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ESG Disclosure and Financial Analysts' Accuracy in Saudi Arabia: The Moderating Role of the 2021 ESG Guidelines

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Abstract

This study explores how environmental, social and governance (ESG) disclosure relates to analysts' forecast accuracy in Saudi Arabia, focusing on the ESG disclosure guidelines introduced by the Saudi Stock Exchange (Tadawul) in 2021. It suggests that ESG disclosure enhances corporate transparency, decreases information asymmetry, and provides analysts with additional non-financial information that can improve the earnings forecast quality. Furthermore, the introduction of ESG guidelines is likely to enhance the consistency and reliability of sustainability reporting, thereby strengthening the informational environment of the capital market. Based on a sample of listed firms from 2017 to 2024 and employing panel regression techniques, including fixed-effects and two-step system generalized method of moments (GMM) estimations, the results indicate that a higher ESG disclosure is associated with lower analyst forecast errors, reflecting an improved forecast accuracy. The findings also reveal that the forecast accuracy increased following the ESG guidelines' introduction and that the connection between ESG disclosure and analysts' forecast accuracy became greater after the implementation of the guidelines. Our results demonstrate the informational value of ESG disclosure and suggest that ESG reporting initiatives can boost the quality of financial information in emerging markets.

Keywords: ESG; disclosure; forecast; earnings; accounting

1. Introduction

In recent years, environmental, social, and governance (ESG) disclosure has become an increasingly important component of corporate reporting and investment decisions. As an extension of firms' overall disclosure practices, ESG reporting aims to enhance transparency and improve the information environment of capital markets (Healy & Palepu, 2001; Bushman & Smith, 2001). A growing body of research suggests that a more comprehensive disclosure reduces the information asymmetry and improves the usefulness of financial reporting (Diamond & Verrecchia, 1991; Lambert et al., 2007).

Financial analysts, as key information intermediaries, rely on both financial and non-financial disclosures when forming earnings expectations, and analysts' forecast accuracy is widely used as a proxy for the quality of the information environment (Lang & Lundholm, 1996; Hope, 2003). Prior studies show that greater transparency is associated with more accurate forecasts (Dhaliwal et al., 2012; Ferrer et al., 2020; Acheampong & Elshandidy, 2025). However, the evidence specifically on ESG disclosure remains limited and is largely concentrated in developed markets (Luo & Wu, 2022; Roger, 2024; Li & Chen, 2025), leaving the role of ESG information in emerging markets relatively underexplored.



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This study investigates whether ESG disclosure improves analysts' forecast accuracy and whether this relationship changes following the introduction of ESG disclosure guidelines in 2021. Saudi Arabia provides a relevant setting, as ESG reporting has evolved rapidly in recent years, particularly under the influence of Vision 2030 and the introduction of ESG disclosure guidelines by the Saudi Exchange. These guidelines promote more structured and comparable ESG reporting, potentially enhancing the usefulness of ESG information for market participants.

This paper contributes to the literature by offering evidence from Saudi Arabia, which is an underexplored emerging market context characterized by a rapidly evolving ESG reporting environment. This extends the theoretical understanding of how ESG disclosure shapes the information environment and analyst behavior in markets that are undergoing an institutional transformation. It also examines the 2021 ESG disclosure guidelines as a key institutional development to assess how changes in ESG reporting practices relate to analysts' forecast accuracy. While the study does not propose a new theoretical mechanism, it highlights how the informativeness of ESG disclosure varies in an evolving regulatory and market context. Practically, the findings offer insights for regulators, standard setters, and firms on how structured ESG reporting can enhance the usefulness of corporate information for capital market participants.

Our findings indicate that ESG disclosure is associated with more accurate earnings forecasts and that this relationship becomes stronger following the introduction of the 2021 guidelines. These results suggest that more structured ESG reporting contributes to improving the information environment and supports analysts in forming more precise expectations.

The rest of the paper proceeds as follows: Section 2 reviews the relevant literature and outlines the study's hypotheses, Section 3 explains the research methodology, Section 4 reports the main results and additional robustness analyses, and Section 5 provides the concluding remarks.

2. Literature and Hypotheses

2.1. ESG Disclosure and the Information Environment

A large body of research assesses how corporate reporting influences the information environment in capital markets. The disclosure theory suggests that more extensive and higher-quality disclosure enhances transparency, improves the credibility of reported information, and diminishes informational gaps between corporations and external parties (Healy & Palepu, 2001; Verrecchia, 2001). High-quality disclosure limits managers' ability to withhold or selectively release information and facilitates more effective monitoring for investors and analysts (Beyer et al., 2010). Prior studies document that improved disclosure quality contributes to a lower information risk, reduced cost of capital, improved stock liquidity, and more efficient capital markets (Diamond & Verrecchia, 1991; Botosan, 1997; Lambert et al., 2007).

Within this literature, ESG disclosure has emerged as an important extension of firms' reporting practices. Although ESG information is non-financial, it conveys economically relevant insights about firms' risk exposures, governance structures, stakeholder relationships, and future value creation strategies (Eccles et al., 2014; Khan et al., 2016). Prior research shows that ESG or sustainability disclosures support higher firm value and lower financing costs and risk (Dhaliwal et al., 2011; El Ghouli et al., 2018; Cheng et al., 2014; Fuadah et al., 2022). ESG disclosure thus complements traditional financial reporting by providing additional context for assessing firms' long-term performance and risk profiles.

