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ESG ACTIONS, CORPORATE DISCOURSE, AND MARKET ASSESSMENT NEXUS: EVIDENCE FROM THE OIL AND GAS SECTOR

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Abstract. This paper focuses on the oil and gas sector because of its direct exposure to the complete range of ESG challenges, as well as strong pressure to change business models due to the energy transition. We investigate the ESG scores of a sample of global companies in this sector and their relationship to stock market performance and to the ESG intensity of corporate reports. As an original contribution, we incorporate the intensity of corporate discourse on technology-related sustainability topics for the first time in the literature. Our findings reveal that investors examine both sustainability discourse and results when determining a company's value and validate the role of ESG scores and rankings in providing investors with an accurate and meaningful assessment of companies' sustainability actions. Moreover, companies' disclosure of their sustainable actions and technological developments related to sustainability is positively related to stock returns. This implies that a focus on sustainable practices and constant communication with investors might result in higher market performance. Furthermore, encouraging companies, particularly those in sectors and industries sensitive to ESG factors, to invest in ESG initiatives, is accompanied by improved performance, which makes them more attractive and better positioned to attract financing.

Keywords: ESG scores, corporate discourse, sustainability, technology, corporate performance, stock returns, panel modelling.

JEL Classification: M21, L21, O14, Q56.

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1. Introduction

The 2015 Paris Agreement adopted at COP21 was expected to be a game-changer for climate change mitigation, but countries' pledges to reduce greenhouse gas emissions were not well kept. The 2022 COP27 Conference in Egypt involved corporations in the debate and stressed that corporate accounts and financial reporting must "speak the truth" about companies' carbon intensity and accurately reflect the climate challenge (Climate Action 100+, 2022).

In this context, public expectations about environment, social and governance (ESG) issues and responsibilities have risen. Therefore, businesses have faced new challenges and

pressures related to ESG disclosures (Kamal & Deegan, 2013), which became critical for their long-term impact on investors and stakeholders (Tarmuji et al., 2016; Busch et al., 2016). Oil and gas (O&G) firms risk missing out on investment fund opportunities, which could affect their finance, investment, and development strategies, unless they build sustainability in their strategies.

Companies in the O&G sector have been heavily criticized for a lack of industry-wide reporting standards, reliance on unproven technologies and carbon offsets, and weak or absent interim targets (Carbon Tracker, 2021). This shows that companies struggle to find credibility, since achieving the net-zero emissions (NZE) would require a fundamental transformation of decades-old business models.

The relationship between ESG criteria and corporate performance has been debated since the 1970s (Friede et al., 2015), with many inconclusive or even contradictory findings (Revelli & Viviani, 2015). The purpose of this paper is to contribute to this line of research by examining sustainable business actions more broadly, focusing not only on ESG scores and their relationship to stock market performance, but also on the link between corporate communications to investors as reflected by Quarterly Earnings Calls (QECs) and ESG scores, on the one hand, and between the ESG intensity of QECs and stock returns, on the other hand. The rationale behind adding the communication dimension is its potential role in shaping the market's expectations regarding the future of a company. Assessing the link between the two has important practical implications in the context of a rising focus on ESG topics throughout the investment community (Moody's, 2021). If discourse intensity proves beneficial, then constant communication with investors would constitute an advantage. Moreover, the relationship between corporate discourse and ESG scores may be used by market analysts and other stakeholders to check whether discourse is reflective of action.

Since there is little literature on individual sectors and industries in connection to ESG issues, we direct our analysis to the O&G sector due to the exposure of its companies to the full spectrum of ESG issues. Their impact on the environment is typically the focus of various stakeholders, but the socioeconomic outcomes for local communities can be equally controversial. Moreover, the energy transition pressures O&G companies to shift their business models toward clean energy while maintaining profitability. Such a shift would require the development of new skills and knowhow in highly competitive sectors such as renewable energy and electric mobility. For this reason, we add technology to the three ESG topics.

Our research contributes significantly to the increasing literature on sustainability disclosure, ESG performance, and corporate value in three ways. First, it drills down to the sector level, concentrating primarily on oil and gas businesses, which face considerable sustainability risks and difficulties in meeting the NZE target. There is a notable research gap in this domain, with very few scholarly efforts focusing on the energy sector, despite its enormous environmental effect and critical role in the sustainability transition. Our research provides distinctively relevant insights by focusing on the most exposed yet under-researched industry. Furthermore, because we assess all three ESG components, our methodology is applicable to a wide range of industries, with varying materiality considerations for each dimension.

Second, the methodology includes quantitative ESG ratings as well as qualitative discourse analysis of earnings calls into an integrated framework that reflects the duality of sustainability communications – discourse and action. This novel approach investigates whether executives' ESG commitments translate into measurable performance advantages visible to investors. In this regard, we employ QECs to investigate enterprises' sustainability rhetoric. Because they are issued more frequently than annual or sustainability reports, they are more

focused on recent performance and may include more information regarding the company's initiatives. As a result, the paper's contribution resides in bridging qualitative and quantitative methods in order to provide a thorough and comprehensive understanding of how sustainability communications impact market value.

Third, and perhaps most importantly from the standpoint of practitioners, the analysis pioneers the inclusion of technological improvements for sustainability alongside ESG topics. This underscores the critical importance of technical innovation in allowing oil and gas firms to align with decarbonization pathways. By analysing rhetorical emphasis and demonstrated capabilities around low-carbon technologies, this approach guides investors to anticipate stranded asset risks and competitive positioning. To the best of the authors' knowledge, no previous academic work has proposed this technological perspective into assessments of sustainability communications; thus, this study is the first attempt to establish a link between corporate communication regarding sustainable initiatives and technology-related subjects relevant to sustainability, followed by an examination of their impact on companies' ESG ratings and market valuation.

