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An empirical analysis on the effect of ESG/CSR ratings on the costs of capital in the global oil and gas industry

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Abstract

This work examines the relationships between Refinitiv ESG scores and costs of equity and costs of debt capital for a sample of 231 companies in the global oil and gas industry across 965 firm-year observations from 2015 to 2020. Using univariate analysis and multivariate linear regressions, we find that high ESG/CSR scoring companies in the global oil and gas industry experience cheaper equity and debt financing than their peers with lower ESG/CSR scores. By looking deeper into the individual ESG Pillar scores, we find that oil and gas companies with higher Environmental Pillar scores are expected to experience lower costs of equity than peers with lower scores. Conversely, firms with high Social Pillar scores are expected to have higher costs of equity compared with lower scoring peers. On the debt side, oil and gas companies with higher Environmental and Governance Pillar scores are expected to experience lower costs of debt compared with lower scoring peers. Our main findings are mostly consistent with arguments in the literature on the relationship between ESG/CSR and costs of capital in general, but we are cautious to draw causal conclusions and do not interpret our results as an exact representation of reality. We call for further industry specific research on this relationship to enable comparison across business models, and eventually establish causal inference.

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List of Abbreviations

CFP – Corporate Financial Performance

CSP – Corporate Social Performance

ESG – Environmental, Social and Governance

IV – Instrumental Variable

IVA – Intangible Value Assessment

KLD – Kinder, Lydenberg and Domini (KLD Research and Analytics; now MSCI ESG Research)

PRI – Principles for Responsible Investing

ROA – Return on Assets

SRI – Socially Responsible Investing

TRBC – Thomson Reuters Business Classification

VIF – Variance Inflation Factor

1 Introduction

The demand for sustainable development and the growth of a large number of individuals' pro-social preference has driven an increased focus on social responsible investments (SRI) (Chen, et al., 2021). Only in Q3 2020, the Principles for Responsible Investments (PRI), whose mission is to develop an efficient and sustainable global financial system to benefit the environment and society, saw 262 new signatories, representing a growth of 8,6 percent (Reynolds, 2020). The total assets under management for signatories represented approximately US$100 trillion in Q3 2020 compared to US$ 20 trillion in 2010 (PRI Association, 2020).

As investors have become more aware and focused on Corporate Social Responsibility (CSR) and Environmental, Social and Governance (ESG) factors over the past decades, an increasing number now integrate ESG/CSR into their investment processes. Several studies on how SRI strategies can improve long-term financial performance have been conducted, where some hold that there is no significant difference between financial performance for strategies with high ESG/CSR rated firms and for strategies with low ESG/CSR rated firms, while others find that such strategies may provide abnormal returns (Chen, et al., 2021).

The inconclusiveness of the studies give rise to an interesting question on how ESG/CSR can affect fundamental performance. In Hong and Kacperczyk's 2009 study on the effects of social norms on markets, evidence showed that sinful[1] stocks generally have a higher cost of equity capital as they are less preferred by norm-constrained investors (Hong & Kacperczyk, 2009). The narrative in this study becomes especially interesting in industries that are more susceptible to changes due to the increasing attention towards sustainable development. We argue that future research should be industry specific, as we are more likely to establish causal inference and facilitate comparison when investigating comparable business models. Consequently, this paper seeks to provide initial evidence on the relationships between ESG/CSR scores and costs of equity and costs of debt capital in the global oil and gas industry, an industry that is increasingly seen as sinful.

[1] By sinful stocks, Hong and Kacperczyk refer to companies involved in the production alcohol, tobacco and gaming, i.e. stocks that are less preferred by norm-constrained investors.

The following research question is thus evaluated:

- Do companies in the global oil and gas industry experience lower costs of equity capital and costs of debt capital from higher ESG/CSR scores?

This work is further motivated by the use of capital costs to price companies' future cash flows and finally evaluate companies' market value. The costs of capital reflect the degree of risk in a given firm at a given time. Consequently, if ESG/CSR scores are a good indication of a firm's corporate social responsibility (CSR), and if these affect the perceived riskiness of firms, then socially responsible firms should prosper from higher ESG/CSR scores resulting in lower costs of equity capital. Similarly, if debt owners see reduced risk with higher ESG/CSR scores, this may reduce the costs of debt capital for the companies issuing debt.