Nevertheless, most existing evidence is drawn from developed markets characterized by strong investor protection and mature disclosure regimes (Leuz et al., 2003; Ball et al., 2000). In emerging markets, information environments are often marked by higher

uncertainty, greater reporting discretion, and weaker enforcement, which may limit the effectiveness of disclosure in improving transparency (Hope, 2003; Francis et al., 2005). Consequently, whether ESG disclosure enhances the information environment in such settings remains an open empirical question.

2.2. ESG Disclosure and Analysts' Forecast Accuracy

Financial analysts are the catalysts of equity markets by transforming publicly available information into earnings forecasts. Prior research shows that analysts' forecast accuracy improves when firms provide more informative, transparent, and timely disclosures, as an enhanced disclosure reduces uncertainty surrounding firms' earnings processes and future cash flows (Lang & Lundholm, 1996; Hope, 2003; Kothari et al., 2009). More informative disclosure allows analysts to better assess current performance, earnings persistence, and exposure to firm-specific risks, thereby reducing their forecast errors.

The recent studies focusing on ESG or sustainability disclosures suggest that ESG information provides analysts with useful incremental signals beyond those contained in traditional financial statements. The disclosures related to governance quality, environmental risk management, and social practices help analysts assess the sustainability of profits and the likelihood of future performance shocks (Dhaliwal et al., 2012; Khan et al., 2016). Using Bloomberg ESG metrics, Luo and Wu (2022) show that higher ESG ratings enhance analysts' forecast accuracy by reducing information and operational risk. Similarly, Roger (2024) finds that analysts' earnings expectations are significantly more favorable for firms with strong ESG disclosure scores. Complementing these findings, Schiemann and Tietmeyer (2022) demonstrate that firms can mitigate the negative impact of ESG controversies on analysts' forecast errors through increased ESG disclosure. The evidence from Huang and Fang (2025) further indicates that material ESG disclosure lowers analyst forecast errors and dispersion, whereas immaterial disclosures have adverse effects, highlighting materiality as a key feature that improves forecast quality. Moreover, even when ESG rating disagreements exist, such differences can paradoxically lead to more rigorous and higher-quality analyst forecasts (Li & Chen, 2025). Supporting this, Derrien et al. (2025) provide evidence that analysts' forecast revisions are informative and accurately incorporate ESG-related information when forming earnings expectations.

Evidence from broader sustainability reporting also supports the information-enhancing role of non-financial disclosure. Nicolò et al. (2025) find that the disclosure of sustainable development goals (SDGs) improves the information environment of firms and enables analysts to form more precise earnings expectations. Other research highlights that the response of analysts to ESG disclosures can be moderated by contextual factors; for example, analysts' recommendations are influenced by ESG disclosures in the GCC region, but political connections, such as royal family directors, can weaken how seriously ESG information is interpreted (Alazzani et al., 2021). Additionally, the institutional enforcement strength appears to condition the informativeness of voluntary disclosures, as integrated reporting improves the forecast accuracy mainly in countries with strong investor protection (Rossignoli et al., 2022).

The empirical evidence further indicates that firms with more extensive and higher-quality sustainability disclosure exhibit higher analyst forecast accuracy, mainly when ESG data is material, standardized, and reliable (García-Sánchez et al., 2019; Horton et al., 2013; Acheampong & Elshandidy, 2025). Overall, an enhanced ESG and sustainability disclosure is expected to reduce uncertainty about firms' long-term strategies and non-financial risks, enabling analysts to interpret reported earnings more effectively and form more precise earnings expectations.

Building on this evidence, the following hypothesis is proposed to test the association between ESG disclosure and analysts' forecast accuracy:

H1. *ESG disclosure is associated with increased analysts' earnings forecast accuracy.*

2.3. The Role of ESG Disclosure Guidelines in Saudi Arabia

The structured ESG disclosure guidance plays a critical role in shaping firms' reporting incentives and the quality of information available to market participants. Prior research shows that formal frameworks promoting standardized and consistent disclosure improve the reporting quality, enhance the comparability, and strengthen the information environment, particularly in contexts with relatively weaker disclosure practices and enforcement mechanisms (Hail et al., 2010; Christensen et al., 2013; Leuz & Wysocki, 2016). For instance, Ferrer et al. (2020) demonstrate that the adoption of the EU Directive 2014/95/EU on sustainability reporting improved the disclosure quality and comparability in European countries, which, in turn, increased analysts' earnings forecast accuracy. Such evidence highlights how structured reporting frameworks can enhance the informativeness of ESG-related disclosures for financial analysts.

In Saudi Arabia, the launch of Saudi Vision 2030 placed sustainability, transparency, and alignment with international best practices at the core of corporate governance reforms, signaling strong national support for standardized ESG reporting. In line with this vision, the Capital Market Authority (CMA) and the Saudi Exchange (Tadawul) require all the listed firms to align with the ESG disclosure practices, which are strongly encouraged and subject to regulatory monitoring. However, ESG reporting remained inconsistent until the Saudi Exchange issued formal ESG disclosure guidelines in 2021. These guidelines consolidated the prior governance and transparency initiatives into a more coherent ESG reporting framework by promoting standardized metrics, clearer narrative disclosures, and greater comparability across firms.