We further contribute to existing scholarly work in three ways in terms of methodological design. First, we examine the association between corporate practices and stock performance using the three primary constituents of ESG factors (environment, social and governance), in addition to the total ESG score, adding to the relatively few scholarly studies that have taken this approach. Second, our study covers a longer time period (11 years), whereas previous research covered much shorter periods (typically three to five years). As a result, we investigate the influence of concerns about sustainability and ESG principles during the last decade, including the two most difficult pandemic years, 2020 and 2021 – during these two years, corporate efforts were mostly directed towards cost control and survival, therefore sustainability actions became secondary to business strategies. Finally, rather than constructs like Tobin's Q or accounting-based performance metrics like ROA and ROE, which are particularly prone to management manipulation (Cornett et al., 2008), we employ stock returns as a measure of a company's market performance.

To summarize, this research explores a novel research agenda by highlighting a previously disregarded industry, developing a novel methodological approach mixing discursive and measurable sustainability outputs, and bringing technology into the assessment of ESG influence on corporate performance. The findings are critical not only for executives planning around ESG communications and technological investments in the race to Net Zero, but also for policymakers designing regulations and strategies to encourage companies to improve sustainability discourses, which are reflected in business valuations.

The remainder of the paper is organized into four sections. The first is the Literature review, followed by Research methods, which details the data and justifies the use of dynamic panel modelling approach. The next section highlights and discusses the key findings. The last section concludes, examines the implications of our research, and outlines potential avenues for further research.

2. Literature review

Although there is no specific integrative theoretical framework dedicated to the relationship between sustainability actions, discourse and corporate performance, several related theories and conceptual frames of reference support the relationship between the three, highlighting the potential positive influence of ESG considerations on a company's financial perfor-

mance and overall sustainability. Some are more relevant for the effects of discourse and here we highlight signaling theory according to which management will provide additional information as a way to deal with information asymmetry (Akerlof, 1970), with companies registering good performance and prospects expected to signal this to investors. Along with Stakeholder, Agency and Legitimacy theories described below they underpin the field of voluntary disclosure research which explores the rationale behind deliberate corporate disclosures and their effects – for an overview and comparison of each in the voluntary disclosure context see Cotter et al. (2011).

The problems are determined by the lack of consensus in reporting or by selecting indicators that show only favourable results in this area. Without a homogenous and standardized basis for ESG disclosures, it is difficult to measure the ESG performance of a firm (Garz & Volk, 2011). Certainly, ESG ratings depend on the selected criteria. Some ESG criteria are related to improvements in ecological and/or social-ethical results (Chatterji et al., 2009), whereas others must be regarded as relatively meaningless (Delmas & Blass, 2010) and this creates negative consequences (Orlitzky, 2013). An increased level of transparency is also necessary for the screening techniques used in sustainability assessments and ratings, as investors need to understand and fully trust ESG information and scores.

Regarding the ESG disclosures across economic sectors, Baier et al. (2020) noticed that the healthcare and energy sectors present the highest share of ESG reporting and disclosures, but the focus is mainly on corporate governance. Díaz et al. (2020) found that corporate environmental and social dimensions are the main drivers for ESG impact in different sectors and the environmental pillar displays the weakest impact on the energy sector returns, while the social pillar impacts mainly on Communications, Real Estate, Financial sector, Industrials and Technology sector.

At present, the ESG ratings industry is highly fragmented, and the backgrounds of firms are heterogeneous, many entering this business from different areas of historical expertise (Larcker et al., 2022). Extant research has used these ratings to explore what information included in corporate reports makes its way to ESG scores, but also to investigate the relationship between ESG score and companies' financial performance.

The relationship between sustainability reporting and corporate performance was widely studied (Goyal et al., 2013), but the results were inconclusive or mixed, because of different methodologies applied (Orlitzky et al., 2003). In this vein, Caesaria and Basuki (2017) found a positive relation between sustainability disclosure and market performance, but Hvidkjær (2017) reached mixed results on the relationship between environmental and social disclosures and investors' returns, while social screens were positively related to investors' returns. Bernardi and Stark (2018) found a strong relationship between ESG disclosures and the accuracy of forecasting the financial performance for both financial and non-financial firms. ESG reports support meeting the needs of external stakeholders and contribute to a better allocation of internal resources of the companies (Villiers, 2014). However, they can only provide historical information and may not be relevant to investment decision (Lin et al., 2009) or create additional costs that may have negative impact on companies' financial performance, costs that can be transferred to customers (Lamberton, 2005).

A firm engaged in disclosing ESG information and having a good relationship with its stakeholders can achieve sustainable corporate performance (Rezaee, 2016). Voluntary ESG disclosures show that the companies are complying with societal expectations and norms (Lys et al., 2015). Besides theoretical developments, many previous empirical studies have demonstrated that ESG reports positively influence both the financial and environmental

performance of the companies that adhere to the ESG principles (Weber, 2014). Since the mid-1990s, the positive correlation patterns have been stable over time in most of the studies.

Researchers have explored mainly one specific dimension of ESG and its relationship with firms' performance (Lee et al., 2016), but a few studies examined all three ESG dimensions in relation with firms' performance (Tarmuji et al., 2016; Bhaskaran et al., 2020). Zahid et al. (2022) investigated the relation between all three aspects of ESG and corporate financial performance for Western European companies and found there is an adverse impact of ESG disclosure and practices on the financial performance of the companies, because ESG reporting increases costs. However, according to the authors, it also leads to increases in companies' income, since customers are attracted to the firms that make efforts to implement ESG practices and properly inform stakeholders. Zahid et al. (2023) demonstrated that a high ESG performance determines an easy access to financing on stock markets for companies and lower indebtedness ratio and this relation, particularly for state-owned companies operating at national level, compared to other companies operating at regional level in China. Eliwa et al. (2021) proved that ESG disclosure determines the decrease of the capital cost, improves financial performance and the company value.