Building on the aforementioned premise, we hypothesize *ceteris paribus*, that companies in the global oil and gas industry with higher ESG/CSR scores have lower costs of equity and lower costs of debt capital.

To assess the effects of ESG/CSR on the costs of equity and costs of debt of these firms, data is collected from the investment universe of interest and is analyzed by univariate analysis and multivariate linear regressions. The final sample includes 965 firm-year observations from 231 companies for fiscal years 2015 to 2020. The relationships between the individual ESG Pillar scores, and the combined ESG score, with costs of equity and costs of debt capital are finally interpreted and discussed.

This work contributes to the existing literature in several ways. First, it answers prior calls from studies such as Renneboog et al.'s 2007 study on SRI, and Sharfman and Fernando's 2008 study on environmental risk management, to further investigate effects from ESG/CSR on costs of capital (Renneboog, et al., 2007; Sharfman & Fernando, 2008). Second, as prior research on industry specific cost of capital effects from ESG/CSR is particularly scarce, this work represents an early steppingstone into an understudied part of the literature. While most studies involving ESG/CSR investigate its impact on company value and stock performance, this study specifically targets the relationships between ESG/CSR and costs of equity and costs of debt for the global oil and gas industry. This work further prompts new research on cost of capital effects from ESG/CSR in other industries, hopefully facilitating comparison and causal inference.

The structure of this work is as follows. Chapter 2 reviews previous work relating to how ESG/CSR impacts company characteristics and their cost of equity and cost of debt capital. It further covers our hypotheses and theoretical arguments. Chapter 3 describes the research method used; it covers the regression models, the cost of equity capital and cost of debt capital models, the independent variables in the regressions and sample construction. Chapter 4 presents the empirical results including descriptive statistics of the sample, results from the univariate analysis, results from the multivariate regressions and other tests. Chapter 5 discusses the results and evaluates them towards our hypotheses. Finally, Chapter 6 concludes the work and Chapter 7 presents suggestions for future research.

1.1 Limitations

This work is limited by the resources provided by the University of Stavanger where the author was provided access to a shared Refinitiv Eikon user. The study is thus restricted to analysis using Refinitiv ESG scores as ESG/CSR proxy and company-specific data available through use of the software. Several firm-year observations were removed because of missing data. This is explained further in section 3.3.

2 Literature review and hypotheses development

In this chapter, former work on ESG/CSR is reviewed. Further, hypotheses are developed based on theoretical arguments promoting our expectation that *ceteris paribus*, the cost of equity capital and the cost of debt capital for high ESG/CSR scoring oil and gas firms is lower than for low ESG/CSR scoring oil and gas firms globally.

2.1 Literature review

The literature review in this section is intended to provide information on ESG/CSR attributes that allow us to evaluate what company-specific variables to include in our analyses, and to provide us with empirical arguments that support and challenge our expectations. The review in this work is based on a recently published article by Gillan, et al. (2021) who provide a review of financial economics-based research on ESG and CSR with an emphasis on corporate finance (Gillan, et al., 2021)[2]. Their review does not include investments literature on ESG-investing or SRI, nor the extensive culture trust, social capital and climate finance literature, but rather focuses on questions related to firms' ESG/CSR attributes and market characteristics, firms' ESG/CSR practices and boards, executives and executive compensation, firms' ESG/CSR attributes and ownership characteristics, firms' ESG/CSR attributes and firm risk, including cost of debt and cost of equity, and finally firms' ESG/CSR attributes and firm performance and value. Their review highlights robust findings while also encourages further research on questions that remain unanswered or that have unclear answers.