Although the guidelines are not legally enforced in the strict sense, they function as a de facto mandatory framework within the Saudi capital market, and noncompliance may have reputational consequences and potentially affect access to capital (Alazzani et al., 2021). This quasi-mandatory status arises from their integration into the Saudi Vision 2030 strategic framework, which increasingly links access to government-led mega-projects and international capital with robust ESG transparency. Consequently, firms that fail to adhere to these standards risk exclusion from the lucrative Public Investment Fund (PIF) procurement ecosystem, where sustainability metrics are now a prerequisite for pre-qualification. This risk is further compounded by the rising cost of debt, as local and international lenders begin to price in "transition risks" for companies with opaque environmental disclosures (Al Adeem, 2024).

Accordingly, the post-2021 period represents a meaningful institutional shift in the ESG information environment, suggesting that stronger ESG disclosure is likely to enhance the usefulness of ESG information for financial analysts by improving clarity, comparability, and credibility. We therefore anticipate a more pronounced relationship between ESG disclosure and analysts' forecast accuracy in the post-guidelines period, which is consistent with the evidence from other contexts, such as Europe (Ferrer et al., 2020).

Building on this institutional shift, the following hypothesis examines how the 2021 ESG disclosure guidelines influence the ESG–analyst forecast accuracy relationship:

H2. *The association between ESG disclosure and analysts' earnings forecast accuracy is stronger following the introduction of the 2021 ESG disclosure guidelines.*

3. Research Design

This study focuses on ESG disclosure in Saudi Arabia and its association with financial analysts' earnings forecast accuracy, with a particular emphasis on the role of the Saudi Exchange 2021 ESG guidelines. ESG reporting tends to improve information transparency, expand accessibility to non-financial data, and reduce the information asymmetry related to firms' long-term risks and sustainability practices, therefore enhancing analysts' forecast accuracy. Moreover, standardized ESG disclosure guidelines are expected to strengthen this association by limiting the reporting discretion and improving the reliability and comparability of ESG information across firms. Following prior research on disclosure regulation and analyst forecasts, we assess changes in analysts' accuracy around the implementation of the 2021 ESG disclosure guidelines.

3.1. Sample

The empirical analysis focuses on Saudi-listed firms over the period 2017–2024. This period is selected to capture the impact of the Saudi Exchange ESG disclosure guidelines that were issued in 2021, which represent a substantial advance in the Saudi market. To analyze the effect of these guidelines, this study employs a balanced pre- and post-guidelines research design, covering four years before (2017–2020) and four years after (2021–2024) their introduction. This balanced window allows for a clear comparison of analysts' forecasting behavior surrounding the ESG disclosure guidelines.

The accounting and market data, including actual earnings per share (EPS), stock prices, and firm-level financial characteristics, are obtained from Bloomberg. ESG disclosure information is also sourced from Bloomberg, which provides firm-specific scores capturing the extent and quality of publicly available ESG disclosures (Alazzani et al., 2021; Luo & Wu, 2022; Silva, 2022; Campanella et al., 2021).

The IBES database provides analysts' earnings forecasts and actual earnings data. To ensure reliable measures of forecast accuracy, forecast errors are calculated using the median earnings forecast (Bessière & Elkemali, 2014; Elkemali, 2023), and firm-year observations are required to have earnings forecasts issued by at least three analysts. This restriction mitigates the noise arising from thin analyst coverage and is consistent with established practices in the analyst forecast literature.

Several filters are applied to improve the sample quality. The financial organizations are omitted due to their specific regulatory and financial environment. The observations of the missing ESG scores, earnings forecasts, or key financial variables are removed, and values in the 1st and 99th percentiles are dropped. Annual reports were used to manually gather the corporate governance variables to ensure accuracy and consistency.

By the end of 2024, the Saudi stock exchange listed 247 firms. The screening criteria resulted in a final sample including 49 firms and 328 firm-year observations. Our sample is larger than that of Alazzani et al. (2021), who used 28 Saudi firms and 169 observations from 2010 to 2016, supporting the adequacy of our dataset for empirical analysis.

3.2. Models and Variables

To test our first hypothesis regarding the association between ESG disclosure and analysts' forecast accuracy, we follow the baseline model of García-Sánchez et al. (2019), Luo and Wu (2022), and Elkemali (2025).

$$\begin{aligned} \text{AFER}_{i,t+1} = & \alpha_0 + \beta_1 \text{ESG}_{i,t} + \beta_2 \text{FSIZE}_{i,t} + \beta_3 \text{MB}_{i,t} + \beta_4 \text{ROA}_{i,t} + \beta_5 \text{LEV}_{i,t} + \beta_6 \text{LOSS} + \\ & \beta_7 \text{SDROA} + \beta_8 \text{BIG4}_{i,t} + \beta_9 \text{OWNERC}_{i,t} + \beta_{10} \text{COV}_{i,t} + \beta_{11} \text{BIND}_{i,t} + \beta_{12} \text{BDIV}_{i,t} + \\ & \beta_{13} \text{BZISE}_{i,t} + \beta_{14} \text{Duality}_{i,t} + \text{IndustryEffect} + \text{YearEffect} + \zeta_{i,t} \end{aligned} \quad (1)$$

where AFER represents the forecast accuracy, which is calculated as the absolute difference between the realized (EPS) and forecasted earnings per share (FEPS) in $t + 1$, scaled by the stock price closing year t (PRICE). The lower values of AFER indicate more accurate earnings predictions (Elkemali, 2024a). Formally, AFER is expressed as:

$$\text{AFER}_{i,t+1} = |\text{EPS}_{i,t+1} - \text{FEPS}_{i,t+1}| / \text{PRICE}_{i,t}$$