The above-mentioned theories also explain the relationship between actions (actual ESG performance) and market performance. According to Freeman's Stakeholder theory (Freeman, 1984), firms are accountable to a wide range of stakeholders, including employees, consumers, suppliers, communities, and the environment (Parmar et al., 2010). Furthermore, the Agency theory can be used to highlight that ESG actions can align managers' and shareholders' interests. Thus, managers may act in the best interests of shareholders by evaluating long-term sustainable plans, resulting in improved business performance and value creation (Panda & Leepsa, 2017; Velte, 2017). Legitimacy theory is focused on the company's need to operate within the bounds of society's value system. An organization will seek to gain the support of stakeholders and alleviate their concerns particularly in the wake of a major negative event such as the 2010 Deepwater Horizon disaster (Breeze, 2012). Among the levers used are actions and discourse related to ESG. The O&G sector is confronted with a pressing requirement to secure its legitimacy in the context of the energy transition, making the theory highly relevant.

The Resource-Based View (RBV) theory can be also used to emphasize that companies that effectively manage ESG issues can strengthen their competitive advantage by developing intangible assets such as strong brand reputation, innovation capabilities, and social capital (Lockett et al., 2009 for a good overview of RBV). Additionally, because it evaluates performance in three dimensions – financial, social, and environmental – the Triple Bottom Line framework may be credited with integrating ESG factors into company operations. As a result, by addressing ESG concerns, businesses can foster trust and positive connections with stakeholders, resulting in enhanced loyalty, a better reputation, and long-term sustainable performance even in the face of market adversity (Huang, 2021).

Kim and Li (2021) found a positive relation between the total ESG score and its corporate governance dimension, on the one hand, and corporate performance, on the other hand, based on observations during 1991–2013. Kim and Li (2021) also found that, except the environmental dimension, total ESG scores and the other two dimensions significantly impact on corporate credit ratings and, thus, on corporate risk. Qureshi et al. (2021) found a positive relation between ESG factors and market-based financial performance of companies, but only mixed evidence for the relation between ESG factors and accounting-based financial performance for US corporations during 2009–2018. ESG scores are directly and indirectly

influenced by the firm's size and its available resources, and this means that larger companies benefit from a higher ESG score. Therefore, not always an ESG score can best predict an improvement in the corporate sustainable performance (Drempetic et al., 2020).

Birgden et al. (2009) have studied the ESG role for management investment decisions in emerging markets and found that corporate social responsibility (CSR) displays a greater importance than environmental social responsibility (ESR) in emerging markets like China, Brazil, India or South Korea. They consider ESG as a tool for covering the management risk, rather than a tool for increasing the market value of a company in the long-run.

Based on the identified research gap in the existing literature, the paper's research goal is to conduct a comprehensive investigation of the relationship between sustainable actions and business performance in the global O&G sector, mediated by corporate communications on sustainable practices. Thus, the major research question we examine is whether the intensity of companies' sustainability rhetoric is reflected in both ESG scores and stock market value (through stock returns). As previously stated, examining the relationship between corporate communications on sustainable actions and stock market valuation is critical given the growing interest in ESG-related topics in the investment community, particularly for a sector with significant exposure to potential sustainability risks.

3. Research methodology

The main objective of our paper is to study the link between corporate sustainability discourse, ESG scores and financial performance in the O&G sector. To reach this objective, we implemented a two-phase analysis, described in Figure 1. In the first phase, using the latent Dirichlet allocation (LDA) model, QECs of 45 companies from the O&G sector have been searched based on a comprehensive and relevant list of sustainability-related words on four dimensions: environment (E), social (S), governance (G) and technology (T) – the list of words is available from the authors. Then, we calculated the frequencies of sustainability-related words in QEC for each year included in the analysis, which became the fundamental blocks for the second stage of our analysis. In the second stage, applying panel data methods (random effects panel regressions and dynamic panel GMM estimators) we tested the link between companies' sustainability discourse reflected in frequencies and ESG scores – sub-stage (1), – the relationship between the sustainability discourse and market performance – sub-stage (2), and the association between ESG scores and companies' market performance, embedded in annual returns – sub-stage (3). Firms were selected from US, Europe and Canada, because there are large difference in terms of sustainability friendly practices in Europe comparing to US or Canada and the way companies communicate that to investors. Sustainability reporting is mandatory for big public interests companies the EU (Vander Bauwhede & Van Cauwenberge, 2022).

Building on the theoretical framework described in the literature review section, we list the following hypotheses for the relationships described above.

Hypothesis 1: Sustainability discourse is positively related to ESG scores.

This can be explained by the fact that companies with strong performance in this area would be likely to emphasize it, according to signaling theory. The relationship between sustainability discourse and market performance is less clear. As QECs have limited time, if a business's management pursues ESG or technology themes and prompts related queries, it is reasonable to assume that it believes the company has a competitive advantage regarding these topics, in line with RBV theory, and that discussion will positively affect the market's

valuation of the company. Hence, a strong ESG or technology focus in corporate QECs should result in positive market performance. Therefore, we state that:

Hypothesis 2: Sustainability discourse positively impacts the market performance of corporations.

Nevertheless, environmental achievements can be overemphasized, leading to allegations of so-called greenwashing, and so too can technological ones. Furthermore, management can choose to focus on these topics to detract from poor operational or financial performance. This makes the relationship between this type of corporate discourse and market performance unclear. However, when viewed through the lens of legitimacy theory, companies are expected to match discourse with action in order to address stakeholder concerns, else risk losing support and legitimacy. Due to the increased focus on ESG concerns in recent years, we expect a positive correlation between ESG scores and market performance with the caveat that such scores are an imperfect measure of a company's actual performance, as noted in the previous sections. As postulated by Agency theory, ESG actions may serve to prove that management is aiming for long term value creation in line with shareholder interests, supporting market outcomes. Moreover, since such ESG considerations serve the interests of a broad range of stakeholders to which the company is accountable (as suggested by Stakeholder theory), benefits can be derived such as reputation and ease in securing talent. These may further aid market returns. Thus, we state that:

Hypothesis 3: The ESG score positively impacts the market performance of the companies.