Gillan, et al. (2021) also provide an overview of the terminology for ESG/CSR and its evolution. The term ESG was introduced in a 2004 report by 20 financial institutions in a call from the Secretary-General of the United Nations (Gillan, et al., 2021). While ESG deals with how entities integrate environmental, social and governance concerns into their business models, CSR refers to the activities corporations do to become more socially responsible and become a better corporate

[2] A summary of all the studies reviewed by Gillan et al. (2021) is attached in Appendix A.

citizen. The main difference is that ESG includes governance explicitly. ESG has therefore a broader meaning than CSR. In this work ESG and CSR is used interchangeably.

2.1.1 Market characteristics and ESG/CSR

Several studies look at the relationship between firms' ESG/CSR attributes and market characteristics of the market in which the firms operate. Evidence provided by Cai et al. (2016) and Liang and Renneboog (2017b) shows that geographic location is an important factor in explaining ESG/CSR activities (Liang & Renneboog, 2017; Cai, et al., 2016). More specifically, Cai et al. (2016) provide evidence that firms' MSCI ESG Intangible Value Assessment (IVA)[3] ratings are significantly related to a country's economic development, a country's legal system and a country's culture (Cai, et al., 2016).[4] In a study of 23.000 firms in 113 different countries, Liang and Renneboog (2017b) found evidence that legal origin is a stronger explanatory factor than firm and country characteristics such as ownership concentration, political institutions and globalization (Liang & Renneboog, 2017). They found that firms from common law countries have lower CSR than companies from civil law countries, where Scandinavian civil law firms had the highest CSR ratings (Liang & Renneboog, 2017)[5]. Further, Di Giuli and Kostovetsky (2014) found that there can be important differences within a country. Specifically, they looked at the largest 3.000 publicly traded U.S. companies from 2003 to 2009 and found evidence that companies that score higher on CSR generally have Democratic rather than Republican founders, CEOs, and directors, and companies headquartered in Democratic-leaning states also have higher CSR score than firms headquartered in Republican-leaning states (Di Giuli & Kostovetsky, 2014). The findings in these articles show that CSR activity is highly dependent on the firms' geographic location and the socio-political views in the locations where the companies are headquartered.

[3] MSCI ESG Intangible Value Assessment ratings are an ESG rating system developped by MSCI where five ESG key issues are identified and evaluated for each company. Each company is assigned a letter rating ranging from the best (AAA) to the worst (CCC).

[4]The country's economic development was proxied by using income per capita, the country's legal system was proxied by the existence of competition laws and the existence of strong civil liberties and political rights, and the country's culture was proxied for harmony and autonomy.

[5] An overview of countries' legal Corporate social responsibility and legal origin is given in Appendix B.

Additionally, ESG/CSR activities are also strongly dependent on the operating industries of the firms. Borghesi et al. (2014) found evidence that some industries underperform others when it comes to ESG/CSR scores. In their study, the Petroleum and Natural Gas industry was the 43rd poorest performer across 49 industries from 1992-2006 (Borghesi, et al., 2014). It should also be noted that many researchers do not use raw ESG/CSR scores, but rather industry adjusted scores and benchmarks because the industry effect on ESG/CSR activities is so significant (Gillan, et al., 2021).

2.1.2 Firms' Board and Management and ESG/CSR

As boards and management are responsible for corporate decision-making, an important question arises on whether higher ESG/CSR ratings are explained by well-governed decision-making or if it comes as a result of agency problems between managers and stakeholders. In a study of U.S. firms, Iliev and Roth (2020) found that directors serving on boards of international firms that are exposed to changes in regulation and reporting requirements experience and increase in ESG/CSR performance (Gillan, et al., 2021). For "clean" industries, the main improvement is concentrated on the environmental performance whilst for "dirty" industries, such as the oil and gas industry, improvement was found in social performance. In addition to looking at the industry effect on ESG/CSR, Borghesi et al. (2014) found that U.S. firms with women as managers or board members have significantly higher ESG/CSR scores (Borghesi, et al., 2014). Dyck, Lins, Roth, Towner and Wagner's 2020 study also find that women on boards improves environmental performance, but also that having a women represented on the firms' boards is more impactful than other firm and board characteristics on environmental performance (Gillan, et al., 2021). Studies have also looked at CEO attributes in connection with ESG/CSR performance. Interestingly, some studies have found significant positive relation between CEO compensation and ESG performance while others find an inconclusive or negative relation. In a 2010 study, Gillan, et al. found evidence that CEOs of companies with higher ESG/CSR scores have lower salaries, supporting the view that although ESG/CSR spending suggests that CEOs are rent seeking, they are substitutes for CEO pay, rather than complements (Gillan, et al., 2021). A study by Jian and Lee (2015) find that CEOs are rewarded for "normal" levels of ESG/CSR spending and penalized through lower pay when ESG/CSR spending deviates from the norm (Jian & Lee, 2015). Likewise to both Gillan et al.