The key independent variable, ESG disclosure, is measured using Bloomberg ESG scores, ranging from 0% to 100%. This measure is widely used in the prior literature as a proxy for firms' ESG reporting practices (e.g., Manita et al., 2018; Luo & Wu, 2022; Silva, 2022). The score is constructed from the ESG-related data points collected from publicly available sources, including annual reports, sustainability reports, company websites, and other disclosures, as well as Bloomberg proprietary surveys and external sources such as the Carbon Disclosure Project (CDP). Bloomberg applies a standardized methodology across firms and countries, weighing data points according to their relevance within each industry while also incorporating comparable cross-sector indicators. As such, the score captures both the breadth of ESG reporting and aspects of disclosure quality through Bloomberg's processing of publicly available information. In line with prior studies, our paper treats the overall ESG disclosure as reflected by the Bloomberg ESG score, without isolating specific dimensions such as quantity or quality.

The control variables are grouped into three categories: firm-related, analyst-related, and corporate governance-related characteristics (Luo & Wu, 2022; Elkemali, 2024b; Elkemali, 2025). The firm-level controls include firm size (FSIZE), market-to-book (MB), profitability (ROA), leverage (LEV), loss (LOSS), earnings volatility (SDROA), audit quality (BIG4), and ownership concentration (OWNERC). The analyst-related controls include analyst coverage (COV). The corporate governance-related controls include board size (BSIZE), board gender diversity (BDIV), board independence (BIND), and CEO duality (DUALITY). To account for the heterogeneity across sectors and temporal shocks, including the COVID-19 pandemic, industry and year fixed effects were included.

To examine Hypothesis 2, expecting a stronger association between ESG disclosure and analysts' forecast accuracy after the introduction of the 2021 ESG guidelines, we employ a disclosure–guideline shock design. We introduce a post-guidelines indicator variable (POST), which is equal to one for years 2021 to 2024, and have this indicator interact with ESG disclosure ($\text{ESG} \times \text{POST}$). The model is specified as:

$$\begin{aligned} \text{AFER}_{i,t+1} = & \alpha_0 + \beta_1 \text{ESG}_{i,t} + \beta_2 \text{POST}_t + \beta_3 (\text{ESG}_{i,t} \times \text{POST}_t) + \beta_4 \text{FSIZE}_{i,t} + \beta_5 \text{MB}_{i,t} + \\ & \beta_6 \text{ROA}_{i,t} + \beta_7 \text{LEV}_{i,t} + \beta_8 \text{LOSS}_{i,t} + \beta_9 \text{SDROA}_{i,t} + \beta_{10} \text{BIG4}_{i,t} + \beta_{11} \text{OWNERC}_{i,t} + \\ & \beta_{12} \text{COV}_{i,t} + \beta_{13} \text{BIND}_{i,t} + \beta_{14} \text{BDIV}_{i,t} + \beta_{15} \text{BZISE}_{i,t} + \beta_{16} \text{Duality}_{i,t} + \text{IndustryEffect} \\ & + \text{YearEffect} + \zeta_{i,t} \end{aligned} \quad (2)$$

Here, β_1 measures how ESG disclosure is associated with the forecast accuracy in the pre-guidelines period, and the interaction term β_3 indicates the incremental impact of guidelines on this association. A significant negative β_3 would provide evidence that ESG reporting became more informative for analysts following the 2021 guidelines, supporting Hypothesis 2. β_2 captures overall changes in the forecast accuracy after 2021 that are unrelated to ESG disclosure. Variable measures are described in Table 1.

Table 1. The variable descriptions.

Variable		Description
<i>Dependent variable</i>		
AFER	Forecast Accuracy	Absolute forecast error, measured as the absolute difference between the realized (EPS) and forecasted earnings per share (FEPS) in $t + 1$, scaled by the stock price closing year t (PRICE). Lower values indicate higher forecast accuracy.
<i>Independent variable</i>		
ESG	ESG Disclosure	Bloomberg ESG score (from 0% to 100%).
<i>Moderator</i>		
POST	Post-Guidelines Indicator	Dummy variable equal to 1 for the post-guidelines period (2021–2024) and 0 for the pre-guidelines period (2017–2020).
ESG $\times$ POST	Interaction Term	Interaction of ESG disclosure with POST to test whether the effect of ESG on forecast accuracy differs between pre- and post-guidelines periods.
<i>Control Variables</i>		
FSIZE	Firm Size	Natural log of total assets
MB	Growth Opportunities	Market value to book value of equity
ROA	Profitability	Net income scaled by total assets
LEV	Leverage	Total debt scaled by total assets
LOSS	Loss Indicator	Dummy variable equal to 1 if the net income reported (t) is negative, and 0 otherwise.
SDROA	Earnings Volatility	Standard deviation of ROA over the preceding five fiscal years for firm i .
BIG4	Audit Quality	Dummy variable equal to 1 if a firm is audited by one of the Big Four and 0 otherwise.
COV	Analyst Coverage	Number of financial analysts covering the firm in year t .
OWNERC	Ownership Concentration	Percentage of total outstanding shares owned by the five largest shareholders.
BIND	Board Independence	Proportion of board members who are independent directors.
BDIV	Board Gender Diversity	Proportion of female directors on the board.
BSIZE	Board Size	Total number of directors on the board.
DUALITY	CEO Duality	Dummy variable equal to 1 if the CEO also serves as board chair and 0 otherwise.