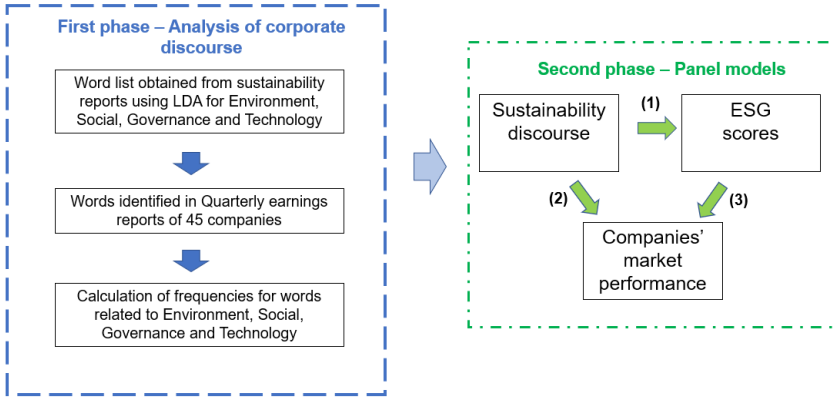

Figure 1. Research phases (source: authors' design and representation)

Phase 1. ESG and technology information in companies' discourses

The corporate discourse is represented by transcripts of QECs, a suitable communication channel since it is not under the full control of the company. These types of events typically include a questions and answers section in which analysts can query management on various topics of relevance. The transcripts were sourced from NASDAQ for the 2011–2021 period for 45 listed companies in the Oil, Gas & Consumable Fuels GICS – Global Industry Classification Standard sector of market participants (MSCI, 2023). The number of companies in the sample was limited by the availability of ESG scores provided by Refinitiv over the entire period. The list of companies is available from the authors.

Since our dataset is restricted to O&G companies, we opt for constructing a sector-specific word list and measuring the intensity of selected topics by computing the frequencies of relevant words. The challenge lies in constructing a comprehensive list of words for each topic, but there are advantages of using a sector-specific approach due to polysemy and idiosyncratic contexts of different industries. We also use a combination of machine learning and manual labelling with the application of the LDA model introduced by Blei et al. (2003). An in-depth discussion on the method is provided by Steyvers and Griffiths (2007). The words were chosen from among the top 100 words (with the highest probability scores) in each area. After compiling the word list, we calculate the frequency of each of the four categories for each company every year, dividing the number of occurrences in each transcript by its length, after excluding similar paragraphs and words removed during pre-processing. Calculations were performed in Matlab.

Phase 2. Linking sustainability discourse to ESG scores and corporate market performance

The second stage of our research is built on the frequencies of E, S, G and T related words and investigates the link between sustainability discourse of companies in the O&G industry and their market performance. We proceed in three sub-stages, as follows.

Sub-stage 1. Sustainability discourse and ESG scores

We examine the significance of sustainability discourse – E, S, and G – for ESG scores, with the goal of determining whether corporate managers' communications to market investors in sustainability are incorporated into ESG scores. We collected the ESG scores and their three components from Refinitiv over the 2011–2021 period. The scores are based on over 630 business-level ESG measures, which are further combined to provide the E, S and G pillar ratings (Refinitiv, 2022). The ESG score is a relative sum of the weights for E and S, which vary by industry, while the weights for G are the same across all industries. For the O&G sector, the weights are 34.5% for E, 42% for S, and 23.5% for G.

We used panel data regression to model the association between corporate discourse and ESG scores. Panel models are a well-established econometric tool because of their ability to work with small samples and additional benefits such as less collinearity, controlled heterogeneity, more degrees of freedom, and higher efficiency in identifying and measuring relationships between economic (and other) phenomena (Baltagi, 2005). Furthermore, the GMM framework's flexibility is better suited for unbalanced panels and handles many endogenous variables well (Roodman, 2007).

The estimated panel model is based on Wooldridge (2010) and takes the form below:

$$Y_{it} = \alpha_{it} + \beta_{it} X_{it} + \gamma_{it} + \varepsilon_{it}, \quad t = 1,\ldots T \text{ and } i = 1,\ldots N, \tag{1}$$

where Y_{it} is the dependent variable, X_{it} denotes the set of independent variables, and β_{it} designates the estimated coefficients. Individual effects (company effects) are included in the model by γ_{it} and ε_{it} is the idiosyncratic model error.

In this specification ESG score is the dependent variable and corporate discourse frequencies are independent variables. All variables are logarithmically transformed to achieve more normal distributions. Table 1 lists the variables examined in this study.

We begin by estimating a basic pooled ordinary least squares (OLS) panel and testing for the presence of its underlying assumptions using the Durbin-Watson test for autocor-

Table 1. Variables description (source: authors' work)

Variable	Notation	Definition	Source
Corporate discourse			
Frequency of E–related words	E_FREQ	Number of "environment" – related words in companies' QEC	Own calculation
Frequency of S–related words	S_FREQ	Number of "social" – related words in companies' QEC	
Frequency of G–related words	G_FREQ	Number of "governance" – related words in companies' QEC	
Frequency of ESG–related words	ESG_FREQ	Sum of E, S and G frequencies	
ESG scores			Refinitiv
ESG Pillar Score	ESG	Refinitiv ESG score	
Environment Pillar Score	ENV	Environmental score	
Social Pillar Score	SOC	Social score	
Governance Pillar Score	GOV	Governance score	
Corporate performance and control variables			
Annual return	RET	52-week return (%)	
Financial leverage	LEV	Long-term debt to total capital (%)	
Company size	MKC	Market capitalization, end of year (billion USD)	
Oil price	BRENT	Price of Brent oil, average of the year (USD)	

relation and the Breusch-Pagan test for heteroscedasticity. In case the pooled OLS model is rejected, we estimate fixed effects (FE) or random effects (RE) panel models (Baltagi, 2005). To discriminate between the FE and RE effects estimation, the typical approach relies in using the Hausman test (1978) for correlated random effects, whose null hypothesis states that the difference in coefficients between RE and FE is not systematic. Hence, after verifying the pooled OLS assumptions, we have applied the Hausman test to decide on the best estimation approach.