(2010) and Jian and Lee's (2015) studies, Ferrell, et al. (2016) also find that CEO compensation is impacted negatively from increased spending on ESG/CSR activities. Contrarily, some studies do not find a relationship between the two, exemplified by the 2014 study of Borghesi et al. (2014) that found no evidence relating CEO pay and a firm's aggregate ESG/CSR score (Borghesi, et al., 2014). Overall, the Gillan et al. (2021) review concludes that the variation in ESG/CSR considerations in CEO pay across firms and industries supports an optimal contracting view (Gillan, et al., 2021).

2.1.3 Ownership characteristics and ESG/CSR

The review on ownership characteristics and ESG/CSR provided by Gillan, et al. (2021) is separated into three parts based on ownership types: Institutional investor ownership, family ownership and state ownership.

In several countries institutional ownership represents the largest group of equity investors. It is therefore interesting to see how this type of ownership affects ESG/CSR performance. Studies of institutional ownership and ESG/CSR help us understand causality of investor preferences versus investors' role as active owners. The research shows divided views on the shape and sign of the relationship between institutional ownership and ESG/CSR activities (Gillan, et al., 2021). Some studies argue that causality is tied with investor preferences while others argue that engagement is the most important factor. Borghesi et al. (2014) and Gillan et al. (2010) found that institutional ownership is negatively related to firms' ESG/CSR scores, and that improvements in ESG/CSR scores lead to a decrease in institutional ownership (Borghesi, et al., 2014; Gillan, et al., 2021). On the other hand, Nofsinger et al. (2019) found that even though the relationship between institutional ownership and high environmental and social scores is not positive, the relationship between institutional ownership and low environmental and social scores is negative (Nofsinger, et al., 2019). Similarly, Chava (2014) found that institutional ownership and low environmental scores are negatively related (Chava, 2014). Evidence that the type of institutional ownership also has an influence has been documented. In a study by Hong and Kacperczyk (2009), there is evidence that socially constrained investors like pension funds have a smaller degree of ownership in stocks that score lower on ESG/CSR scores, suggesting that there exists a disproportionate ownership structure in high scoring ESG/CSR stocks and lower scoring ESG/CSR stocks (Hong & Kacperczyk, 2009). Contrarily to the aforementioned studies, some argue that the causality of the relationship is due to engagement of institutional investors rather than investor preferences. Dimson et al. (2015) and Barko et al. (2018), who study the CSR engagements by two different institutional investors, conclude that the investors' engagements increase ESG/CSR scores when firms find themselves in lower ESG/CSR quartiles, but scores decrease when ESG/CSR scores are in higher quartiles (Dimson, et al., 2015; Gillan, et al., 2021).

The number of studies on family ownership and ESG/CSR scores is scarce, but there is evidence of prioritization among this group. Abeysekera and Fernando (2020) hypothesized that family owned firms align ESG/CSR strategies to maximize wealth creation as these shareholders tend to be less diversified (Abeysekera & Fernando, 2020). They found that upon deciding on environmental investments, U.S. family owned firms are more concerned about protecting shareholder interests by undertaking significantly lower levels of investment than non-family owned firms (Abeysekera & Fernando, 2020). In a study by Gillan, Sekerci and Starks (2020), the authors find that, for their sample of Swedish firms, family owned companies cater to investor demand for environmental investment, but not to social investment (Gillan, et al., 2021).

