence of firm *i* in year *t*
- **AC.MEETING_{it}** : audit committee meeting frequency of firm *i* in year *t*
- **AC.SIZE_{it}** : Audit Committee members of firm *i* in year *t*
- **CARBON**: Level of carbon disclosure of firm *i* in year *t*.
- **Z_{kit}** : A set of control variables for firm *i* in year *t*, such as firm size, financial leverage, return on assets , and sector type, where *k* denotes the number of control variables.

- **θ₀** :constant
- **ε_{3,it}** : Error term

3. Results & Discussion

3.1. Descriptive statistics and correlation

Table 2 displays the descriptive statistics for the research variables based on 800 firm-year data. The mean for (MB) is 0.276 (SD = 0.260), and the mean for (CARBON) is 4.86 (SD = 2.238), with a range of 0 to 10. The average return on assets (ROA) is 0.032, and the average return on leverage (LEV) is 0.474. The average size of a firm (SIZE) is 21.661, with a standard deviation of 1.223. In terms of governance, audit committees meet an average of 3.874 times a year (SD = 1.408), with an average of 3.168 members (SD = 1.107), and are made up of 6.066 members (SD = 1.572). In general, the statistics show that the variables have enough variation to be used in multivariate analyses later on.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
MB	800	.276	.26	-.24	1.286
CARBON	800	4.86	2.238	0	10
ROA	800	.032	.037	-.178	.414
LEV	800	.474	.154	.04	.901
SIZE	800	21.661	1.223	18.95	26.084
SECTOR	800	.604	.49	0	1
AC.meeting	800	3.874	1.408	2	6
AC.indepen	800	3.168	1.107	2	5
AC. SIZE	800	6.066	1.572	4	9

Table 3 presents the correlation matrix of the study variables, Market-to-Book value (MB) is positively and significantly correlated with carbon disclosure ($r = 0.501$, $p < 0.01$) and audit committee characteristics, including AC meetings ($r = 0.705$, $p < 0.01$), AC. independence ($r = 0.742$, $p < 0.01$), and AC. size ($r = 0.759$, $p < 0.01$). MB is also strongly correlated with business size ($r = 0.291$, $p < 0.01$) and profitability (ROA) ($r = 0.239$, $p <$

0.01). In addition Leverage shows a strong negative relationship with ROA ($r = -0.455$, $p < 0.01$), however the effects of the sector are minor and mostly not important. Strong intercorrelations among AC variables ($r > 0.85$) indicate their complementary governance responsibilities and necessitate additional multicollinearity evaluation in multivariate analysis.

Table 3. Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) MB	1.000								
(2) CARBON	0.501 (0.000)	1.000							
(3) ROA	0.239 (0.000)	0.000 (0.998)	1.000						
(4) LEV	-0.083 (0.065)	-0.014 (0.759)	-0.455 (0.000)	1.000					
(5) SIZE	0.291 (0.000)	0.030 (0.500)	0.370 (0.000)	0.160 (0.000)	1.000				
(6) SECTOR	0.012 (0.793)	-0.029 (0.521)	0.138 (0.002)	-0.222 (0.000)	0.015 (0.733)	1.000			
(7) AC.meeting	0.705 (0.000)	0.419 (0.000)	0.002 (0.966)	-0.028 (0.532)	0.038 (0.401)	0.003 (0.946)	1.000		
(8) AC.indepen	0.742 (0.000)	0.421 (0.000)	-0.006 (0.887)	-0.022 (0.624)	0.063 (0.157)	-0.021 (0.636)	0.857 (0.000)	1.000	
(9) AC.size	0.759 (0.000)	0.407 (0.000)	-0.015 (0.742)	0.003 (0.948)	0.061 (0.177)	-0.047 (0.297)	0.876 (0.000)	0.939 (0.000)	1.000

3.2 Regression results

3.2.1 Impact of Audit Committee (AC) & Financial Reporting Quality (FRQ)

Table 4 presents the regression results examining the effect of AC. independence on (FRQ), measured by (MB). The results indicate that AC. independence has a positive and highly statistically significant effect on FRQ ($\beta = 0.171$, $t = 26.83$, $p < 0.01$), suggesting that a higher proportion of independence AC members enhances

monitoring effectiveness and improves the quality of financial reporting. With respect to the control variables, (ROA) and (SIZE) are positively and significantly associated with FRQ, while leverage (LEV) and sector classification remain statistically insignificant. The model is statistically significant overall ($F = 173.57$, $p < 0.01$) and explains a substantial proportion of variation in FRQ, as indicated by an R^2 of 0.638, providing strong empirical support for the role of AC. independence in enhancing FRQ.