4. Empirical Results

4.1. Descriptive Analysis

The descriptive statistics (Table 2) indicate that the average ESG disclosure (ESG) in our sample is 28.5, with a median of 27, suggesting moderate voluntary reporting among the Saudi-listed firms. Notably, this mean level of ESG disclosure is substantially higher than the values reported in earlier studies on the Saudi firms. For instance, Alazzani et al. (2021) documented an average ESG score of 12.29, while Bamahros et al. (2022) reported a mean of 14.62. The increase in ESG disclosure over time may reflect the growing awareness of

sustainability issues, an alignment with international reporting practices, and the influence of initiatives such as the Saudi Exchange ESG disclosure guidelines in 2021.

Table 2. The descriptive statistics.

Variable	Obs	Mean	Median	Std	Q25%	Q75%
AFER	328	0.25	0.18	0.13	0.11	0.31
ESG	328	28.5	27	10.2	20	34.5
FSIZE	328	10.7	10.6	0.6	10.2	11.2
MB	328	1.9	1.75	0.85	1.25	2.4
LEV	328	0.27	0.26	0.17	0.16	0.36
ROA	328	0.07	0.06	0.07	0.03	0.09
SDROA	328	0.05	0.04	0.03	0.03	0.07
LOSS	328	0.19	0	0.39	0	0
BIG4	328	0.7	1	0.46	0	1
OWNERC	328	0.44	0.42	0.14	0.32	0.56
COV	328	4.8	4	2.2	3	7
BIND	328	0.41	0.4	0.11	0.33	0.5
BDIV	328	0.12	0.1	0.14	0.05	0.2
BSIZE	328	9	9	1.5	8	10
DUALITY	328	0.16	0	0.37	0	1

Note: The variable measures are defined in Table 1.

Other descriptive statistics indicate that the firms in the sample are of medium size (FSIZE mean = 10.7) and moderately leveraged (LEV mean = 0.27). The ownership remains relatively concentrated (OWNERC mean = 0.44), and the boards are moderately independent (BIND mean = 0.41) and have limited gender diversity (BDIV mean = 0.12). The prevalence of CEO duality is 16%, while 70% of the firms are audited by an auditor from one of the Big Four, which is consistent with the corporate governance practices in the region.

Table 3 presents a comparison of analysts' forecast accuracy and the ESG disclosure levels before and after the issuance of the ESG guidelines in 2021. The results indicate a noticeable improvement in analysts' forecasting performance in the post-guidelines period, as the mean absolute forecast error (AFER) declines from 0.28 in 2017–2020 to 0.22 in 2021–2024. Since lower values of AFER indicate a higher forecast accuracy, this reduction suggests an increase in analysts' precision following the guidelines' introduction. The significant difference in means (0.06) implies that this amelioration in the forecast accuracy is not randomly driven.

The table also shows a substantial increase in ESG disclosure levels across the two periods. The mean ESG score rises from 25.3 before the guidelines to 31.7 after their introduction, representing a significant ESG disclosure expansion of 6.4 points following the issuance of the 2021 guidelines.

These preliminary results confirm the expectation that enhanced ESG transparency develops the informational environment and facilitates more accurate earnings forecasts.

Table 4 provides preliminary evidence on the correlations among the study's variables. Consistent with Hypothesis 1, ESG disclosure (ESG) is inversely related to analysts' forecast error (AFER), suggesting that improved ESG reporting is associated with smaller forecast errors and therefore greater forecast accuracy. Furthermore, the correlations among the other variables are moderate, suggesting that multicollinearity is unlikely to be a concern, as all coefficients are below the commonly used threshold of 0.7 (Hair et al., 2010). The VIF tests, reported in the regression tables, further confirm that multicollinearity is not an issue, as all the values are below 10 (Hair et al., 2010).

Table 3. The comparison of analysts' forecast accuracy and ESG disclosure before and after the 2021 ESG disclosure guidelines.

Variable	Period	Obs	Mean	Median	Std.	Q25%	Q75%
AFER	Pre-guidelines (2017–2020)	152	0.28	0.2	0.14	0.12	0.34
	Post-guidelines (2021–2024)	176	0.22	0.16	0.11	0.1	0.28
	Difference Pre-Post guidelines		0.06				
	<i>t</i> -statistics		2.35				
	<i>p</i> -value		0.021 **				
ESG	Pre-guidelines (2017–2020)	152	25.3	24	9.5	18	31
	Post-guidelines (2021–2024)	176	31.7	30	9.8	25	39
	Difference Pre-Post guidelines		6.4	—	—	—	—
	<i>t</i> -statistics		4.28	—	—	—	—
	<i>p</i> -value		0.000 ***	—	—	—	—

Note: The variable measures are defined in Table 1. *** and ** denote statistical significance at the 1% and 5% levels, respectively.

Table 4. The Pearson correlation matrix.

