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Is the corporate financial strategy in the oil and gas sector affected by ESG dimensions?

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ABSTRACT

The oil and gas sector is under pressure because of its impact on sustainability. Company's stakeholders are aware of the ethical behavior of those firms related to hazardous activities. Literature has analyzed the relationship between corporate social responsibility and different measures of efficiency (e.g., financial performance or market value) without a conclusive result.

This research establishes an ESG index (environmental, social and governance) that allows a comprehensive measure of corporate social responsibility and its effects on corporate financial strategy. The study analyzes how the ESG index influences the value of oil and gas companies as well as their financial performance and financial risk. To do this, the PLS-SEM was applied to a sample of 219 oil and gas companies in different countries. Results show that the environmental and governance dimensions are the backbone of the ESG index that positively impact on all three.

1. Introduction

Corporate Social Responsibility (CSR) is *"a concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis"* (European Commission, 2001). The implementation of CSR activities in a given company is to achieve the opportunity to get the truth of stakeholders (Streimikiene et al., 2009). However, the engagement in CSR as indicator of companies' sustainability or sustainability development is a complex topic to address, especially in the energy sector; what is more, as Streimikiene et al. (2009) write, *"CSR is a guiding principle that underpins corporate vision, strategy and decision-making and represents a series of emerging issues that must be "managed'' by the energy company in order to maintain its "license to operate''*.The term CSR has grown in importance and significance since the 1950s. Several definitions have proliferated[1] in the literature from the initially definition introduced by Bowen (1953). Later, especially the contribution of Carroll (1999) through the diffusion of CSR Pyramid, expanded companies' responsibilities to four dimensions: economic, legal, ethical and philanthropic. Carroll (1999) states that *"firm should strive to make a profit, obey the law, be ethical, and be a good corporate citizen"*. Evolving over the years, literature supports that the performance and success of a company are also measured through social and environmental dimensions as same as economic (Dahlsrud, 2008; Norman and Macdonald, 2004). Therefore, it is clear that CSR is a multi-dimensional construct based on environmental, social and governance (ESG) scores (Terjesen et al., 2009, 2016; Sassen et al., 2016).

A plethora of studies have analyzed the consequences to engage in CSR activities, examining their effect on financial performance (Ambec and Lanoie, 2008; Brantley et al., 2014; Pätäri et al., 2012), market risk (Albuquerque et al., 2019; Chollet and Sandwidi, 2018; Sadorsky, 2001; Shakil, 2021), firm value (Behl et al., 2021; Fatemi et al., 2018; Gong et al., 2021; Miralles-Quirós et al., 2019) or cost of capital (El Ghoul, Guedhami, Kwok and Mishra, 2011).

The above relationships are ascribed to the stakeholder theory (Freeman, 1984) and the agency theory (Jensen and Meckling, 1976). Both theories have been used by practitioners to assess the benefits and costs of CSR practices in a company. From the stakeholder theory, companies should address the demands of stakeholder's interest (Freeman, 1984), not only to serve the interest of shareholders (Friedman, 1970). This theory points out that companies enhancing the relationship with employees, clients, suppliers, community and the

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[1] See Dahlsrud (2008).

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environment provide benefits to the company as well as the shareholders (Hasan, Kobeissi, Liu and Wang, 2018). Furthermore, according to the agency theory, CSR could be the manifestation of agency problems inside the company because managers (agents) benefit opportunistically from investments in CSR (Champagne et al., 2021; Krüger, 2015).

Sectors with a hazardous nature have more pressure to engage in CSR practices in their core business to underpin a long-term economic value because of their greater exposure to environmental and social concerns in comparison with others such as insurance, financial or consumer goods (Beck et al., 2018; Shahbaz et al., 2020). This is the case of the oil and gas (O&G) activities as the main current sources of energy (Eurostat, 2022; International Energy Agency, 2021); they are aware to move towards more sustainable energy model (International Energy Agency, 2021). Given the singularities of that sector, O&G companies are under the spotlight of investors, governments, ecologists and general population for the highly evident negative environmental effects of their daily processes. With the increment pressure of each stakeholder, companies responded by applying more sustainability policies and regulations (International Energy Agency, 2021; Loorbach, 2004; Masson-Delmotte et al., 2021; United Nations, 2015). From the "Paris Agreement" established in 2015 until the Sustainable Development Goals (SDGs) proposed in the "Agenda 2030" to meet sustainability challenges (United Nations, 2015), O&G companies understood the important role that play to combat environmental and social problems attached to their production and consumption (e.g., geopolitical conflicts, gas and venting of CO2, tackling methane emissions, local disruption, water contamination).

While different studies have been devoted to the relationship between CSR and financial performance, CSR and firm value and CSR and market risk separately, as far as we know, no empirical studies have addressed the net of relationships between CSR and the corporate financial strategy which allows us to deepen in those relationships. The objective of this work is to analyze whether the environmental, social, and governance dimensions influence on the value of O&G companies as well as their effect on financial performance and market risk, which impact in the market value too. To do this, unlike previous studies, we developed a new index that includes the three dimensions (the ESG index). Until now, previous studies have analyzed the aforementioned relationships across the dimensions, individually and separately (Aouadi and Marsat, 2018; Ferrero-Ferrero et al., 2016; Jiang et al., 2018; Lins et al., 2017; Oikonomou et al., 2012; Paolone et al., 2021; Pätäri et al., 2012; Shakil, 2021). For example, Taliento et al. (2019) use the ESG score with weights subjectively weighted by the data provider however do not use environmental, social, and governance scores separately and individually. López-Toro et al. (2021) use environmental, social, and governance scores individually but do not construct an index from these dimensions as we do in this work. Therefore, the significance of the present research is to highlight all crucial relationships between CSR profile and corporate financial strategy at once; CSR-financial performance, CSR-market risk as well as CSR-market value, showing that there is a much wider class of models.

To our knowledge, this article is the first to contribute to this ongoing discussion by providing a robust nomological network between financial variables and the environmental, social and governance index for O&G companies. To achieve this purpose, we used Partial Least Square structural equation modeling–PLS-SEM to generate a new ESG global index and its relationship with the corporate finance strategy in a sample of 219 O&G companies for 2020. Furthermore, our contribution is also based on the hierarchical analysis approach used to build the ESG index. This ESG-firm score is based on the information score of the three pillars (environmental, social and governance) and the internal weighting assigned by the non-parametric PLS-SEM method. In contrast to previous literature, we avoid subjective assignments in the ESG index estimation in accordance with previous literature (Callan and Thomas, 2009; Gyönyörová et al., 2021) that considered these weights inadequate. Finally, the importance, in economic and production terms, of both subsectors within the energy industry serves as justification for this study (International Energy Agency, 2021; Lu and Lai, 2019). Our results determine that O&G companies tend to align their environmental and social responsibilities with the stakeholders' demands to improve their benefits in terms of financial return, risk, and maximizing market value.

The remainder of the article is presented as follows. Section 2 addresses a detailed literature review and sets the research hypotheses. Section 3 presents the data and methodology used. The results are reported in Section 4. The discussion and main conclusion are found in Sections 5 and 6.