Table 4. Linear regression of (AC. Independence) & (FRQ)

MB	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
AC. Independence	.171	.006	26.83	0	.159	.184	***
ROA	1.154	.247	4.68	0	.669	1.638	***
LEV	-.037	.057	-0.64	.52	-.149	.075	
SIZE	.04	.007	5.83	0	.026	.053	***
SECTOR	-.001	.015	-0.09	.93	-.03	.028	
Constant	-1.141	.135	-8.43	0	-1.407	-.875	***
Mean dependent var		0.276	SD dependent var				0.260
R-squared		0.638	Number of obs				800
F-test		173.571	Prob > F				0.000
Akaike crit. (AIC)		-424.428	Bayesian crit. (BIC)				-399.152

*** $p < .01$, ** $p < .05$, * $p < .1$

The Figure 1 illustrates a positive partial relationship between AC independence and (MB), after controlling for firm-specific factors. The upward sloping fitted line is

consistent with the regression results, confirming a positive and statistically significant effect of AC independence on FRQ.

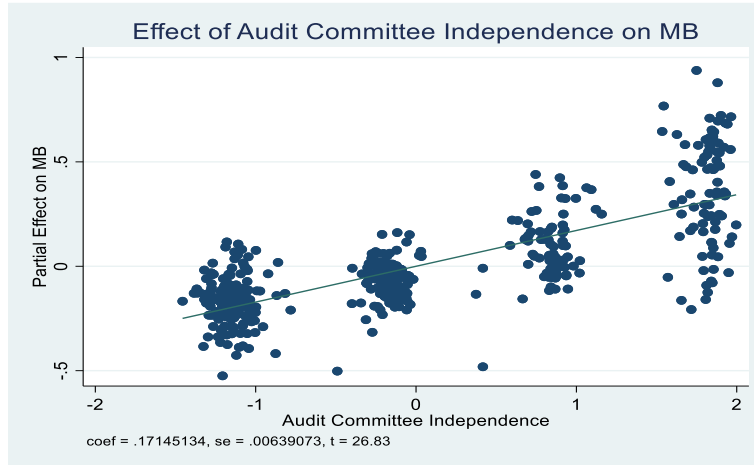


Figure 1. Independence of the AC and FRQ

Table 5 reports the regression results examining the effect of AC size on (FRQ), measured by (MB). The findings indicate that (AC_size) has a positive and highly statistically significant effect on FRQ ($\beta = 0.124$, $t = 28.79$, $p < 0.01$), suggesting that larger AC enhance monitoring capacity and contribute to higher FRQ. Regarding the control variables, profitability (ROA) is positively and significantly associated with

FRQ ($\beta = 1.107$, $t = 4.69$, $p < 0.01$), while firm size (SIZE) also shows a positive and statistically significant relationship with FRQ ($\beta = 0.041$, $t = 6.29$, $p < 0.01$). The model is statistically significant overall ($F = 198.09$, $p < 0.01$) and explains a substantial proportion of variation in FRQ, as reflected by an R^2 of 0.668, providing strong empirical support for the role of AC size in enhancing FRQ.

Table 5. Linear regression of (AC. SIZE) & (FRQ)

MB	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
AC. size	.124	.004	28.79	0	.116	.133	***
ROA	1.107	.236	4.69	0	.643	1.571	***
LEV	-.068	.055	-1.25	.211	-.175	.039	
SIZE	.041	.006	6.29	0	.028	.054	***
SECTOR	.007	.014	0.51	.609	-.021	.035	
Constant	-1.368	.13	-10.48	0	-1.624	-1.111	***
Mean dependent var		0.276	SD dependent var				0.260
R-squared		0.668	Number of obs				800
F-test		198.085	Prob > F				0.000
Akaike crit. (AIC)		-467.462	Bayesian crit. (BIC)				-442.186
*** $p < .01$, ** $p < .05$, * $p < .1$							

In addition to Figure 2 depicts a positive partial relationship between AC size and (MB), after controlling for firm-specific characteristics. The upward-sloping fitted

line is consistent with the regression results, confirming a positive and statistically significant effect of AC size on FRQ.