Variable	AFER	ESG	FSIZE	MB	LEV	ROA	SDROA	LOSS	BIG4	OWNERC	COV
AFER	1										
ESG	−0.21 ***	1									
FSIZE	−0.18 ***	0.32 ***	1								
MB	0.09 *	0.14 **	0.11 **	1							
LEV	0.12 **	−0.06	0.15 **	0.08 *	1						
ROA	−0.24 ***	0.19 ***	0.22 ***	0.12 **	−0.28 ***	1					
SDROA	0.27 ***	−0.08	−0.10 *	0.05	0.14 **	−0.35 ***	1				
LOSS	0.31 ***	−0.12 **	−0.16 ***	−0.04	0.09 *	−0.52 ***	0.29 ***	1			
BIG4	−0.14 **	0.26 ***	0.34 ***	0.07	−0.05	0.17 ***	−0.06	−0.11 **	1		
OWNERC	−0.06	0.09 *	0.18 ***	−0.03	0.11 **	0.06	−0.02	−0.05	0.08 *	1	
COV	−0.29 ***	0.31 ***	0.41 ***	0.15 ***	0.04	0.20 ***	−0.09 *	−0.13 **	0.22 ***	0.05	1
BIND	−0.08	0.17 ***	0.10 *	0.03	−0.04	0.06	−0.02	−0.05	0.12 **	0.14 **	0.07
BDIV	−0.05	0.21 ***	0.09 *	0.02	−0.03	0.05	−0.01	−0.04	0.11 **	0.10 *	0.06
BSIZE	−0.07	0.16 ***	0.24 ***	0.06	0.05	0.08 *	−0.03	−0.05	0.14 **	0.12 **	0.19 ***
DUALITY	0.10 *	−0.07	−0.08	0.02	0.04	−0.09 *	0.06	0.11 **	−0.05	−0.03	−0.07
	BIND	BDIV	BSIZE	DUALITY							
BIND	1										
BDIV	0.07	1									
BSIZE	0.06	0.18 ***	1								
DUALITY	0.19 ***	0.27 ***	0.16 ***	1							

Note: The variable measures are defined in Table 1. ***, **, and * denote statistical significance of correlations at the 1%, 5%, and 10% levels, respectively.

4.2. Regression Analysis Results

Table 5 compares our baseline results (Model 1) with those including ESG disclosure guidelines (Model 2). Based on the Hausman test, we used a fixed-effects approach for both models. To correct for heteroscedasticity and serial correlation, we applied firm-level clustered robust standard errors (Petersen, 2009). Finally, we controlled for industry and year effects to handle unobserved heterogeneity.

Regarding Model 1, the results indicate a significant negative coefficient for ESG disclosure of -0.023 ($t = -3.12$), showing that a higher ESG disclosure is associated with lower absolute forecast errors and, consequently, improved forecast accuracy. Our findings confirm Hypothesis 1, supporting that greater ESG transparency allows analysts to make more accurate earnings forecasts. This reinforces the previous evidence from researchers like Khan et al. (2016) and Ferrer et al. (2020), who observed that high-quality sustainability disclosures reduce information asymmetry and increase the quality of predictions.

Table 5. The regression results—ESG disclosure and analysts’ forecast accuracy.

Variable	Model (1) Baseline AFER	Model (2) ESG Guidelines AFER
ESG	−0.023 *** (−3.12)	−0.018 *** (−2.81)
POST	— —	−0.041 *** (−4.09)
ESG × POST	— —	−0.014 *** (−2.76)
FSIZE	−0.011 *** (−2.78)	−0.010 ** (−2.51)
MB	0.013 *** (−2.91)	0.011 *** (−2.64)
LEV	0.041 ** (−2.12)	0.038 ** (−2.05)
ROA	−0.193 *** (−3.46)	−0.187 *** (−3.22)
SDROA	0.284 *** (−3.98)	0.276 *** (−3.75)
LOSS	0.036 ** (−2.17)	0.029 ** (−2.03)
BIG4	−0.018 * (−1.88)	−0.016 * (−1.76)
OWNERC	−0.012 ** (−2.14)	−0.011 ** (−2.01)
BIND	−0.015 * (−1.84)	−0.012 * (−1.71)
BDIV	−0.007 (−0.64)	−0.006 (−0.59)
BSIZE	−0.021 *** (−2.88)	−0.019 *** (−2.63)
DUALITY	0.021 * (−1.73)	0.017 (−1.61)
Constant	0.312 *** (−3.41)	0.298 *** (−3.16)
IndustryEffect	Yes	Yes
YearEffect	Yes	Yes
Observations	328	328
Adjusted R ²	0.29	0.31
Max VIF	1.35	1.37
Hausman Test χ^2 (p-value)	24.57 (0.008)	24.63 (0.007)

Note: The variable measures are defined in Table 1. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Model 2 introduces the POST dummy and the interaction ESG × POST to assess whether the association between ESG disclosure and forecast accuracy changed following the introduction of guidelines in 2021. The significantly negative POST coefficient (−0.041) indicates better forecast precision in the post-guidelines period. More importantly, the significant interaction term ESG × POST (−0.014) confirms that the association between ESG disclosure and forecast accuracy becomes stronger following the introduction of the ESG guidelines, supporting Hypothesis 2. While this finding is consistent with the role of the 2021 ESG guidelines in improving the ESG information environment, these guidelines operate as a quasi-mandatory framework rather than a strictly enforced regulation. In accordance with this, the observed improvement should be interpreted as reflecting a

broader institutional shift, which is driven by regulatory oversight, Vision 2030 reforms, and market-based incentives, in which the ESG guidelines play a central but not exclusive role.

From an economic perspective, the stronger post-guidelines association suggests that enhanced ESG reporting reduces the information asymmetry between firms and analysts, potentially lowering the risk premium demanded by investors and improving the capital allocation efficiency. In practical terms, more informative ESG disclosure allows analysts to make more precise earnings forecasts, which can translate into narrower forecast error bands, increased market confidence, and potentially lower cost of capital for firms that comply with the guidelines (Li & Chen, 2025). This illustrates that the improvements in ESG transparency are not only statistically significant but also have tangible economic consequences for corporate financing and investment decisions.