When it comes to state ownership, Hsu, Lian and Mator (2018) present evidence that state-owned firms are more engaged in environmental and social issues than other firms, especially when it comes to firms in the energy sector and firms in emerging markets (Gillan, et al., 2021). Further, Boubakri et al. (2019) who studied a sample of privatized firms from 41 different countries found that prior to privatization, the firms had higher ESG/CSR scores than other publicly listed companies (Boubakri, et al., 2019). Similarly to the evidence mentioned in section 2.1.1, they also found that state ownership, political environment and geography have a significant impact on this relationship.

2.1.4 Risk and ESG/CSR

Many articles have looked at the relationship between ESG/CSR and risk. The review of Gillan et al. (2021) provides an overview of the reasearch looking into the relationship between systematic risk, credit risk, downside risk, legal risk, ideosyncratic risk, equity cost of capital and debt cost of capital with ESG/CSR. Most of the studies reviewed report a negative relationship between ESG/CSR and risk measures.

The review in this section mostly covers the effect of ESG/CSR on the costs of equity capital and the costs of debt capital as this is the main topic of this work.

El Ghoul et al. (2016), Albuquerque et al. (2019) and Okonomou et al. (2012) all found a negative relationship between systematic risk and ESG/CSR (El Ghoul, et al., 2016; Albuquerque, et al., 2019; Oikonomou, et al., 2012). They have different argumentations as to why this relationship is negative. Albuquerque et al. (2019) argues for example that the effect of ESG/CSR on systematic risk is stronger for firms with high product differentiation and El Ghoul et al. (2016) argues that firms with high ESG/CSR scores attract a wider investor base and have lower litigation risks, which then again leads to lower systematic risk (Albuquerque, et al., 2019; El Ghoul, et al., 2016). In several studies on the relationship between bond credit ratings and ESG/CSR scores, such as Seltzer et al. (2020) and Jiraporn et al. (2014), find that higher ESG/CSR scores result in higher bond ratings (Gillan, et al., 2021). However, studies also find that no significant relationship exists, such as in Stellner et al. (2015). They do however find that firms with higher ESG/CSR scores benefit from higher ratings if they operate in a country with high ESG/CSR scores in general, suggesting that geography and socio-political views are important factors (Stellner, et al., 2015). Evidence that higher ESG/CSR ratings contributing to lower legal risk also exists. In a study by Hong and Liskovich (2015), they found that companies subject to litigation charges are treated more leaniently when they have higher ESG/CSR scores supporting the view of a negative relationship between ESG/CSR scores and legal risk (Hong & Liskovich, 2015). Contrarily to most other risk measures, the two studies reviewed by Gillan et al. (2021) on the relationship between ESG/CSR and idiosyncratic risk, either showed evidence supporting a positive relationship or non-conclusive evidence (Gillan, et al., 2021).

Studies examining the relationship between ESG/CSR and equity cost of capital have showed variying results, however most of them show that there exists a negative relationship, meaning that firms with a higher ESG/CSR score will have a lower cost of equity capital (Gillan, et al., 2021).