2. Literature review

Energy companies, more specifically O&G, have environmental and social threats where they operate and thus, need the implementation of ESG practices in their business operations. For example, the carbon emission of this sector (62 per cent over the total) makes up the vast majority of the greenhouse gases (GHG) emissions (International Energy Agency, 2021) that causes the global warming. In the current context, energy companies must respond properly to national and international government regulations, guidelines, social expectations, or investors requirements. Hence, to get the support of different stakeholders, companies have committed in Corporate Social Responsibility practices (Demirbas, 2009). Due to the uniqueness of this sector, the challenge of energy companies is the implementation of sustainability practices being efficient. Thus, energy companies are pretended to minimize their environmental and social impacts being profitable simultaneously (Pätäri et al., 2014).

ESG scores are not only about the environmental impact of business practices but also describe social and corporate governance performance of companies (Terjesen et al., 2009, 2016). ESG scores and nexus to financial indicators are explained by two different theories: Stakeholder theory (Jensen and Meckling, 1976) and agency theory (Freeman, 1984). Stakeholder theory highlights that CSR practices are tether to stakeholders interests (Hasan et al., 2018). There is a value creation for stakeholders and also this is spread to the shareholders when companies perform on CSR (Rodgers et al., 2013; Freeman and McVea, 2005). Therefore, companies with higher ESG scores may probably have better results. Agency theory finds an adversarial relationship between corporate management and stakeholders' incentives to be responsible (Hussain et al., 2018). CSR practices could generate agency problems, that is, a conflict with the shareholders' objective of the firm (maximize their value). In this vein, monitoring mechanics could mitigate the opportunistic behavior of the agents by board independent and board diversity (Shahbaz et al., 2020; Ho and Shun Wong, 2001). Even the legitimacy theory (Dowling and Pfeffer, 1975) is sometimes used regarding the degree of disclosure of corporate social information because it affects the reaction of interested parties to a company. As Patten (2005) suggests, firms that ignore socially recognized values may lose their social legitimacy.

2.1. ESG index and financial performance

Extant literature has examined the connection between CSR and financial performance (Kurapatskie and Darnall, 2013; Sassen et al., 2016; Badía et al., 2020; Bodhanwala and Bodhanwala, 2020). Under this approach, socially responsible companies will get the support of a wide array of stakeholders. Therefore, energy companies can contribute to environmental and social sustainability by reducing pollution, carbon dioxide emissions, strengthening worker rights or improving efficiency. This engagement will enhance customer loyalty, corporate reputation, and worker productivity (Freeman, 1984; Hasan et al., 2018). For all these reasons, and the like, literature establishes a positive relationship between CSR and financial performance. For example, Pätäri et al. (2014) examined Granger causality between investments in CSR and

firms' financial performance in the energy industry. Results evidenced that CSR (strengths and concerns) should be treated separately because their results were different according to the performance measure selected. CSR strengths, that is, actions such as selling pollution-control technology or better access to certain markets (Jiang et al., 2018) have only impact on market value. Whereas CSR concerns (i.e., damaging actions with the social or environment) influence ROA and market value. Pätäri et al. (2012) analyzed whether socially responsible companies performed better than those that do not follow sustainability goals. Analyzing a sample of 210 energy companies found that, implementing CSR practices, companies monitoring cost and got better profits than the more conventional companies. Furthermore, this relationship is see-through to use as measurement of the market-capitalization value. Previous results are in line with Jiang et al. (2018), they showed a positive association between proactive corporate environmental responsibility on financial performance for Chinese energy industry. Ekatah et al. (2011) supported that companies with higher CSR score will get better economic profitability. They got this finding for the Royal Dutch Shell Plc. Indeed, Ait Sidhoum and Serra (2017) confirmed that the adoption of cleaner technologies implies an efficiency and financial performance improvement. This relationship was less evident for highly capitalized companies in the electricity sector for 2005 to 2012. On the contrary, some authors also argued a non-significant relationship between ESG scores and financial performance. In this sense, López et al. (2007) documented a non-significant relationship between sustainability investments' and market value. Marsat and Williams, 2013 analyzed energy companies for the period 2011 to 2018. They argued that there is no significant relationship between CSR and financial performance (market value and accounting). According to Shahbaz et al. (2020), higher ESG scores do not ensure better financial performance measured by the Tobin's Q and the return on assets. Using a dynamic panel regression, the results displayed a no predictive value of CSR activities on performance. While Hoang et al. (2020) argued that the relationship between ESG scores and financial performance varies according to the period. Short-term investments in clean energy business have a negative impact on financial performance (proxied by market value and ROA). But, in the long term, previous results were positive and significant.

All in all, previous research shows various and inconclusive findings in the energy sector. Some justifications for the positive association between CSR and financial performance are based on the stakeholder and agency theoretical frameworks. In this sense, CSR activities will attract stakeholders increasing profits and reducing risk and agency problems (Tzouvanas and Mamatzakis, 2021). On the contrary, other studies highlighted that CSR will not exceed the benefits, making unstable financial results (Champagne et al., 2021; McWilliams and Siegel, 2001). Therefore, we posit the following hypothesis.

Hypothesis 1. Higher ESG scores imply higher financial performance of O&G companies.

2.2. Financial performance and market value

Some researchers show a close relationship between companies' financial performance and market valuation (Ambec and Lanoie, 2008; Tzouvanas and Mamatzakis, 2021). As a matter of fact, financial performance is one of the most important sources of information when companies are included in the investment portfolio of investors and investment funds (Ivanisevic Hernaus, 2019; Schröder, 2007). In general, a plethora of studies highlight that CSR generates strong financial performance (Albuquerque et al., 2019; Griffin et al., 2020; Ng and Rezaee, 2015). Mackey et al. (2007) stated that companies engage in CSR activities notwithstanding, it might not maximize the present value of a firm's cash flows but this engagement enlarges the market value of the firm. Evidence shows that, in general, stakeholders consider that CSR practices will increase the stock prices of firms (Tzouvanas and Mamatzakis, 2021). Shakil (2021) showed that financial variables (cash flow, debt ratio, and cost of capital) have a positive relationship with the market value in international markets. An improvement in the previous financial indicators allows companies' valuation shows an upward trend in markets. According to Chava (2014), investors demand higher returns for hazardous sectors. In this sense, O&G companies will give more importance to adapting their activities to environmental requirements. It makes markets more confident of their economic results and favor their market value. Lastly, Shanaev and Ghimire (2021) found that companies with CSR investments outperform in risk-adjusted returns. To address this concern, we postulate this hypothesis.

Hypothesis 2. Higher financial performance implies higher market value of O&G companies.