Regarding the control variables, the results corroborate expectations (García-Sánchez et al., 2019; Elkemali, 2025). The negative relationship between firm size (FSIZE) and forecast errors suggests that analysts provide more precise estimates for larger corporations, possibly due to greater information availability and broader analyst coverage. Firms with higher growth opportunities (MB) exhibit slightly higher forecast errors, reflecting the greater uncertainty associated with growth-oriented firms. Financial leverage (LEV) raises forecast errors, indicating that highly leveraged firms are more difficult to forecast. Profitability (ROA) reduces forecast errors, while earnings volatility (SDROA) increases them, highlighting the importance of earnings stability for forecast accuracy. Firms reporting losses (LOSS) are more difficult for analysts to predict. Among governance variables, board size (BSIZE) and board independence (BIND) are negatively linked to forecast errors, suggesting that stronger governance structures may contribute to improved transparency and better information quality. We note that the adjusted R^2 values indicate that the models explain approximately 29–31% of the variation in analysts' forecast errors, which is reasonable given the complexity of forecasting behavior and the inclusion of firm-level and ESG-related controls.

4.2.1. Additional Analyses: ESG Dimensions

We extend the analysis by examining the standalone ESG components, environmental (ENV), social (SOC), and governance (GOV), to assess their distinct associations with analysts' forecast accuracy. Prior research has shown that these dimensions are often inter-related, and their combined consideration can reinforce effective corporate management (Rahi et al., 2022). Meanwhile, evidence suggests that investors and analysts may attach different levels of importance to each component, reflecting heterogeneous perceptions of their informational value (Duuren et al., 2016).

Consistent with this rationale, Table 6 indicates that all three ESG dimensions are negatively associated with absolute forecast errors, suggesting that greater disclosure in each area improves analysts' forecasting precision. The governance disclosure (model 1.3) exhibits the strongest association, followed by the social and environmental dimensions, implying that transparency regarding governance practices is particularly influential in enhancing analysts' information environment. These findings align with Luo and Wu (2022) and confirm that improvements in analysts' forecast precision are not driven solely by overall ESG disclosure but are supported by each component individually, highlighting the importance of a comprehensive ESG reporting strategy.

Table 6. The regression results—ESG dimensions and analysts’ forecast accuracy.

Variable	Model (1.1)	Model (1.2)	Model (1.3)
ENV	−0.015 ** (−2.45)	— —	— —
SOC	—	−0.018 *** (−2.72)	— —
GOV	—	—	−0.022 *** (−3.05)
FSIZE	−0.010 ** (−2.65)	−0.011 *** (−2.78)	−0.010 ** (−2.71)
MB	0.011 *** (2.53)	0.012 *** (2.71)	0.012 *** (2.68)
LEV	0.038 ** (2.01)	0.040 ** (2.09)	0.039 ** (2.05)
ROA	−0.186 *** (−3.20)	−0.191 *** (−3.39)	−0.188 *** (−3.30)
SDROA	0.278 *** (3.70)	0.282 *** (3.92)	0.280 *** (3.85)
LOSS	0.031 ** (2.05)	0.034 ** (2.14)	0.032 ** (2.09)
BIG4	−0.016 * (−1.72)	−0.017 * (−1.84)	−0.017 * (−1.79)
OWNERC	−0.011 ** (−2.03)	−0.012 ** (−2.12)	−0.012 ** (−2.07)
BIND	−0.012 * (−1.71)	−0.014 * (−1.84)	−0.013 * (−1.78)
BDIV	−0.006 (−0.58)	−0.007 (−0.62)	−0.006 (−0.60)
BSIZE	−0.019 *** (−2.63)	−0.020 *** (−2.85)	−0.019 *** (−2.70)
DUALITY	0.017 (1.61)	0.018 * (1.68)	0.017 (1.63)
Constant	0.298 *** (3.16)	0.307 *** (3.35)	0.304 *** (3.28)
IndustryEffect	Yes	Yes	Yes
YearEffect	Yes	Yes	Yes
Observations	328	328	328
Adjusted R ²	0.30	0.31	0.31
Max VIF	1.31	1.34	1.32
Hausman Test χ^2 (p-value)	23.41 (0.009)	24.15 (0.008)	24.50 (0.007)

Note: The variable measures are defined in Table 1. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.2.2. Robustness

To control for potential endogeneity concerns, we employ the two-step system GMM estimator with Windmeijer-corrected standard errors. This approach is particularly appropriate because it accounts for the persistence of analysts’ forecast accuracy by incorporating lagged dependent variables and addresses endogeneity by using internal instruments (Arellano & Bond, 1991). Compared with alternative approaches, such as generalized linear models (GLM) or Fama–MacBeth regressions, which typically assume exogenous regressors and are less suited to dealing with dynamic panel bias, the GMM estimator explicitly corrects for endogeneity, unobserved firm heterogeneity, and potential autocorrelation in the error terms (Hansen, 1982).