The works reviewed by Gillan et al. have used different theoretical models in their analyses. In the study by Hong and Kacperczyk (2009), who looked at the effects of social norms related to sinful stocks on markets, they found evidence that the neglect of these stocks by large institutions affected the cost of capital for sinful stocks in a significant way (Hong & Kacperczyk, 2009). El Ghoul et al. (2011), who looked at the effect of CSR on the cost of equity capital for US firms, found that firms with better CSR scores have cheaper equity financing by using different methods to estimate firms' ex ante cost of equity. Their findings suggest that investments in employee relations, environmental policies, and product strategies substantially reduce the firms' cost of equity capital (El Ghoul, et al., 2011). Supporting the findings of Hong and Kacperczyk (2009), they also found evidence that participation in tobacco and nuclear power, two "sin" industries, increases companies' cost of equity (El Ghoul, et al., 2011). In a less recent study by Heinkel et al. (2001), that explored the effect of exclusionary ethical investing on corporate behavior in a risk-averse equilibruim setting, evidence supported the view that exclusionary ethical investing reduced the number of investors in polluting firms (Heinkel, et al., 2001). In turn, this lead to lower stock prices and thus higher cost of equity capital for the polluting firms. The higher cost of capital incentivizes these companies in becoming more socially responsible, but the extent is dependent on the amount of investors that exclude polluting companies (Heinkel, et al., 2001). In two recent studies by Pastor et al. (2020) and Pedersen et al. (2020) whose models include ESG/CSR preferences in investors' utility functions, Pastor et al. (2020) found that greener[6] firms have lower costs of capital, and Pedersen et al. (2020) found that the cost of capital of green stocks depend on the wealth of investors that are unaware whether the stocks they invest in are green or brown[7] (Gillan, et al., 2021). Further, the findings of Chava (2014), who looked at the effect from individual ESG/CSR components on the costs of capital, support the view that the cost of equity capital and the cost of debt capital is higher for companies with poor environmental profiles (Chava, 2014). Similarly, Ng and Rezaee (2015) found that there exists a negative relationship between environmental and governance performance and the cost of equity capital, but found no evidence of a relationship between social performance and cost of equity (Ng & Razaee, 2015). As per the cost of debt capital in firms, Goss and Roberts (2011) found that companies with more significant ESG/CSR concerns

[6] By green firms, Gillan et al. refer to high-scoring ESG/CSR companies.
[7] By brown firms, Gillan et al. refer to low-scoring ESG/CSR companies.

pay a higher interest, more specifically between 7 and 18 basis points more, on their bank loans than firms that are more responsible, resulting in a higher cost of debt (Goss & Roberts, 2011). Likewise, the results presented by Zerbib (2019) suggest a small negative premium (-2 basis points) in green bonds versus conventional bonds (Zerbib, 2019).

2.1.5 Financial performance and company value and ESG/CSR

One of the most researched questions with regards to ESG/CSR is whether decisions relating to corporate responsibility affects companies' performance and value, and whether performance or valuations drive decisions on ESG/CSR (Gillan, et al., 2021). Value creation can for example come from customers preferring sustainable products over less sustainble products, or if the cash flows from two firms are the same, but where one is sustainable and one is less sustainable, shareholders would receive more utility by choosing the more sustainable company. Both directions of causality suggest a positive relationship between ESG/CSR performance and shareholder wealth (Gillan, et al., 2021).

Another important factor to consider is shareholder selection. Hong and Kostovetsky (2012) argue that the probability of managers' marginal returns from ESG/CSR activities in order to lower cost of capital is lower when the companies have access to finance, and when investors' appetite for risk is higher (Hong & Kostovetsky, 2012).

Many studies have tried to answer the question on whether and how ESG/CSR affects company performance and value. By analysis of 3.700 study results from roughly 2.200 unique primary studies, Friede et al. (2015) found that approximately 90% of studies find a non-negative relationship between ESG and Corporate Financial Performance (CFP) (Friede, et al., 2015). Of these, 47,9% of vote-count studies and 62,6% of meta-analyses yielded a positive relationship (Friede, et al., 2015).

Waddock and Graves (1997) suggested two causality hypotheses relating to ESG/CSR and financial performance, namely the good management hypothesis and the slack resource hypothesis (Waddock & Graves, 1997). The good management hypothesis argues that by bettering ESG/CSR performance, companies' relationships with key stakeholders improve, which ultimately leads to superior financial performance (Waddock & Graves, 1997). In contrast, the slack resource hypothesis argues that superior financial performance increases resource slack, meaning companies can use more resources on ESG/CSR (Waddock & Graves, 1997).

The review by Gillan et al. (2021) provides further insight on the questions relating to ESG/CSR, CFP and company value. They investigate former research with negative, ambiguous and positive effects from ESG/CSR in different sections.