2.3. ESG index and market value

Shareholders generally are attracted by sustainability policies in the energy sector. A body of research has found that ESG positively affects companies' value creation (Aboud and Diab, 2019; Landi and Sciarelli, 2019). Even though, some authors also provided a negative association between the quality of corporate governance and market value (Batae et al., 2021). Furthermore, Miralles-Quirós et al. (2019) demonstrated that ESG performance gains more incremental value after the global financial crisis, based on the value investors attach to the three ESG pillars. According to Lins et al. (2017), firms with high CSR rating showed higher profitability, growth and efficiency compared to low CSR rating companies. Paolone et al. (2021) evidenced that investors' perception was directly affected by CSR performance of companies, highlighting that companies with high-ESG scores will generate higher stock returns and profitability and therefore, higher market value. Many other researches also documented similar findings (Chan and Walter, 2014; Ferrero-Ferrero et al., 2016; Ivanisevic Hernaus, 2019; Arefeen and Shimada, 2020). For instance, Fatemi et al. (2018) argued that CSR strengths raise firm's valuation and weakness lowering it. Borghesi et al. (2014) highlighted that ESG practices could be driven as a part of strategy to create goodwill or maintain a good reputation. Their finding evidences a positive association between higher level of CSR investments and greater free cash flow. In addition, Ferrero-Ferrero et al. (2016) similarly provided evidence that investors improve their trust in companies when these give off a socially and environmentally responsible image. Market valuation is directly affected by these types of efforts. Otherwise, Meynard (2014) or Naumer and Yurtoglu (2020) did not find a direct relationship between social reputation and market value within the energy industry. These authors also concluded a non-significant relationship between ESG controversies score and market value (Benlemlih and Girerd-Potin, 2017; Nguyen-Van, 2010; Sila et al., 2016). Thus far, Dyck et al. (2019) asserted *"firms are stepping up their E&S performance because investors are asking for it"*. Therefore, we propose the following hypothesis.

Hypothesis 3. Higher ESG scores imply higher market value of O&G companies.

2.4. ESG index and market risk

Empirical research generally shows that engagement in environmental, social, and corporate practices reduces firm risk (Albuquerque et al., 2019; Dilling and Harris, 2018; Shakil, 2021). Champagne et al. (2021) exposed that better ESG scores, i.e., better management of companies' stakeholder, will reduce the impact of several types of risk such as loss of revenues, regulatory sanctions, or declining share prices. Oikonomou et al. (2012) observed in a sample of US companies, a negative association between CSR and systematic firm risk. However, they did not find relationship between some social strengths (i.e., product safety or quality) and systematic risk, whereas social concerns were positively and significantly related to firm risk. Understanding risk as market volatility, firm's probability of default, or reputational effects

(Arefeen and Shimada, 2020; Bollerslev and Ghysels, 1996). The main result is that ESG scores reduce the volatility in the companies' market price, that is, in their financial risk (Lueg et al., 2019; Shakil, 2021; Shakil et al., 2020). Albuquerque et al. (2019) showed, for a panel of 28, 578 U.S. observations, a lower level of risk when CSR scores were higher. They considered CSR as a product differentiation strategy that make more negatively this relationship. In particular, the above relationship is especially relevant in the energy sector, O&G companies implement business strategies to address main risks create in the area where are located (Vicente et al., 2004; Correljé and van der Linde, 2006; Brantley et al., 2014). However, a very limited studies have focused on ESG index and market risk in the energy sector (Lemke and Petersen, 2013). Kuo and Chen (2013) argued that companies in environmentally sensitive industries should have responsible environmental policies to mitigate systemic market risk which is supported by the legitimacy theory. They analyzed this relationship for a sample of 208 firms listed in the Japan Nikkei Stock Index. Pegg (2012) highlighted that, O&G Chinese companies have demonstrated how, with more socially responsible policies, their overseas operations increase and become more economically beneficial in the long term. We hence propose the following hypothesis.

Hypothesis 4. Higher ESG scores imply lower market risk of O&G companies.

2.5. Market risk and market value

Lastly, economic and social risks may affect the companies' performance that operate in financial markets. The above literature shows how social and environmental performance can impact on firms' risk, measured by the price volatility. The volatility often reduces the market value of companies in international markets (Söderbergh et al., 2007; Chia et al., 2009; Arouri et al., 2012). Jo and Na (2012) claimed that energy companies, that face additional risks than do other sectors (i.e., consumer goods, financial or insurance), look for greater environmental and social engagement to drastically reduce their market risk. Likewise, market risk is related to the share price of companies. As risk increases, market value decreases, and vice versa. In recent years, growing literature, focus on the energy sector, showed that market risks arise from different causes such as O&G prices (Demirbas, 2009; Sadorsky, 2012), the supply of and demand for (Solomon and Krishna, 2011; Acharya et al., 2013) and from ESG controversies (Meynard, 2014; Naumer and Yurtoglu, 2020). In fact, risk management theory argues that CSR generates moral capital and relational companies' wealth implying that during periods of financial crisis, companies have a support which allows them reducing negative markets' impact (Chakraborty et al., 2019). Then, the connection between CSR and market risk is negative. Especially, O&G companies lead an intrinsic risk associated to their activity. In this sense, the environmental risk management theory indicates that a good control of these damages, through ESG practices, will result in an improvement of firms' reputation and market value (Boudet et al., 2014; Shakil, 2021). We thus propose the last hypothesis.

Hypothesis 5. Higher market risk implies lower market value of O&G companies

Fig. 1 shows the relationships hypothesized in the previous literature above and establish our theoretical framework. The investigation between CSR profile and O&G firms' corporate finance strategy is established.

3. Method

3.1. Data and sample

The data for this study came from Refinitiv Eikon DataStream. This database contains financial and economic information and ESG parameters for more than 9000 firms across 175 countries (Refinitiv, 2021). In particular, Refinitiv's Eikon database retains data for environmental, social and governance performance on more than nine thousand companies.

In our empirical application, the ESG index was formed by the environmental, social and governance pillars. Environmental evaluates the influence of firm's effects on air, land, water, and the ecosystem as a whole. This score measures how well a company uses best management practices for long-term shareholder value based on its ability to avoid and capitalize on environmental risks (Refinitiv, 2021). Social pillar measures an organization's ability to generate trust and loyalty with its customers, workforce, and society. These factors influence the company's ability to generate long-term shareholder value, including its reputation and the license to operate. (Refinitiv, 2021). Governance pillar measures the company's ability to manage its rights and responsibilities by creating incentives and checks and balances, in order to create long-term shareholder value (Refinitiv, 2021). The governance dimension is reflected in the information of the indicators of management, shareholders, and corporate social responsibility strategy scores. Each pillar scoring is divided into ten categories: three environmental (resource use, emissions, and innovation), four social (community, human rights, workforce, and product responsibility), and three governance categories (shareholders, management, and CSR strategy). The pillar score is ranging from 0 (lowest) to 100 (highest). Refinitiv uses