Sub-stage 2. Sustainability discourse and corporate market performance

Next, we examine whether financial market investors factor in O&G businesses' sustainability discourse and market performance. To this end, we estimate dynamic system-GMM models based on the general specification below:

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 X_{it} + \beta_3 X_{it-1} + \beta_4 Z_{it} + \varphi_t + \varepsilon_{it}, \quad (2)$$

where Y_{it} is the dependent variable, market stock return (RET), $Y_{it\text{-}1}$ is the one-year lag of the dependent variable, and X_{it} is the vector of sustainability discourse variables (main regressors), i.e., frequencies of E, S, G, and T variables (E_FREQ, S_FREQ, G_FREQ, T_FREQ). Moreover, we have constructed the ESG_FREQ variable, which is the sum of E_FREQ, S_FREQ, and G_FREQ. We have implemented the model with one-year lag of regressors (X_{it-1}). In all estimations, the main regressors were accompanied by control variables, included in Z_{it} – leverage (LEV), size (MKC), and the price of Brent oil (BRENT) – to control for the omitted variable bias (see

Table 1). The variables were selected based on existing literature – see, for example, Fama and French (1992), Akron and Taussig (2022).

GMM estimations offer many advantages than pooled or FE/RE models since they do not suffer from the omitted dynamics that affect static panel models (Liu et al., 2020). Thus, the GMM estimation enables flexible instrument selection, which is critical in dealing with endogeneity and other identification issues in panel data analysis (Arellano & Bond, 1995). Furthermore, in panel data models, both the difference and system-GMM approaches produce consistent results. However, system-GMM is often more efficient since it incorporates both contemporaneous and lagged variations of endogenous variables, resulting in more robust and exact parameter estimations (Baltagi et al., 2009; Wintoki et al., 2012). Additionally, the GMM estimate well handles serial correlation in panel data. The difference-GMM strategy is particularly well-suited for dealing with first-order serial correlation, but the system-GMM approach is better suited for dealing with higher-order serial correlation, increasing the confidence in the estimated coefficients (Roodman, 2009).

We begin by using the Blundell and Bond (1998) method to choose between difference and system-GMM, but we also present estimates for the alternative option. To avoid having to choose between one-step and two-step estimators, which are highly debated in the econometric literature, we employ the iterated GMM estimator introduced by Hansen et al. (1996), which updates the weighting matrix and coefficient estimates until convergence is reached, thus eliminating the arbitrariness in selecting the initial weighting matrix (Hansen & Lee, 2021).

The consistency of the estimated models has been verified by several diagnostics. First, we confirmed instruments' validity by employing the Sargan/Hansen test of overidentifying limitations (Sargan, 1958; Hansen, 1982). Second, the Arrellano-Bond test for second-order serial correlations in residuals has been applied (Arellano & Bond, 1991). Windmeijer (2005) finite-sample correction and instrument collapse were used to estimate instrument proliferation in small panels.

Sub-stage 3. ESG scores and corporate market performance

In the third stage, we benchmark the findings in sub-stage 2 against the relationship between ESG scores and stock returns of O&G companies. The general specification of the model is similar to the one presented in Equation (2), except that X_{it} is now the vector of ESG scores. Thus, X_{it} is represented in the models by ESG, ENV, SOC and GOV. We estimate the model parameters using the iterated GMM approach.

4. Results and discussion

4.1. Analysis of corporate discourses

Figure 2 shows the average frequencies for each of the four categories across all companies. The environmental dimension (E_FREQ) exhibits perhaps the most interesting development at sample level. It is broadly stable up to 2019, displaying consistent growth thereafter. This correlates with the launch of Europe's Green Deal policy framework in 2019. However, in the few years following the landmark Paris Agreement in 2015, no significant rise can be observed. This can be interpreted as a need for strong policy commitment to spark interest in environment-related topics. The social dimension (S_FREQ) is stable between 2011 and 2019 but rising in 2020 and 2021, due to the inclusion of words related to the pandemic as related

to health and safety. The governance category (G_FREQ) remains broadly stable throughout the entire period and has a greater weight than all others. This is explained by the presence of words related to shareholders and dividends, shareholder returns being a prevalent theme in QECs. Finally, interest in technology topics (T_FREQ) displays modest growth over the past several years which is explained by the connection with the environment category. Words related to technology include many that are linked to the energy transition (e.g., biofuel, photovoltaic). The variability among firms grew over time for all dimensions of corporate discourse on sustainability, implying more variations between O&G companies in how they communicate sustainable practices to investors. This dynamic may be potentially explained by the geographical distribution of the companies. Out of a total of 45 companies in our sample, 28 are based in the US, 5 in Canada and 12 in Europe. European companies have been much more aggressive in their sustainability ambitions compared to their North American peers, reflecting the differences in policy between Europe and US.