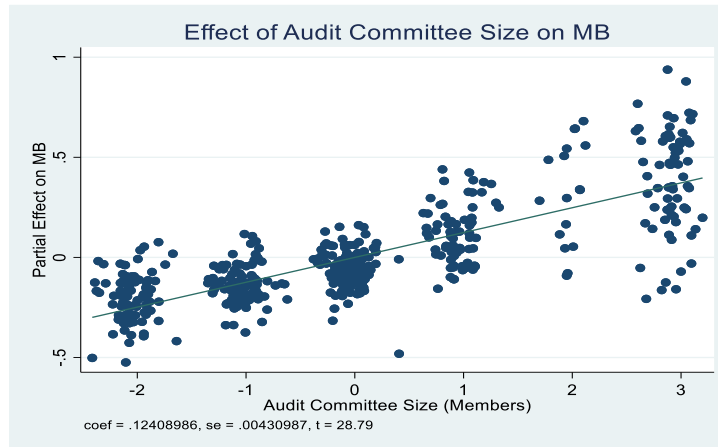


Figure 2. AC Size and (MB)

Table 6 reports the regression results examining the effect of AC. meeting frequency on financial reporting quality (FRQ), measured by the Market-to-Book ratio (MB). The results indicate that (AC_meeting) have a positive and highly statistically significant effect on FRQ ($\beta = 0.128$, $t = 24.11$, $p < 0.01$), suggesting that more frequent AC meetings enhance the effectiveness of oversight and contribute to higher FRQ. Consistent with this finding, firm profitability (ROA) is positively and

significantly associated with FRQ ($\beta = 0.999$, $t = 3.82$, $p < 0.01$), while firm size (SIZE) also exhibits a positive and statistically significant relationship with FRQ ($\beta = 0.046$, $t = 6.41$, $p < 0.01$), indicating that larger and more profitable firms tend to produce higher-quality financial reports.. Overall, the model is statistically significant ($F = 142.53$, $p < 0.01$) and explains a substantial proportion of variation in FRQ, as reflected by an R^2 of 0.591, providing strong empirical support for the role of AC.meeting in enhancing FRQ.

Table 6. Linear regression of (AC.meeting) & (FRQ)

MB	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
AC.meeting	.128	.005	24.11	0	.118	.139	***
ROA	.999	.262	3.82	0	.485	1.513	***
LEV	-.063	.061	-1.04	.297	-.182	.056	
SIZE	.046	.007	6.41	0	.032	.06	***
SECTOR	-.011	.016	-0.71	.478	-.042	.02	
Constant	-1.215	.144	-8.43	0	-1.498	-.932	***
Mean dependent var		0.276	SD dependent var			0.260	
R-squared		0.591	Number of obs			800	
F-test		142.533	Prob > F			0.000	
Akaike crit. (AIC)		-364.008	Bayesian crit. (BIC)			-338.732	
*** $p < .01$, ** $p < .05$, * $p < .1$							

The Figure 3 shows a positive partial relationship between AC. meeting frequency and (MB), after controlling for firm characteristics. The upward-sloping fitted

line is consistent with the regression results, confirming a positive and statistically significant effect of AC. meetings on FRQ.

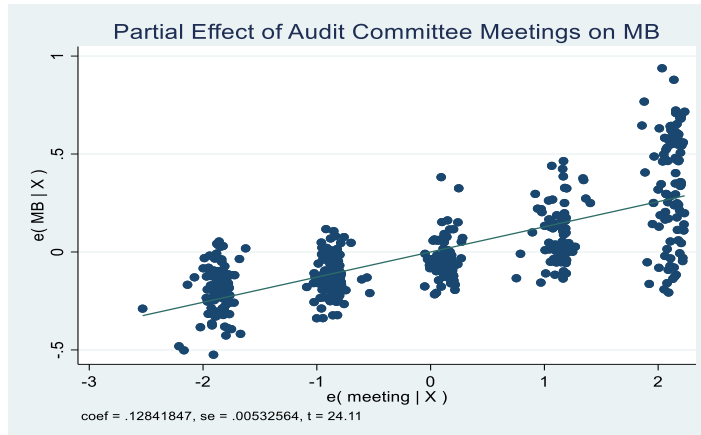


Figure 3. Partial Effect of AC. Meetings on FRQ

3.2.2 Impact of Carbon Disclosure on Financial Reporting Quality

Table 7 presents the regression results examining the effect of carbon disclosure on (FRQ). The results indicate that carbon disclosure (CARBON) has a positive and highly statistically significant effect on FRQ ($\beta = 0.057$, $t = 13.58$, $p < 0.01$), suggesting that higher levels of carbon-related disclosure are associated with improved FRQ and greater value relevance of financial information. Regarding the control variables,

(ROA) shows a positive and significant relationship with FRQ ($\beta = 0.856$, $t = 2.60$, $p < 0.05$), while (SIZE) is also positively and significantly associated with FRQ ($\beta = 0.051$, $t = 5.64$, $p < 0.01$), indicating that larger and more profitable firms tend to exhibit higher FRQ. The model is statistically significant overall ($F = 53.41$, $p < 0.01$) and explains a meaningful proportion of variation in FRQ, as reflected by an R^2 of 0.351, supporting the explanatory power of carbon disclosure and firm characteristics in explaining FRQ.