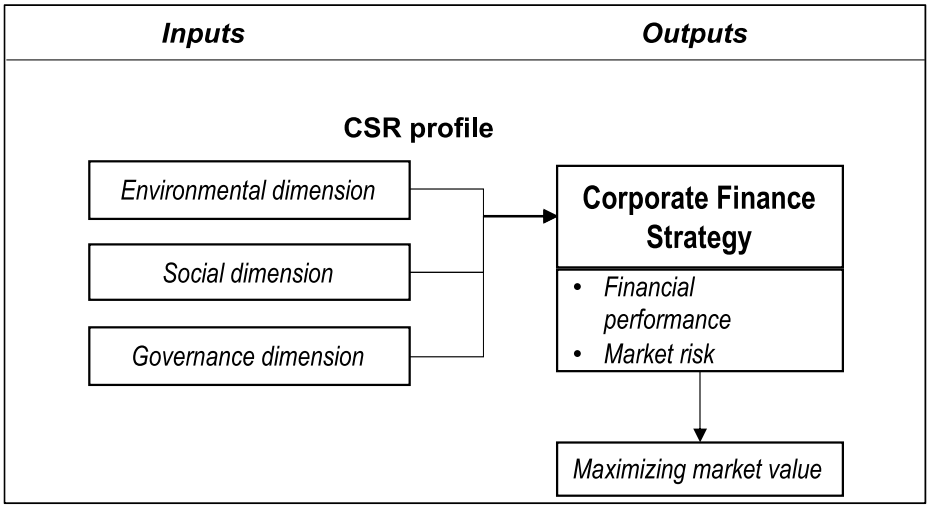

Fig. 1. Theoretical framework for CSR profile and Corporate Financial Strategy.

this percentile rank scoring methodology to define the scores (*E*, *S*, and *G*) between 0 and 100 through the analysis of publicly reported data by more than 150 content research analysts across the globe.

On the other hand, Eikon database also presents economic and financial data related to financial performance, market risk and market value. According to previous literature, we use Return on asset (ROA) to capture operating performance and we capture financial performance through Return on equity (ROE) (Martins, 2021; Sachin and Rajesh, 2021; Shahbaz et al., 2020). ROA is calculated as the income after taxes for the fiscal period divided by the average total assets. ROE is computed as the income available to common excluding extraordinary items for the fiscal period divided by common equity. Lins et al. (2017) and Miralles-Quirós et al. (2019) use the closing price to reflect the market value, and Aouadi and Marsat (2018) and Pätäri et al. (2012) use the indicator of market capitalization. Price close is the latest available closing price. Market Value of Company (MVC) is the consolidated market value of a company displayed in local currency. MVC for companies with a single listed equity security is the share price multiplied by the number of ordinary shares in issue. Finally, market risk is less common. Only a few recent papers mention CAPM Beta or the Sharpe ratio (Ivanisevic Hernaus, 2019; Naffa and Fain, 2021). CAPM Beta is a measure of how much the stock moves for a given move in the market. It is the covariance of the security's price movement in relation to the market's price movement. The Sharpe ratio or reward-to-variability ratio is a measure of the excess return (or risk premium) per unit of risk in an investment asset, named after William Forsyth Sharpe.

Once all the previous variables were obtained, we got information for a sample of 245 O&G companies worldwide for 2020. After the exclusion of missing values, we discarded around the 11% of the initial observations, the final sample comprised 219 O&G companies. Table 1 summarizes the variables used in the analysis. The sample used secondary and cross-sectional data was tested. To determine the minimum sample size needed, we follow Faul et al. (2009). The results of applying a significance level of 0.05 with an effect size f^2 of 0.15 using G*Power software were satisfactory. A required size of 119 observations with statistical power of 0.95 was indicated while we validated 219 observations.

Table 2 shows the descriptive statistics where the highest values of the indicators *E*, *S*, and *G* corresponded to *S1* or the workforce score that contains data on diversity, turnover of employees, training and development policy, health and safety policy, equal opportunities, flexible working hours and salary gaps, and *S3* community rating whose data includes bribery, fair competition, corruption, community involvement, business ethics, and community lending (both 99.80). As well as *E2* or emissions score (99.79) related to the emission policy and objectives, total CO_2 emissions, climate change opportunities, environmental restoration, waste management, environmental expenses and income, reduction of the impact of personnel transportation. The product responsibility rating *S4*, also starts from an average value of 90.78, thus highlighting that this dimension weighs heavily in the ESG components of oil and gas companies as a controversial industry (Aouadi and Marsat, 2018) compared to the rest of the attributes of pillars *E*, *S*, and *G*. Likewise, *E1* or the resource use score, also represents a high maximum value of 99.76 in the 219 companies with data for this score, where factors such as water and energy efficiency are considered policies, total energy and water use, environmental management systems, renewable energy use ratio, supply chain management and monitoring, and green buildings. Within the governance dimension, the *G2* shareholders score (99.68) indicator stands out, which includes voting cap percentage, equal shareholders rights and specific policies, shareholders vote on executive pay, anti-takeover devices, director election majority requirement, veto power or golden shares, auditor tenure, and non-audit to audit fees ratio. In second place, the management score *G1* (99.67) is positioned with data on CEO-chairperson separation, compensation, corporate boards, the nomination committee and its independence, the succession plan, remuneration packages linked to the total shareholders return, and internal audit, among others.

Table 1
Composites and description of indicators.

Composites	Indicators	Description
Environmental(Mode B)	E1	Resource use score
	E2*	Emissions score
	E3	Environmental innovation score
Social(Mode B)	S1	Workforce score
	S2	Human rights score
	S3	Community score
	S4	Product responsibility score
Governance(Mode B)	G1	Management score
	G2	Shareholders score
	G3	CSR strategy score
Financial performance(Mode A)	ROA	Return on asset (total assets)
	ROE	Return on equity (common equity)
Market value(Mode A)	P	Price close
	lnMVC	Logarithm of market value for company
Market risk(Mode A)	Beta	CAPM Beta
	Sharpe	The Sharpe ratio

Source: Eikon from Thomson Reuters (2020). Note: * These indicators were not included in latent variables due to problems of multicollinearity.

Table 2
Descriptive statistics.

Variables	Mean	Std. Deviation	Minimum	Maximum
E1	43.60	32.37	0.00	99.76
E2	49.37	30.69	0.00	99.79
E3	15.54	27.05	0.00	80.67
S1	52.67	29.61	40.00	99.80
S2	33.41	33.81	0.00	95.39
S3	51.34	29.39	79.00	99.80
S4	46.44	29.26	0.00	99.78
G1	54.19	30.69	2.00	99.67
G2	54.59	28.64	54.00	99.68
G3	50.37	33.38	0.00	99.63
ROA	−0.11	0.19	−0.81	0.15
ROE	−0.45	1.66	−19.66	0.49
lnMVC	9.38	0.84	7.20	11.36
P	14.06	25.98	0.01	221.13
Beta	1.90	1.09	0.00	6.85
Sharpe	−0.01	0.11	−0.40	0.48

Source: Own elaboration based on Eikon database for a sample of N = 219 companies. Note: *E1, E2* and *E3* means Resource use, Emissions and environmental innovation scores. *S1, S2* and *S3* means workforce, human rights, community and product responsibility scores. *G1, G2* and *G3* means management, shareholder and CSR strategy scores. *ROA* is return on assets; *ROE* is return on equity; *lnMVC* is the logarithm of market value for company; *P* is the price to close; *Beta* is CAPM beta and *Sharpe* is the Sharpe ratio value.