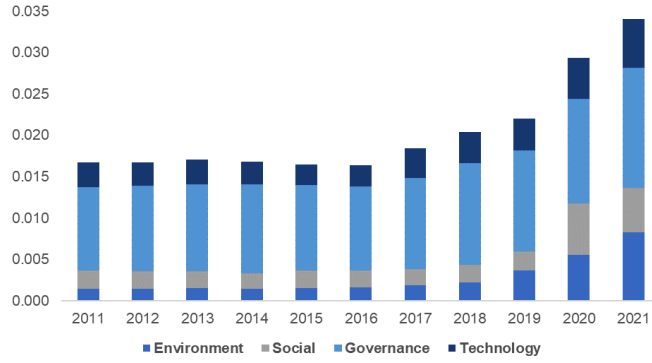

Figure 2. Frequency averages (source: authors' representation)

4.2. Analysis of ESG scores

Overall ESG scores in our sample were constant as mean and median between 2011 and 2013, then decreased until 2016 before resuming an upward trend to reach the highest level in history in 2021 (see Figure 3). This is explained by companies' efforts to improve their ESG performance, strongly coupled with the emphasis that investors have placed on sustainable corporate performance (McNulty & Nordberg, 2016). Many institutional investors have also

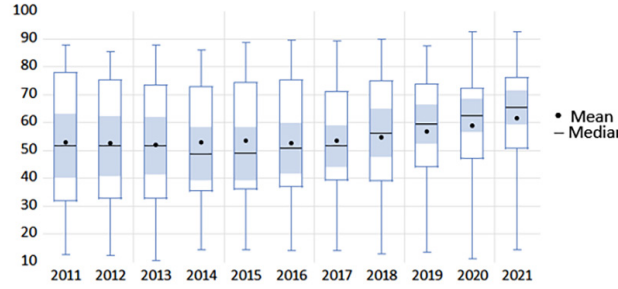

Figure 3. ESG scores over time (source: authors' representation)

adopted sustainable investment approaches, such as investing in companies that have a good environmental impact or are socially responsible (Folqué et al., 2021).

4.3. Results of panel regression models

Table 2 presents the descriptive statistics for all variables in our models. The results of our panel model estimations are presented in Tables 3 to 6. Since data on ESG scores, return and the other independent variables, except for frequencies of ESG discourse, were not available for all companies during the investigating time frame, the number of observations for these variables was lower than 495. Moreover, all the panel estimations were performed for unbalanced panels.

Table 2. Descriptive statistics (source: authors' work)

Variables	Observations	Mean	Standard deviation	Minimum	Maximum
RET	476	0.086	0.487	–0.760	3.820
ESG_FREQ	495	0.014	0.008	0.000	0.050
E_FREQ	495	0.001	0.004	0.000	0.020
S_FREQ	495	0.001	0.004	0.000	0.020
G_FREQ	495	0.011	0.004	0.000	0.020
T_FREQ	495	0.002	0.004	0.000	0.020
ESG	471	54.994	21.671	10.680	92.890
ENV	466	49.866	26.796	0.980	93.670
SOC	471	52.938	25.458	6.310	95.570
GOV	471	66.958	21.419	9.700	98.550
LEV	494	0.347	0.258	0.000	2.800
MKC	476	38.70	68.90	0.89	439.00
BRENT_AVG	495	75.358	26.174	41.960	111.630

First, we provide the findings regarding the reflection of corporate sustainability discourse in ESG scores. The pooled OLS model was rejected based on the Durbin-Watson autocorrelation and Breusch-Pagan heteroscedasticity tests, so we resorted to FE/RE panel estimation. The Hausman test revealed that RE is better suited to our estimation. Except for G_FREQ, all other frequency coefficients are positive and statistically significant (see Table 3). This implies that ESG scores are consistent with O&G businesses' reports of sustainability framework initiatives, and a 1% increase in overall ESG frequency in earnings calls results in a 6.7% increase in the ESG score. Furthermore, a 1% increase in E_FREQ leads to a 5.8% increase in the ESG score, and a 1% increase in S_FREQ leads to an 8.7% increase in the ESG score. Our findings imply that sustainability initiatives discussed in QECs have a positive impact on ESG scores, which validates the first hypothesis formulated in the study. Furthermore, this supports the role of ESG scores and rankings in providing investors with an accurate and meaningful assessment of the sustainability of O&G companies.

Second, in Table 4 we report the results of iterated difference and system-GMM estimations (10 models) for the relationship between corporate discourses in the O&G industry and

Table 3. Discourse to ESG score: results of panel estimates (source: authors' work)

Variables	Model 1	Model 2
Dependent: LOGESG		
LOGESG_FREQ	0.067***	
LOGE_FREQ		0.058***
LOGS_FREQ		0.087***
LOGG_FREQ		0.309
Constant	1.972***	2.068***
Observations	471	471
Wald test	57.14	115.18
p-value of Wald test	0.00	0.00
Hausman test	0.558	0.191
Model	RE	RE

Note: *** denotes statistical significance at 1% level.

stock returns. The difference-GMM was identified as the best approach using the Blundell and Bond (1998) method, but we also present the findings of the system-GMM estimation. To avoid the selection of either one or two step system-GMM, we opt for the iterated system-GMM, as outlined in the Research methodology section. However, the two estimation approaches offer very similar results. We implemented five specifications: we initially included ESG FREQ (Models 3 and 8), then E_FREQ, S_FREQ, and G_FREQ separately (Models 4–6 and 9–11), followed by a joint assessment of their impact on ESG scores (Models 7 and 12).

The positive and statistically significant coefficients for ESG_FREQ imply that companies' reporting of their sustainable operations has a favourable influence on their stock returns. A 1% increase in the frequency of words related to sustainability in QECs results in 9–18% higher returns. Furthermore, investors appear to be interested in past reporting on sustainable practices, given the positive coefficient for 1-year lagged ESG_FREQ. Corporate communications on environmental and social actions matter to market investors: a 1% increase in E_FREQ leads to a 16–33% increase in annual return (coefficients are positive and statistically significant in both difference and system-GMM), while a 1% increase in S_FREQ leads to a 15% increase in returns. Furthermore, O&G companies' social activities and initiatives are remembered by investors since such actions result in a 14% rise in future year's returns when S_FREQ increases by 1%. Also, S_FREQ is statistically significant for returns in the all-frequencies model (Model 12), both for contemporaneous and lagged values. In contrast, no association with returns appears to exist for G_FREQ in any of the models.