Table 7. Linear regression of carbon disclosure & (FRQ)

MB	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
CARBON	.057	.004	13.58	0	.049	.066	***
ROA	.856	.329	2.60	.01	.209	1.503	***
LEV	-.102	.076	-1.34	.18	-.252	.047	
SIZE	.051	.009	5.64	0	.033	.069	***
SECTOR	-.005	.02	-0.25	.804	-.044	.034	
Constant	-1.084	.181	-5.98	0	-1.441	-.728	***
Mean dependent var		0.276	SD dependent var			0.260	
R-squared		0.351	Number of obs			800	
F-test		53.414	Prob > F			0.000	
Akaike crit. (AIC)		-133.780	Bayesian crit. (BIC)			-108.505	
*** $p < .01$, ** $p < .05$, * $p < .1$							

The Figure 4 illustrates a positive partial relationship between carbon disclosure and (MB), after controlling for firm-specific characteristics. The upward-sloping fitted

line is consistent with the regression results, confirming a positive and statistically significant effect of carbon disclosure on FRQ.

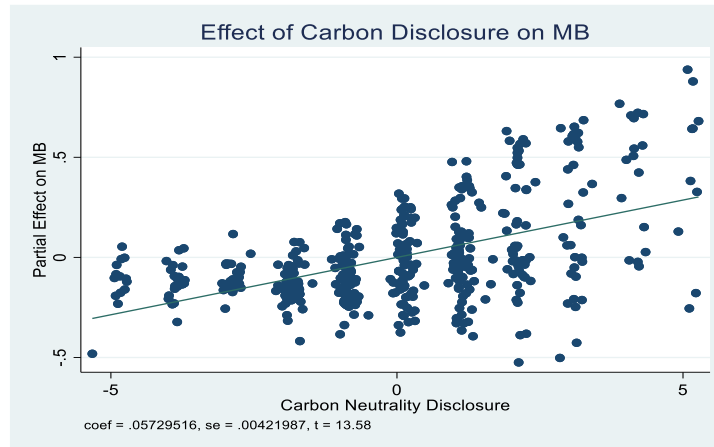


Figure 4. Carbon Disclosure and Financial Reporting Quality

3.2.3 Impact of Carbon Disclosure on AC&FRQ

Table 8 examines the moderating effect of carbon neutrality disclosure on the relationship between audit committee independence and financial reporting quality (FRQ), measured by the Market-to-Book ratio (MB). Audit committee independence has a positive and significant direct effect on

FRQ ($\beta = 0.081$, $p < 0.01$), while carbon disclosure also shows a positive main effect ($\beta = 0.111$, $p < 0.01$). Importantly, the interaction term (AC_independence $\times$ CARBON) is positive and highly significant ($\beta = 0.044$, $p < 0.01$), indicating that carbon disclosure strengthens the positive impact of audit committee independence on financial reporting quality. The model exhibits strong explanatory power ($R^2 = 0.845$).

Table 8. Linear regression of Impact of Carbon Disclosure on AC. independent &FRQ

MB	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
AC. independent	.081	.011	7.29	0	.102	.059	***
CARBON	.111	.006	17.28	0	.124	.099	***
AC. Independent* CARBON	.044	.002	22.83	0	.04	.047	***
ROA	.916	.162	5.65	0	.598	1.235	***
LEV	-.039	.037	-1.03	.303	-.112	.035	
SIZE	.042	.004	9.48	0	.033	.051	***
SECTOR	-.006	.01	-0.60	.55	-.025	.013	
Constant	-.565	.093	-6.06	0	-.748	-.382	***
Mean dependent var		0.276	SD dependent var			0.260	
R-squared		0.845	Number of obs			800	
F-test		381.423	Prob > F			0.000	
Akaike crit. (AIC)		-842.995	Bayesian crit. (BIC)			-809.294	
*** $p < .01$, ** $p < .05$, * $p < .1$							

The Figure 5 shows that the positive effect of AC independence on FRQ strengthens as the level of carbon disclosure increases,

confirming a significant moderating effect of carbon disclosure.