3.2. ESG index construct

We respond to one of the problems that very often underlay the selection of the most appropriate ESG measure through our ESG-firm index that constituted the exogenous variable of our analysis as a proxy of CSR activities. The ESG index was operationalized following Henseler (2017), who considered that the concept of an artifact is any construct designed by the human mind, representing a theoretical thought made up of elementary components that define it. They are called design constructs. The literature conventionally assumes that CSR comprises three elements or component parts, in our case, the environmental, social and governance pillars. In this line, we scaled the constructs of this study as composite variables.

Table 3 shows the data related to the ESG variables used as dimensions of the ESG index design construct. The three environmental, social, and governance pillars include ten categories which in turn are integrated by a set of items from the Eikon database.

Designing CSR as a multidimensional construct means we

Table 3
Variables ESG used in the analysis.

Variables	Definition	Items
Resource use (E1)	Resource use variable highlights a firm's performance and capacity to reduce the use of materials, energy or water and to find eco-efficient solutions by improving supply chain management	water and energy efficiency policies; environmental management systems; total energy and water use; renewable energy use ratio; green buildings; and supply chain management and monitoring
Emissions (E2)	The emission reduction variable reflects the firm's commitment and effectiveness in reducing environmental emission in the production and operational processes	emission policies and targets; total CO_2 emissions; indirect and Scope 3 emissions to revenues; climate change opportunities; waste management; e-waste reduction; environmental restoration; staff transportation impact reduction; environmental expenditures and revenues
Environmental innovation (E3)	The environmental innovation variable reflects a company's capacity to reduce the environmental costs and aims to create new market opportunities through new environmental technologies and processes or eco-designed products	environmental project financing; environmental products; environmental assets under management; Equator principles; and clean energy products
Workforce (S1)	The work variable measures a company's effectiveness towards job satisfaction, healthy and safe workplaces, maintaining the diversity and equal opportunities and development opportunities for its workforce	health and safety policy; training and development policy; diversity; equal opportunities; salary gaps; turnover of employees; and flexible working hours
Human rights (S2)	The human rights variable measures a company's effectiveness towards respecting fundamental human rights conventions	freedom of association; child labor; and human rights
Community (S3)	The community variable measures a company's commitment towards being a good citizen, protecting public health and respecting business ethics	fair competition; bribery; corruption; business ethics; community involvement; and community lending
Product responsibility (S4)	The product responsibility variable reflects a company's capacity to produce quality goods and services integrating the customer's health and safety, integrity and data privacy	data privacy (especially the General Data Protection Regulation); customer satisfaction; and quality management systems
Management (G1)	The management variable measures a company's commitment and effectiveness towards following the best corporate governance principles	corporate boards; compensation; the nomination committee and its independence; CEO-chairperson separation; remuneration packages linked to the total shareholder's return; the succession plan; internal audit; external consultants, and audit committee independence
Shareholders (G2)	The shareholder variable measures a firm's effectiveness towards the equal treatment of shareholders and the use of anti-takeover devices	equal shareholders rights and specific policies; voting cap percentage; shareholders vote on executive pay; director election majority requirement; veto power or golden shares; anti-takeover devices; non-audit to audit fees ratio, and auditor tenure
CSR strategy (G3)	The CSR strategy variable reflects a company's practices to communicate, in which it integrates the economic (financial), social and environmental dimensions into its day-to-day decision-making processes	existence of the CSR sustainability committee; stakeholder engagement; CSR sustainability reporting, and external audit

Source: based on Batae et al. (2021), and Ting et al. (2020).

conceptualize it as a variable that only exists to the extent that its sub-dimensions are present. With the advancement of research on CSR, unidimensional and multidimensional conceptualizations of the concept have been reached. However, considering CSR as a multidimensional rather than a one-dimensional construct requires a separate scope and measurement models (Bollen, 2011).

A construct is described as multidimensional (higher-order construct) when its indicators are themselves latent constructs (dimensions) (Polites et al., 2012). A multidimensional construct refers to several related but distinct dimensions treated as a single theoretical concept (Edwards, 2001). Each dimension represents a single content domain, and they are latent variables (lower-order constructs) inferred through their observable variables (indicators).

Namely, in our case, the environmental, social and governance dimensions added as an exact linear combination leads to the formation of the design construct that we call the ESG index. In that way, we avoid subjective assignments in calculating the ESG index in accordance with previous literature (Callan and Thomas, 2009; Gyönyörová et al., 2021) that considered these weights inadequate. Therefore, we did not use the weighted ESG score provided by the data provider Eikon, but we built our own ESG index. The ESG index falls within the aggregate multidimensional construct typology, that is, it is a composite of its dimensions, which means that the dimensions are combined to produce the construct, with a causal relationship (Edwards, 2001). Our model that directly estimates dimension weights is captured by the following equation:

$$\eta = \sum \gamma_i \xi_i \tag{1}$$

where.

η = higher-order construct or aggregate construct
γ_i = dimension weights
ξ_i = dimension or lower-order constructs

Equation (1) of the aggregate construct represents the relationships with its dimensions by estimating the weights as free parameters within the model itself. Additionally, we are dealing with a study of a single sector of activity, so the problem of commensurability pointed out by Capelle-Blancard and Petit (2017) did not apply in our case.

3.3. PLS-SEM analysis

The analytical approach employed in this study was partial least square structural equation modeling–PLS-SEM (Chin, 1998; Wold, 1980). The program SmartPLS 3.3.3 (Ringle et al., 2015) was used, drawing the models shown in Fig. 2. The program also allows testing second-order structures using hierarchical component models that combined higher order constructs (HOCs) and lower order constructs (LOCs).

PLS-SEM allows the design of models, represented graphically by nomograms, where the relationships between unobserved variables,

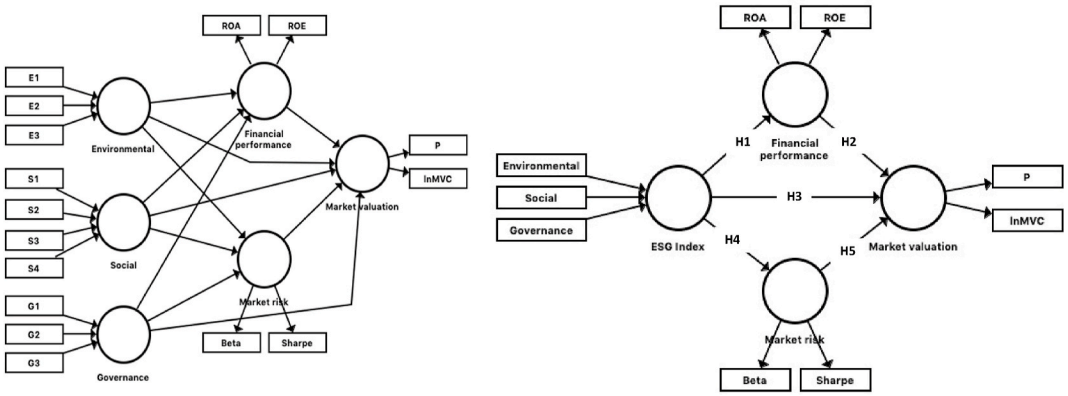

Fig. 2. The theoretical model of the hierarchical component nomogram is compound by (a) the Lower-order model; (b) the Higher-order model.

called latent variables or constructs (ellipses), and their indicators (rectangles) are simultaneously tested. Likewise, the structural hypotheses (*Hi*) are to be contrasted between different latent variables. Thus, two statistical traditions are used in combination. On the one hand, factor analysis where a factor variable (latent variable or construct in PLS-SEM) is defined by *p* communal variables (indicators or items in PLS-SEM) so that the latent variable can explain the shared content of the *p* original variables. On the other hand, linear regression analysis, where the behavior of a variable (endogenous, explained, or dependent) is explained using the information provided by the values taken by a set of explanatory variables (exogenous or independent).