These findings validate the second hypothesis of the study, as the overall sustainability discourse (embedded in the ESG score) leads to higher stock returns of O&G companies. However, only the environmental and social components of the sustainability discourse was found to positively impact returns, while the governance score is not related to performance. A positive association between ESG and the environmental component of the ESG discourse and company's market valuation was also found by Amel-Zadeh and Serafeim (2018) and Plumlee et al. (2015), and our results confirm these studies' conclusions. On the other hand, Henry et al. (2021) found that ESG discourse is positively associated with companies' market value, but not environmental disclosures. The difference may stem from the sector inves-

Table 4. Discourse to performance: results of panel GMM estimates (source: authors' work)

	Iterated difference GMM					Iterated system-GMM				
Variables / Model	3	4	5	6	7	8	9	10	11	12
Dependent: LOGRET										
LOGRET(-1)	–0.286***	–0.247***	–0.262***	–0.436***	–0.269	–0.083	–0.187**	-0.157*	–0.358***	–0.129
LOGESG_FREQ	0.183*					0.089***				
LOGESG_FREQ(-1)	0.030					0.124**				
LOGE_FREQ		0.331***			0.049		0.164**			0.03
LOGE_FREQ(-1)		–0.121			0.003		0.102			0.004
LOGS_FREQ			0.059		0.059			0.153**		0.139***
LOGS_FREQ(-1)			0.143***		0.127			0.141**		0.151***
LOGG_FREQ				4.435	–6.512				2.018	–1.894
LOGG_FREQ(-1)				0.164	2.317				0.164	0.271
LOGLEV	–2.329	–1.994	–1.083	1.923*	–0.959	–3.652***	–2.61*	–1.78*	1.663	–1.958**
LOGMKC	0.995***	0.732***	0.638***	1.620***	0.664	0.315	0.536***	0.532***	1.413***	0.4788
LOGBRENT	–0.604***	0.399***	–0.328***	0.155	–0.322**	–0.395**	–0.418***	–0.278***	–0.348	–0.288***
Observations	409	431	431	431	431	409	431	431	431	431
Constant	–7.376*	–5.507*	4.798*	–15.299*	–5.002**	–0.778	–3.2***	–3.522**	–13.40*	–2.87***
AR(2)	0.736	0.059	0.138	0.595	0.422	0.637	0.615	0.761	0.836	0.53
Hansen statistic	0.567	0.668	0.063	0.844	0.092	0.49	0.134	0.428	0.746	0.704

Note: ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively. The table reports z-tests and corresponding p-values.

tigated in the current study, O&G, with a strong environmental footprint, but marked by consistent efforts made by companies to invest in protecting the environment and convince investors of their environmentally-conscious behaviour.

The relevance of technology topics in corporate discourse for O&G company stock returns was estimated in the next step (see Table 5). As in the case of results reported in Table 4, the difference and system-GMM results are very similar. Investors pay attention to information in QECs related to technology advances related to sustainable practices, and business attempts to convey their actions in this area are reflected in higher returns. All statistically significant coefficients are consistent across the four models: positive for contemporaneous T_FREQ but negative for 1-year lagged values. When T_FREQ increases by 1%, O&G companies' stock returns increase by 18–44%, depending on the model. The negative coefficients of lagged T_FREQ were unexpected, and they may stem from the cyclical nature of the business, with alternating periods of high and low returns. Discussion around technology topics may be more sensitive to such conditions, being deemphasized during a downturn, as appears to be the case for the 2014–2016 period. The positive coefficients for ESG_FREQ also imply that comprehensive sustainability reporting in all relevant areas contributes to improved stock returns in the O&G sector.

Table 5. Technology discourse to performance: results of panel GMM estimates (source: authors' work)

	Iterated difference GMM		Iterated system-GMM	
Variables	13	14	15	16
Dependent: LOGRET				
LOGRET(-1)	–0.386***	–0.386***	–0.262***	–0.087
LOGESG_FREQ		0.114**		0.076*
LOGESG_FREQ(-1)		0.012		0.119*
LOGT_FREQ	0.446***	0.181*	0.271**	0.042
LOGT_FREQ(-1)	–0.141***	–0.116***	–0.096***	0.031
LOGLEV	–1.154	1.791*	–1.885	–3.663***
LOGMKC	0.805	0.759***	0.483	0.315
LOGBRENT	–0.413***	–0.381***	–0.231*	–0.391**
Observations	431	409	431	409
Constant	6.055***	–0.565	–3.447	–0.689
AR(2)	0.337	0.341	0.443	0.542
Hansen statistic	0.337	0.382	0.081	0.633

Note: ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively. The table reports z-tests and corresponding p-values.

Finally, Table 6 displays the GMM estimates of the relationship between ESG scores and stock returns. The findings – very similar for the difference versus system-GMM - reveal that investors factor these ratings into the valuation of O&G firms, and that superior sustainability performance translates into higher returns. Improvements in the total ESG score and in each of its components result in higher returns for O&G enterprises. Thus, a 1% rise in ESG scores leads to a 196% higher return (Model 22), but an increase in ENV scores results in a 56–239%

Table 6. ESG scores to performance: results of panel GMM estimates (source: authors' work)