Firstly, Gillan et al. (2021) review the studies that found negative effects from ESG/CSR on performance and value. Di Giuli and Kostovetsky (2014), who studied red and blue (democratic and republican) companies and their inclinement to ESG, found no significant relationship between ESG/CSR (measured using KLD[8] scores) score changes over a period of three years and revenue growth (Di Giuli & Kostovetsky, 2014). However, they did find a significant negative relationship between companies' changes in ESG/CSR scores and changes in return on assets (ROA) or stock performance over the period, and suggest that any benefit to stakeholders from social responsibility come at the direct expence of firm value through declines in company ROA and stock performance (Di Giuli & Kostovetsky, 2014). Interestingly, Buchanan et al. (2018) found that during the financial crisis, as more severe agency problems occurred, the costs of over-investment in ESG/CSR caused higher scoring companies to experience greater declines in company values (Buchanan, et al., 2018). Their findings support the findings of Giuli and Kostovetsky (2014).

Secondly, Gillan et al. (2021) review the studies with ambiguous or no effects. Hsu et al. (2018) found that the environmental decisions for state owned firms was not significantly related to shareholder value when measued by long-term profitability or Tobin's Q (Gillan, et al., 2021). By using a proprietary Corporate Social Performance (CSP) rating database for companies in the UK,

[8] KLD scores are Environmental, social and governance performance indicators developpped by KLD Research and Analytics (now MSCI ESG Research). There has been extensive use of these scores for academic research since its inception in 1990.

Humphrey et al. (2012) found that there was no significant differences in risk-adjusted performance for UK firms (Humphrey, et al., 2012). They therefore argue that investors and managers are able to implement a CSP investment or business strategy without incurring any significant financial cost (or benefit) in terms of risk or return (Humphrey, et al., 2012).
Finally, Gillan et al. (2021) review the studies with positive effects. In a study by Gillan et al. (2010) examining the relationship between ESG ratings (all 7 different KLD categories) and firm performance, they found that firms with higher ESG scores have higher operating performance and Tobin's Q (Gillan, et al., 2021). Similarly, Borghesi et al. (2014) found that companies with stronger operating performance and larger cash flows have higher KLD scores (Borghesi, et al., 2014). Both Ferrell et al. (2016) and Gao and Zhang (2015) found a positive correlation between ESG/CSR scores and Tobin's Q (Ferrell, et al., 2016; Gao & Zhang, 2015). Servaes and Tamayo (2013) and Albuquerque et al. (2019) also found that ESG/CSR performance creates value, but only for companies that have high advertizing costs (Servaes & Tamayo, 2013; Albuquerque, et al., 2019). Some studies relate high ESG/CSR scores with higher valuations, but lower subsequent returns. Other studies draw conclusions that high ESG/CSR scores have a positive relationship with stock returns. Hong and Kacperczyk (2009) found that "sin" stocks (low ESG/CSR scores) have low valuations and thus experience greater subsequent returns while Dimson et al. (2015) found greater abnormal returns following successful engagements in environmental, social and governance concerns (Hong & Kacperczyk, 2009; Dimson, et al., 2015). In contrast to Humphrey et al. (2012) who found no significant difference in financial performance between firms with high or low ESG/CSR ratings for a sample of UK companies, Statman and Glushkov (2009) found a positive relationship between KLD scores and financial performance in their sample of US companies (Statman & Glushkov, 2009). Tang and Zhang (2020) and Flammer (2021) studied the relationship between stock market performance and the issuance of green bonds. While green bonds are not necessarily issued by high-scoring ESG/CSR companies, they can influence the companies' ESG scores. Tang and Zhang (2020), who studied a sample of firms issuing green bonds in 28 countries from 2007 to 2017, found that the stock market reacts positively to the announcement of green bonds, and these firms experience greater stock liquidity and increased institutional ownership (Tang & Zhang, 2020). Interestingly, they did not observe a significant premium for green bonds, suggesting that the positive stock returns gained from the announcements are not entirely driven by lower interest rates (Tang & Zhang, 2020). Similarly,

Flammer (2021) also found evidence that investors respond positively to the issuance announcement, resulting in higher stock prices, and that issuers improve their environmental performance (higher environmental ratings) post-issuance (Flammer, 2021).