The PLS-SEM algorithm sequence in the first place evaluated the measurement model. This step tested the criteria of individual item reliability, construct reliability, convergent validity, and discriminant validity for constructs in mode A. For its part, if the latent variable is defined as mode B or formative, the criteria to be validated were multicollinearity between indicators and the significance and relevance of the weights of each indicator (Hair et al., 2019).

In a second place, we evaluated the structural model. Once the reliability and validity of the measurement models have been verified in the previous stage, asses of the structural model will test the fulfillment of the hypotheses and the predictive power of the complete model. In this sense, the criteria to be taken into account have to do with predictive validity (Q^2), size of effects (f^2), and coefficients of determination (R^2).

The use of PLS-SEM has the potential advantage of being able to scale as composite variables to those that represent a theoretical thought designed as an artifact composed of elementary items that define it. What is known under the name of "design-construct" (Henseler et al., 2014; Henseler, 2017). Precisely, we have considered the ESG index variable a design construct composed of three dimensions (environmental, social and governance) created in this way for research purposes as we have explained above. In our particular case, we designed ESG index as a higher-order construct. Furthermore, we have defined the ESG index variable as a formative-formative type according to Polites et al. (2012).

Using the two-step approach (Hair et al., 2017), we went from a LOC model to a more parsimonious HOC model. For this procedure, we used the scores of environmental, social and governance as indicators of the higher-order ESG index construct (Ringle et al., 2020). When we analyze models with lower-order constructs and higher-order constructs, the analysis of components in PLS-SEM allows the calculation of scores of latent variables as an exact linear combination of the indicators, adding them in constructs of order higher (Chin, 1998; Richter et al., 2016). Considering the ESG index as an aggregate of its dimensions is a specific contribution of this work concerning others that only consider first-level structures of this variable.

4. Results

In this section, we present results for predicting market value through the incidence of ESG index, financial performance, and market risk for O&G companies.

Fig. 3 shows the nomogram graph of this empirical application. This figure reveals three antecedent explanatory constructs (environmental, social and governance–ESG index; financial performance–FP; and market risk–MR) that predicted the endogenous variable (market value–MV). Since the exogenous variable, ESG index, was a composite measured in mode formative through higher-order component, the magnitudes of the individual coefficients (E, S, and G) correspond to their relative importance.

4.1. Assessment of LOC measurement model

The lower-order constructs measurement model constitutes the first stage in the two-step approach of the PLS-SEM algorithm for higher-order models. Thus, it is tested compliance with the measurement scales whether the model of indicator-construct relationships was both in A-reflective mode or B-formative mode.

On the one hand, to test the individual item's reliability of measurement in mode A or reflective, all the indicators of the LOCs in mode A (financial performance, market risk, and market value) presented

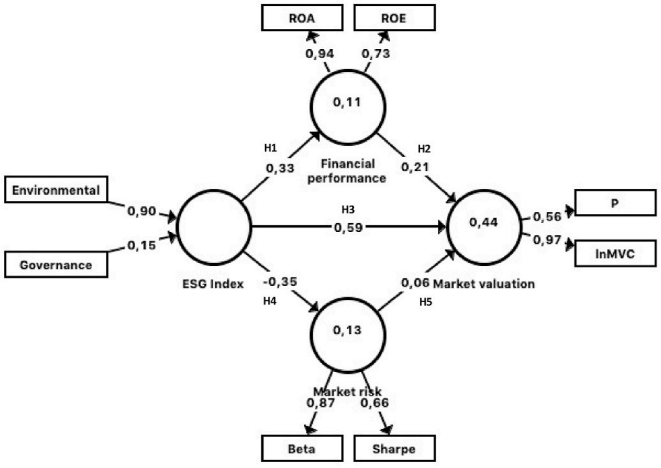

Fig. 3. Higher-order final model results.

loads higher than the threshold value of 0.707, and it was not necessary to eliminate any of them. That is, the variation of the items due to the construct was statistically significant, validating the commonality of the indicators.

The internal consistency reliability of the indicators was measured by the composite reliability that reached values above the threshold of 0.7 (see Table 4). For its part, the convergent validity through the AVE gave values greater than 0.5, meaning that the construct explained more than half of the variance of its indicators, as seen in Table 4. Therefore, the two criteria were met.

Discriminant validity analysis indicated the degree to which the constructs differed and were met through Fornell and Larcker criterion (see Table 5), where the square root of the AVE values of each construct (in bold) was higher than its correlations with the rest of the constructs.

On the other hand, the measurement of mode B indicators' LOC multicollinearity problems were detected for indicator *E2. Emissions score* of the lower-order construct environment and, consequently, it was eliminated from the model. Specifically, it presented a variance inflation factor (VIF) value above the threshold of 3.3 (see Table 6).

After we eliminated the multicollinear indicator *E2* from the B-mode measurement models, we applied the structural equation modeling algorithm again. It was verified that the formative constructs *E*, *S*, and *G* were reliable and valid.

4.2. Assessment of HOC measurement model

Once the LOCs measurement models (both reflective and formative) were validated in the first stage of the two-step approach, obtained the scores of the dimensions environmental, social and governance. They were then used as indicators of the higher-order construct obtaining the ESG index as an exact linear combination. Next, we present the evaluation of the criteria to know the reliability and validity of the higher-order model measurement scale.

Since the second-order construct (ESG index) is measured in formative mode or B, we tested for multicollinearity problems detected for the social indicator and eliminated it from the model. Specifically, it presented a VIF value (3.644) above the threshold of 3.3. Once the social indicator was removed from the model, the problem was solved.

Concerning significance and relevance, the analysis of the formative construct in mode B, ESG index, showed that the indicator with the most significant weight was the environmental dimension (0.898) and significative (0.000). Secondly, although the governance indicator had less importance in forming the ESG index, it also presented significance. Although the p-value is higher than 0.05, however, its loading value was higher than 0.5, and in such cases, it is considered that the weight is significant and supplied content validity to the model (see Table 7).