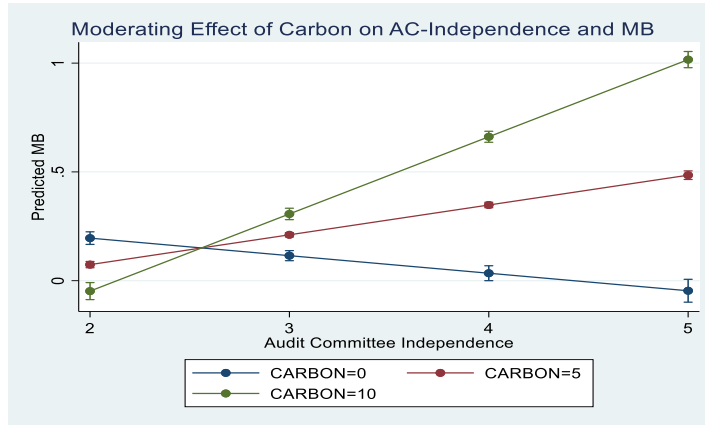


Figure 5. Moderating Effect of Carbon Disclosure on AC. independence &FRQ

Table 9 reports the regression results testing the moderating effect of carbon disclosure on the relationship between audit committee size and financial reporting quality (FRQ), measured by the Market-to-Book ratio (MB). Audit committee size has a positive and statistically significant direct effect on FRQ ($\beta = 0.069$, $p < 0.01$), while carbon disclosure also shows a positive main effect ($\beta = 0.179$,

$p < 0.01$). Importantly, the interaction term between audit committee size and carbon disclosure ($AC_size \times CARBON$) is positive and highly significant ($\beta = 0.034$, $p < 0.01$), indicating that carbon disclosure strengthens the positive impact of audit committee size on financial reporting quality. The model demonstrates strong explanatory power, with an R^2 of 0.911.

Table 9. Linear regression of Impact of Carbon Disclosure on AC.size &FRQ

MB	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
AC. size	.069	.006	11.71	0	.08	.057	***
CARBON	.179	.006	27.94	0	.191	-.166	***
AC.size* CARBON	.034	.001	33.26	0	.032	.036	***
ROA	.969	.123	7.90	0	.728	1.21	***
LEV	-.078	.028	-2.76	.006	-.134	-.023	***
SIZE	.043	.003	12.89	0	.037	.05	***
SECTOR	-.003	.007	-0.37	.712	-.017	.012	
Constant	-.423	.074	-5.73	0	-.568	-.278	***
Mean dependent var		0.276	SD dependent var			0.260	
R-squared		0.911	Number of obs			800	
F-test		716.969	Prob > F			0.000	
Akaike crit. (AIC)		-1120.264	Bayesian crit. (BIC)			-1086.563	

*** $p < .01$, ** $p < .05$, * $p < .1$

The Figure 6 shows that the positive relationship between AC size and FRQ strengthens as the level of carbon disclosure

increases, confirming the presence of a significant moderating effect.

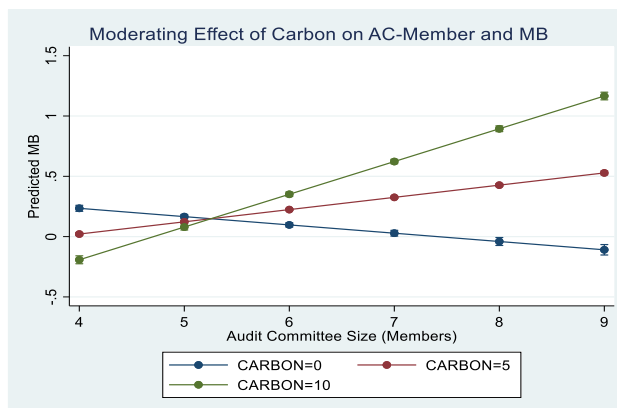


Figure 6. Moderating Effect of Carbon Disclosure on AC size & FRQ

Table 10 presents the regression results examining the moderating effect of carbon disclosure on the relationship between audit committee meetings and financial reporting quality (FRQ), measured by the Market-to-Book ratio (MB). Carbon disclosure shows a positive and statistically significant direct effect on FRQ ($\beta = 0.109$, $p < 0.01$), while audit committee meeting frequency is also positively and significantly associated with

FRQ ($\beta = 0.069$, $p < 0.01$). Importantly, the interaction term between audit committee meetings and carbon disclosure ($AC_meeting \times CARBON$) is positive and highly significant ($\beta = 0.036$, $p < 0.01$), indicating that carbon disclosure strengthens the positive impact of audit committee activity on financial reporting quality. The model exhibits strong explanatory power, with an R^2 of 0.817.