	Iterated difference GMM					Iterated system-GMM				
Variables	17	18	19	20	21	22	23	24	25	26
Dependent: LOGRET										
LOGRET(-1)	–0.302*	–0.170	–0.197	–0.012	0.105	–0.292**	–0.221	–0.314***	–0.191**	–0.153
LOGESG	2.511					1.965**				
LOGESG(-1)	–1.927					–1.348*				
LOGENV		2.397*			0.045		1.218**			0.557*
LOGENV(-1)		–1.890			–0.594		–0.825**			0.531*
LOGSOC			–1.071		–3.746			0.888*		0.813*
LOGSOC(-1)			1.696		4.465			–0.439		–0.557
LOGGOV				1.971*	2.039				0.377	0.294
LOGGOV(-1)				–1.097	–1.067				0.105	0.219
LOGLEV	0.696	3.705*	–0.203	0.045	0.938	0.704	1.654	0.555	0.869	0.287
LOGMKC	1.054	0.985*	1.075	1.260*	2.385	1.013***	0.941***	0.833*	0.9488	0.714***
LOGBRENT	–0.256	0.318	–0.446	–0.639*	–1.323	–0.255	0.0574	–0.134	–0.252*	0.024
Observations	413	407	412	412	407	412	407	412	412	407
Constant	10.964	–11.567**	–10.729***	–13.019	–23.626	–10.608***	–10.192	–8.649	–9.979***	–8.454***
AR(2)	0.345	0.888	0.249	0.159	0.599	0.16	0.972	0.742	0.706	0.935
Hansen statistic	0.230	0.506	0.172	0.43	0.826	0.678	0.296	0.222	0.0956	0.385

Note: ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively. The table reports z-tests and corresponding p-values.

increase in returns (Models 18, 23 and 26). Returns increase by 88% when the SOC score rises by 1% (Model 24), and by 197% when the GOV score rises by 1%. (Model 20). This shows that the implementation of ESG practices provides significant and tangible financial benefits to O&G enterprises. Moreover, we confirm the positive association between ESG disclosures and market performance of firms demonstrated in previous studies (Caesaria & Basuki, 2017; Hvidkjær, 2017; Kim & Li, 2021). At the same time, the results of this study do not validate the conclusion reached by Demers et al. (2021) that good ESG scores do not offer protection to investors in times of market crashes and volatility. Most likely, this divergence is explained by the ten years' time frame used in this research, which may allow for a longer-term manifestation of shareholder value creation in companies.

All estimations and models show that stock returns are persistent over time, as evidenced by the statistically significant coefficients, but return corrections from one year to the other are to be expected for O&G companies. These findings support the long-term persistence of stock returns (Lo & MacKinlay, 1988).

When the control variables are considered, our findings suggest that higher sized companies tend to provide investors with higher returns. This may be explained by the diversification opportunities they provide, a broader range of products and services, and a larger client base, which translates into higher investors' confidence (Martani et al., 2009). At the same time, our estimations evidence that increases in the oil price led to lower returns, which confirm the results of Driesprong et al. (2008) who conclude that investors underreact to information in the oil price. In the case of leverage (LEV), further analysis on how it impacts the link between corporate sustainable practices in the O&G industry is needed. The presence of a statistically significant link between size, the price of oil and returns in our findings confirms the previous findings of Bianconi and Yoshino (2014) in their analysis of O&G companies returns as opposed to renewable energy companies. Also, we support Narayan and Sharma (2011), who concluded that for higher sized companies the relationship between oil prices and returns appears to be more statistically significant but negative.

The diagnosis tests show that our instruments are valid (Hansen statistics above 0.05) and there is no serial correlation in residuals (AR(2) above 0.05). Therefore, our estimations are consistent and solid.

5. Conclusions

Our paper contributes to the extant literature by observing the relationship between corporate ESG discourse, ESG scores, and market performance of corporations in the global O&G sector, which are directly exposed to the full range of ESG issues. These companies need to manage their impact on the environment, as well as the relationships with local communities. Moreover, the traditional business model in the O&G sector is under pressure, as the energy transition determines companies to shift toward renewable and clean energy, while remaining competitive and profitable.

The two-stage research approach followed in the paper aimed at exploring whether the intensity of corporate discourse around sustainability topics is relevant for ESG performance, ascertaining its significance for investors via the impact on returns, and determining whether there is a connection between ESG scores and market performance.

Our findings show that investors consider both sustainability discourse and results in their assessment of a company's value. Moreover, we validate the role of ESG scores and rankings in providing investors with an accurate and meaningful assessment of companies'

sustainability actions. Further, we argue that an emphasis on sustainability practices and their consistent communication to investors can lead to better returns. The novel contributions of the present paper are multiple. First, we derive an ESG vocabulary particular to the O&G industry. Such an endeavour has been attempted in the literature for a wide range of sectors, but to our knowledge a definitive vocabulary has yet to be compiled. Another element of novelty is the inclusion of the technology category in the sustainability assessment of corporate communication. Finally, the corporate sustainability action, discourse and market assessment triad has, as far as we know, not been studied in such a comprehensive manner.

The findings of our research are of importance to market practitioners, that can use them to calibrate their portfolios of sustainable enterprises and fine tune their interactions to corporations. Additionally, corporate executives may better understand how the ESG initiatives are incorporated into the broader measurement of performance and value. At the wider economy level, our findings highlight the significance of encouraging companies, particularly those in sectors and industries sensitive to ESG factors, to invest in ESG initiatives, as this is accompanied not only by costs but also by improved performance, which makes them more attractive and better positioned to attract financing.

The paper limitations are inherently embedded in the data, time frame under study, and econometric models used. Certainly, extending the analysis over a higher number of companies in the O&G sector, covering for more countries, would have provided more insight into the relationship between ESG factors and corporate performance, but the main obstacle is represented by the time frame of ESG scores availability. Also, panel econometric models that distinguish between the short-versus long-term interaction between ESG principles and returns (such as ARDL or QARDL) might be particularly useful, and we intend to pursue this research avenue in the future. Another interesting research direction is the study of the relationship between corporate discourse and other firm characteristics (e.g., location, subsector of activity). Moreover, it would be alluring to observe whether the current environment, characterised by an emphasis on energy security and additional taxation on O&G company profits, will detract from ESG concerns in QECs.

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Author contributions

AH, VB and MG conceptualized the study. AH and VB were responsible for overall design and econometric data analysis. LB and DGD were responsible for data collection and interpretation of results. MG surveyed the literature and wrote the Literature review section of the paper. All authors contributed to the first draft and the final version of the article.

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The authors declare not having any competing financial, professional, or personal interests from other parties.

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