Therefore, the more significant and more positive the activities and procedures related to the environmental dimension of energy companies, the more the ESG index improves. In addition, when monitoring systems about governance are implemented, the ESG index improves, although the weight or impact is somewhat lower than for the environmental dimension.

4.3. Assessment of HOC structural model

After showing the reliability and validity of the measurement scale by above-evaluating the measurement model, the structural equation modeling PLS-SEM proceeded to assess the predictive power of the HOC model, and the structural relationships model hypothesized.

Fig. 3 illustrates the nomogram of relationships between constructs of the HOC model, and Table 5 gives the calculated path coefficients and significance levels of the hypotheses. Furthermore, Table 5 indicates that latent variables' VIF fluctuated between 1.000 and 1.282, implying multicollinearity was not a concern.

Fig. 3 and Table 8 show all the hypotheses analyzed in the present study were supported and gave well-defined prediction signals except for H5 (market risk - > market value). Through the blindfolding procedure, the measurement of the Stone-Geisser Q^2 value (Geisser, 1974; Stone, 1974) indicated the predictive relevance outside the sample, presenting values more significant than threshold zero (see Table 8).

The coefficients of determination R^2 showed the predictive power of the model. The value of R^2 represents the amount of variance explained by the antecedent constructs associated with an endogenous construct. The predictive level of the constructs financial performance and market risk with R^2 0.11 and 0.13 respectively were adequate, according to Falk and Miller (1992). They suggest at least a value greater than or equal to 0.10. In the case of the construct market value, with an R^2 value of 0.44, its level is more than moderate. The contribution was 37.3% of the ESG index and 8% of the financial performance (see Table 9).

The effect size (f^2) assesses the degree to which an exogenous construct helps to explain a given endogenous construct in terms of R^2 (Cohen, 1988). A heuristic rule of Cohen (1988) to evaluate f^2 maintains that: $0.02 \leq f^2 < 0.15$, it is a small effect; $0.15 \leq f^2 < 0.35$ is a moderate effect and $f^2 \geq 0.35$ is a large effect. In this vein, the results show that the size of the effect between the ESG index exogenous construct and its degree of contribution to the market value endogenous construct

Table 4
Construct reliability and convergent validity LOC.

Constructs	Composite Reliability	AVE
Financial performance	0.827	0.709
Market risk	0.740	0.594
Market value	0.762	0.632

Source: Own elaboration.

Table 5
Fornell and Larcker criterion LOC.

Constructs	E	FP	G	MR	MV
Environmental	**n/a**				
Financial performance	0.325	**0.842**			
Governance	0.653	0.255	**n/a**		
Market risk	−0.367	−0.417	−0.169	**0.771**	
Market value	0.624	0.380	0.509	0.233	**0.795**

Source: Own elaboration.

Table 6
Variance inflation factor.

Variables	VIF
E1	3.72
E2	3.82
E3	1.35
S1	2.26
S2	1.72
S3	1.63
S4	1.61
G1	1.32
G2	1.20
G3	1.14

Source: Own elaboration.

Table 7
Significance of weights.

	Original Sample	*t*	loadings	*p*	Lo95	Hi95
ESG index						
Environmental	0.898	10.762	0.994	0.000	[0.754	1.029]
Governance	0.147	1.303	0.733	0.096	[-0.046	0.328]

*: $p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
Significance, t statistic, and 95% bias-corrected confidence interval performed by 5000 res. boot-strapping procedure.

Table 8
Whole sample results.

	Path	*t*	*p*	Lo95	Hi95	f^2	VIF
Direct effects							
ESG → MV	0.588***	13.087	0.000	[0.514	0.662]	0.513	1.199
FP → MV	0.211***	3.688	0.000	[0.114	0.302]	0.063	1.257
MR → MV	0.063^{ns}	1.187	0.118	[-0.032	0.142]	0.005	1.282
R^2: 0,44; Q^2: 0.237							
ESG → FP	0.329***	7.376	0.000	[0.260	0.406]	0.121	1.000
R^2: 0.11; Q^2: 0.069							
ESG → MR	−0.354***	6.855	0.000	[-0.444	- 0.273]	0.143	1.000
R^2: 0.13; Q^2: 0.065							
Indirect effect						**VAF**	
ESG → FP → MV	0.070***	3.348	0.000	[0.036	0.105]	0.105	n/a
ESG → MR→ MV	-0.022^{ns}	1.127	0.130	[-0.054	0.011]	ns	n/a

*: $p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
Significance, t statistic, and 95% bias-corrected confidence interval performed by 5000 res. boot-strapping procedure. VIF: Inner model Variance Inflation Factor. VAF: Variance Accounted for. n/a: not applicable.

Table 9
Determination coefficient decomposition.

Dependent variable	*R* square	Antecedents	Path	Correlations	Explained variance*
Market valuation	0.44				
		Financial perf.	0.211	0.379	8.0%
		ESG index	0.588	0.635	37.3%
		Market risk	0.063	−0.231	−1.5%

* Explained variance: path coefficients × correlations.

(0.513) is significant, presenting a large effect.

Concerning the hypotheses tested, financial performance and the ESG index had a positive and significant impact on market value (path = 0.211, p = 0.000, and path = 0.588, p = 0.000, respectively); hence, H2 and H3 were supported. Furthermore, the direct effects between the ESG index on financial performance and market risk had a positive/negative and significant impact (path = 0.329, p = 0.000, and path = −0.354, p = 0.000, respectively); therefore, H1 and H4 were supported as well. Finally, hypothesis five was rejected because of its lack of significance (path = 0.063, p = 0.223).

In short, the data seem to show that higher commitments about sustainability, such as reported by the ESG index, increased companies' financial returns and values in the market. Meanwhile, the greater ESG rating reduced market risk. Similarly, the financial performance had a significant positive influence on fundamental analysis of the value of companies. Therefore, these results can help managers to design or define the corporate value creation strategy.

In addition to values of direct effect, Table 8 also illustrated indirect effects. The mediation analysis indicated that the ESG index affects market value directly and indirectly through financial performance, which worked as a mediating variable in the model. Moreover, the value of the variance accounted for (VAF) implied that the measurement was partial with a percentage of 10.5% (see Table 8).

5. Discussion

This research adds to evidence that ESG practices positively impact market value in the energy industry for O&G companies. Obviously, findings support for incorporating robust favorable ESG profiles to develop the corporate finance strategy. It appears that markets are influenced by the level of firms' ESG ratings when performing about environmental and governance issues, thereby supporting Miralles-Quirós et al. (2019); Shakil, 2021; Shanaev and Ghimire (2021) studies'. Results show that environmental and governance dimensions are the factors that conform the ESG index that will be higher when they are both high. Based on this result, companies may consider sustainability management when assessing how the market responds to their ads. Moreover, there was a significant effect size for the ESG index, suggesting that the incorporation of ESG profile appeared to have a strong influence on the markets when they evaluated the value of a corporation. These findings are intuitively appealing because the CEOs are probably more closely associated with the fundamental analysis, and the shareholders are more closely associated with sustainability ratings. The results indicate that companies should consider the three dimensions to determine its performance. Still, even if highly significant, the impact of the governance will not be as important as the environmental dimension when assessing the environmental, social and governance performance. Our findings are in line with Tzouvanas and Mamatzakis (2021), which found a positive relationship between environment score and market value. Furthermore, we subtianted that the social score has not influenced, while governance has a positive influence. Therefore, whereas the stakeholders may want to be aware of the impact that the fundamental analysis can have on the value of a company when it comes to corporate financial strategy, the commitment to the corporation's sustainability, through the ESG index, appears to play a more significant role.