Table 10. Linear regression of Impact of Carbon Disclosure on AC. meeting & FRQ

MB	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
CARBON	.109	.007	16.10	0	.123	.096	***
AC.meeting	.069	.009	7.56	0	.087	.051	***
AC_meeting × CARBON	.036	.002	21.77	0	.032	.039	***
ROA	.988	.176	5.63	0	.643	1.333	***
LEV	-.044	.041	-1.08	.279	-.124	.036	
SIZE	.044	.005	9.07	0	.034	.053	***
SECTOR	-.014	.011	-1.29	.198	-.034	.007	
Constant	-.593	.102	-5.84	0	-.793	-.393	***
Mean dependent var		0.276	SD dependent var			0.260	
R-squared		0.817	Number of obs			800	
F-test		312.574	Prob > F			0.000	
Akaike crit. (AIC)		-760.448	Bayesian crit. (BIC)			-726.747	

*** $p < .01$, ** $p < .05$, * $p < .1$

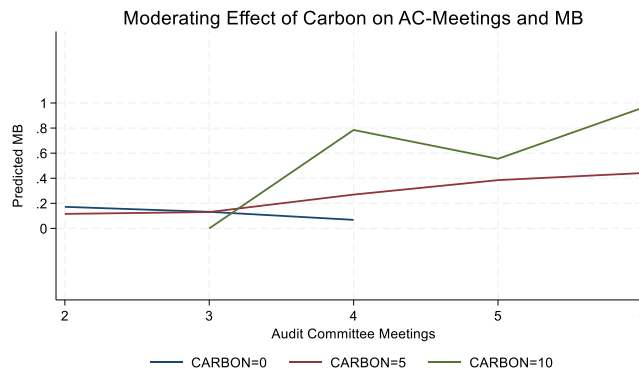


Figure 7. Moderating Effect of Carbon Disclosure on AC Meetings and FRQ

4. Discussion & Conclusion

This study focuses on Saudi non-financial firms listed on the Saudi Exchange and explores how audit committee characteristics relate to financial reporting quality, with carbon neutrality disclosure treated as a conditioning moderating factor. The analysis follows 160 firms over five years (2019–2024), yielding 800 firm-year observations, and it draws on annual reports, sustainability reports, and the Mubasher database. Audit committee characteristics are captured through independence, committee size, and meeting frequency, while financial reporting quality is proxied by accounting conservatism using the market-to-book ratio. In addition to, carbon neutrality disclosure is measured using a disclosure index that reflects the extent of carbon-related and neutrality reporting. To reduce omitted-variable concerns, the model also includes standard firm controls such as size, leverage, ROA, and sector classification.

The positive association between audit committee independence and financial reporting quality can be explained by agency theory, which emphasizes the role of independent directors in reducing information asymmetry and limiting managerial opportunism. Independent audit committee members are better positioned to monitor management and challenge accounting judgments, leading to more reliable financial

reporting. This interpretation is consistent with prior evidence showing that stronger audit committee independence improves earnings quality and reporting transparency (Orazalin et al., 2025; Habib et al., 2022). The findings also suggest that audit committee size and meeting frequency contribute positively to financial reporting quality. From a resource dependence and monitoring intensity perspective, a larger and more active audit committee enhances oversight by providing diverse expertise and allowing for more frequent review of financial reporting issues. Regular meetings facilitate timely communication with auditors and management, thereby reducing reporting risk and improving reporting outcomes. These results align with earlier studies documenting the importance of audit committee structure and activity in strengthening financial reporting quality (Habib et al., 2022). Furthermore, the role of carbon neutrality disclosure supports legitimacy and stakeholder theories, as firms that engage in more extensive carbon related disclosure are subject to higher scrutiny and reputational concerns. Such pressures encourage greater transparency and more conservative reporting practices. More importantly, the moderating effect of carbon disclosure indicates that sustainability transparency complements audit committee monitoring, reinforcing its impact on financial reporting quality. This finding is consistent with prior research

highlighting the interaction between governance mechanisms and environmental disclosure in enhancing overall reporting quality (Orazalin et al., 2025; Luo et al., 2013; Hahn et al., 2015).

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