The GMM results (Table 7) reveal that, in both the baseline model (Model 1) and the ESG guidelines model (Model 2), the lagged dependent variable ($AFER(t - 1)$) is significantly positive, confirming that analysts' forecast accuracy exhibits persistence over time. ESG disclosure remains negative in both models, further corroborating Hypothesis 1. In Model 2, the POST dummy (-0.038) and interaction term $ESG \times POST$ are also negative and significant (-0.012), providing support for Hypothesis 2. The magnitude of the $ESG \times POST$ coefficient implies that, following the introduction of the 2021 ESG guidelines, a one standard deviation increase in ESG disclosure is associated with a 1.2% reduction in analysts' forecast errors. Compared to the pre-guidelines period, this improvement reflects a measurable and economically meaningful enhancement in forecast precision, indicating that ESG disclosure provides analysts with more decision-useful information. In practical terms, even a modest reduction in forecast errors can lead to better-informed investment decisions, more efficient capital allocation, and potentially lower cost of capital for firms (Luo & Wu, 2022; Roger, 2024). This result underscores the tangible benefits of structured ESG reporting in emerging markets like Saudi Arabia, where the post-2021 guidelines have strengthened the informativeness and reliability of non-financial information for market participants.

Table 7. The two-step system GMM estimation results—ESG disclosure and analysts' forecast accuracy.

Variable	Model (1) Baseline	Model (2) ESG Guidelines
$AFER(t - 1)$	0.318 *** (4.27)	0.305 *** (4.11)
ESG	-0.021 *** (-2.94)	-0.017 *** (-2.63)
POST	—	-0.038 *** (-3.85)
$ESG \times POST$	—	-0.012 ** (-2.54)
FSIZE	-0.010 ** (-2.36)	-0.009 ** (-2.18)
MB	0.011 ** (2.58)	0.010 ** (2.41)
LEV	0.039 ** (2.07)	0.036 ** (1.99)
ROA	-0.182 *** (-3.08)	-0.176 *** (-2.94)
SDROA	0.271 *** (3.64)	0.263 *** (3.48)
LOSS	0.031 ** (2.05)	0.027 * (1.94)
BIG4	-0.015 * (-1.71)	-0.014 (-1.63)
OWNERC	-0.011 ** (-1.97)	-0.010 * (-1.89)
BIND	-0.012 * (-1.66)	-0.011 (-1.61)
BDIV	-0.006 (-0.57)	-0.005 (-0.52)
BSIZE	-0.018 ** (-2.41)	-0.017 ** (-2.29)
DUALITY	0.016 (1.49)	0.015 (1.44)

Table 7. Cont.

Variable	Model (1) Baseline	Model (2) ESG Guidelines
Constant	0.291 *** (2.94)	0.279 *** (2.81)
IndustryEffect	Yes	Yes
YearEffect	Yes	Yes
Observations	328	328
Hansen <i>p</i> -value	0.438	0.462
AR(1) <i>p</i> -value	0	0
AR(2) <i>p</i> -value	0.327	0.341

***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

The validity of the instruments and the absence of second-order autocorrelation in the residuals are confirmed by Hansen and Arellano–Bond tests, suggesting that GMM results reinforce the findings from the fixed-effects regressions in Table 5. These additional tests demonstrate that the relationship between ESG reporting and analysts' accuracy is robust to endogeneity, dynamic persistence, and firm-specific heterogeneity, and that the observed improvements are not only statistically significant but also economically relevant for decision-making in the Saudi market.

5. Conclusions

This paper examines whether ESG disclosure is associated with analysts' forecast accuracy in Saudi Arabia, with particular attention to the introduction of the ESG disclosure guidelines issued by the Saudi stock market in 2021. Focusing on the periods pre- (2017–2020) and post-guidelines (2021–2024), we assess how the emergence of a formal ESG reporting framework improves the informational environment for financial analysts.

The empirical results reveal that firms with higher ESG disclosure levels are associated with reduced analyst forecast errors. This finding supports the argument that ESG reporting lowers the information asymmetry and increases the forecast accuracy by enhancing the availability of relevant non-financial information. Furthermore, the analysis confirms that ESG disclosure guidelines improved the forecast accuracy and that the association between ESG and analysts' forecast accuracy became stronger after the implementation of this framework. This suggests that these guidelines enhanced the credibility, consistency, and usefulness of the ESG information available to the market participants. The additional analyses examining the standalone ESG dimensions of the environmental, social, and governance scores, as well as the robustness tests using the GMM estimator, confirm that the main findings remain stable after addressing potential endogeneity and heterogeneity.

Our paper contributes to the growing literature on ESG disclosure and capital market outcomes by providing evidence from Saudi Arabia, a major emerging market where ESG reporting practices are evolving, and the role of ESG information in analysts' forecast accuracy remains relatively underexplored. Additionally, the study examines the 2021 ESG disclosure guidelines as an important institutional development, offering evidence on how changes in ESG reporting practices are associated with improvements in the information environment and analysts' forecast accuracy. This highlights the relevance of ESG disclosure in shaping the usefulness of information available to market participants in an evolving regulatory context.

Despite its contributions, this study has some limitations. First, while the Bloomberg ESG data are widely used in the prior literature and provide comprehensive coverage for many listed firms, relying on a single data source, due to the data availability constraints, may limit the ability to capture alternative ESG measurement approaches. Additionally,

although the study examines the impact of the 2021 ESG disclosure guidelines, the post-guidelines period remains relatively short (four years).

Future research could extend the time horizon and explore additional dimensions of ESG reporting quality, such as ESG assurance, voluntary versus mandatory disclosures, or the role of institutional investors in shaping ESG transparency. Moreover, further studies could expand on how ESG disclosure impacts analysts' behavior, such as overconfidence and optimism, particularly within emerging markets where ESG information is still limited.

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