This study also indicates that financial performance is significantly more important than market risk in determining the market value. Thus, although both play a role in the relation risk-return (Bodhanwala and Bodhanwala, 2020; Tzouvanas and Mamatzakis, 2021), the market risk has considerably less impact when valuing the energy industry. Perhaps the market risk was not significant for market valuation because the ESG index recognizes the energy industry risk factor instead. It could be that the ESG index is more highly involved in the evaluation of the general risks of the O&G industry, primarily by environmental issues, than the market risk. Therefore, the impact of the market volatility would have a more negligible effect on market value. Additionally, there is some evidence that for many stakeholders, the impact of sustainable profile is relevant to assessing a company's value and does not serve only as a peripheral signal (Champagne et al., 2021). This circumstance is particularly true if the company is highly involved with environmental business issues such as the energy sector and other sensitive industries (Alda, 2021; Radhouane et al., 2020).

According to Lins et al. (2017), disclosure on sustainability appears to influence financial performance in the firm, which in turn affects its reputation and legitimacy. Even if the company's financial performance is weak, the reputation of the company may make stakeholders feel more confident and make them significantly more willing to engage with the firm. In addition, our results indicate that the ESG index plays a larger role in corporate financial performance. This can be explained by the higher weighting of environmental and governance dimensions than social. By using compelling environmental strategy that drives ESG ratings, oil and gas companies can produce better financial results using

the legitimacy paradigm. This observation was previously made by López-Toro et al. (2021) for the pharmaceutical sector, who showed that investing in environmental, social, and governance initiatives enhances the visibility and profitability of the industry or Miroshnychenko et al. (2017) who indicated that internal green practices are the main environmental drivers of financial performance.

Our study found a negative and significant association between ESG profile and systematic risk, demonstrating that the higher the ESG rating, the lower the market risk in the O&G industry. According to this finding, previous research has claimed that ESG performance is inversely related to market risk, as reported by Dilling and Harris (2018)) and Shakil, 2021. The commitment of oil companies to environmental and governance policies, coupled with the respect they show for energy transition, allows them to reduce risk and become good firms. In this way, companies' commitment to ESG policies can lower risk at the same time that it can serve as a hedge for higher market valuations. However, the last assumption was not found in our study. It may be because the relationship between market risk and the value of the company should not be defined directly, but rather as a moderating effect between financial performance and market value.

6. Conclusions and implications

As part of their CSR efforts, companies hope to increase their market value. In previous studies of ESG scores within the oil and gas sector, a single factor is linked to the ESG variable. This research unlike previous studies looks at multiple variables that companies' ESG strategies may impact constructing a more comprehensive corporate finance system. In this more comprehensive approach, information is provided on how ESG attributes affect variables such as market risk, financial performance, and market value, which in turn is influenced by financial performance and market risk, completing the aforementioned complex relationship system. Therefore, the purpose of this study has been to identify all the potential relationships between the ESG index and the determinants of corporate financial strategy simultaneously: ESG-financial performance, ESG-market risk, and ESG-market value. ESG index becomes even more important when we consider an industry such as oil and gas, which has a profound impact on the environment. This research contributes to the proposed objective by evaluating the ability of the ESG index, financial performance, and market risk to explain the market value in the oil and gas sector of the world. Through our obtained results we can identify possible strategies that could be implemented within the governmental and business frameworks to reduce the social and environmental impact of the oil and gas sector.

Oil and gas companies should adopt ESG practices that increase their market valuation, reduce their risks, and positively impact their financial performance. By emphasizing the component elements of the ESG index, managers can also develop an overall corporate finance strategy for their shareholders by gaining insight into how the environmental and governance dimensions affect the variables under investigation. Thereby, higher levels of the ESG index, in particular, the contribution of the environmental dimension, benefit the market value of companies. Consequently, more efficient use of resources must be required in the value chain of companies when extracting oil and gas, accompanied by more significant investments in environmental innovations. Simultaneously, within the governance dimension, agency theory is involved. In this vein, the objectives managers should coincide with those of the shareholders through the implementation of mechanisms such as management and supervision of boards, sustainability incentives, shareholders vote on executive pay, equal shareholders rights or the disclosure of CSR sustainability reporting. All this will not only reduce the negative environmental impact of these companies but will also improve their economic and financial performance and their market value considering the obtained results. Furthermore, investors began using ESG indices as a tool to determine potential risks that may result from environmental issues with even greater importance than the weight they gave to market risk in the selection of portfolios. Additionally, the negative association between ESG and market risk brought to the forefront that we can consider the ESG index as a valid measure in financial risk management. Against this background, governments must begin to implement policies and regulations that allow oil and gas companies to improve their environmental and social performance within the framework of an energy transition.

Therefore, the findings indicated that the oil and gas sector might be motivated to adopt environmentally and socially responsible practices that result in corporate finance aligned with the demands of its investors. The agency theory supports this implication for improving the performance of the investment portfolio. Reducing the negative impact that some practices have on the environment and society translated into benefits in terms of financial return, risk or market value. Consequently, international policy and regulation should pay more attention to the analysis and quantification of the dimensions of the ESG index to ensure a higher quality of CSR engagement in companies.

The present work has some limitations that should be pointed out to adopt future lines of research. The sample used has been selected for a single year. Although the data are current, a longer period would provide more information about the relationships tested, and thus would reaffirm or reject the results obtained. Secondly, it is a sectoral study, focusing on multinational oil and gas companies. The results should not be extended to other energy sector companies, such as renewable energy, for example. Additionally, since it is a global sample, the results might be affected by specific policy and legal factors in each country or region.

However, future research can be based on the model designed for this research which related the ESG index with the global corporate finance strategy. A broader sectoral sample within the energy mega sector will allow us to identify and make a comparative analysis that helps to discriminate the behavior of the ESG index between renewable and non-renewable energy companies. Expanding the sample over time and carrying out a study by periods will also identify the impact of economic crises on the relationships (2008 crisis, Covid-19 crisis, for example). Finally, the features of the board and the gender effect will be variables that could have a high impact on the market value within the energy sector.

CRediT authorship contribution statement

Alicia Ramírez-Orellana: Conceptualization, Methodology, Validation, Formal analysis, Writing – original draft, Writing – review & editing, Visualization. **MCarmen Martínez-Victoria:** Writing – original draft, Writing – review & editing. **Antonio García-Amate:** Writing – original draft, Writing – review & editing. **Alfonso A. Rojo-Ramírez:** Writing – original draft, Writing – review & editing.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.resourpol.2023.103303.

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