Overall, the research on the effect from ESG/CSR attributes on firm value and performance mostly show a positive relationship. While some research concludes that high-scoring firms have high valuations and thus suffer from lower subsequent returns, others have also concluded that higher ESG/CSR scoring firms obtain higher stock market returns. Gillan et al. (2021) highlights that the topic's somewhat conflicting conclusions is an example of a joint hypothesis problem, meaning conclusions relating to causality requires market efficiency assumptions on whether or not ESG/CSR scores are considered into stock prices (Gillan, et al., 2021).

2.1.6 ESG/CSR in the oil and gas industry

Most of the studies that investigate the effects from ESG/CSR scores on costs of capital and performance often evaluate a sample from a certain country, group of countries or a stock exchange such as the S&P500. Although many studies control for industry effects, most of the research does not investigate the effects from ESG/CSR scores on costs of capital for specific industries or sectors. We do not find any prior research that investigates the effects from ESG/CSR on either cost of equity capital, nor cost of debt capital, in the oil and gas industry, further motivating the importance of this work.

2.2 Hypotheses and theoretical arguments

This section covers our main hypotheses and sub-hypotheses that we aim to assess. Next it provides arguments that motivate our expectation that, *ceteris paribus*, the cost of equity capital and cost of debt capital is lower for high-scoring ESG/CSR firms than for low-scoring ESG/CSR firms in the global oil and gas industry.

Our primary hypotheses H_1 and H_2 are:

H_1: Global oil and gas companies with higher ESG scores have lower cost of equity capital than global oil and gas companies with lower ESG scores

H_2: Global oil and gas companies with higher ESG scores have lower cost of debt capital than global oil and gas companies with lower ESG scores

Further, we seek to understand how the three ESG dimensions have an impact on cost of equity and cost of debt capital respectively. Therefore, we establish the following sub-hypotheses:

$H_{1.1}$: Global oil and gas companies with higher Environmental scores have lower cost of equity capital than global oil and gas companies with lower Environmental scores

$H_{1.2}$: Global oil and gas companies with higher Social scores have lower cost of equity capital than global oil and gas companies with lower Social scores

$H_{1.3}$: Global oil and gas companies with higher Governance scores have lower cost of equity capital than global oil and gas companies with lower Governance scores

$H_{2.1}$: Global oil and gas companies with higher Environmental scores have lower cost of debt capital than global oil and gas companies with lower Environmental scores

$H_{2.2}$: Global oil and gas companies with higher Social scores have lower cost of debt capital than global oil and gas companies with lower Social scores

$H_{2.3}$: Global oil and gas companies with higher Governance scores have lower cost of debt capital than global oil and gas companies with lower Governance scores

The arguments supporting these hypotheses are based on prior research reviewed in section 2.1 and are consistent with the general view for companies irrespective of industry.

Former studies on the relationship between ESG/CSR activities and costs of capital have shown that investor preference can have a significant impact on costs of capital. According to Heinkel et al. (2001), stock prices are negatively affected by a reduced number of investors in polluting firms owing to exclusionary ethical investing practices, leading to higher costs of equity capital for the polluting firms (Heinkel, et al., 2001). The magnitude of the effect is contingent on the number of investors practicing exclusionary investing. This finding is particularly interesting in the oil and gas industry which is heavily polluting. Heinkel et al. (2001) suggest that the higher cost of capital incentivizes the companies in becoming more socially responsible, which should reflect higher ESG/CSR scores, and subsequently lowers financing costs. Hong and Kacperczyk (2009) found similar evidence where the neglect of "sinful" stocks by large institutions affected costs of capital negatively (Hong & Kacperczyk, 2009). Both studies support our primary hypotheses $\mathbf{H_1}$ and $\mathbf{H_2}$.

Prior work also suggests that lower ESG/CSR scoring firms are perceived as having a higher degree of risk. El Ghoul et al. (2016) find that firms with high ESG/CSR scores attract a wider investor base and have lower litigation risks, which then again leads to lower systematic risk and should lower costs of capital (El Ghoul, et al., 2016). This may also be true for the oil and gas industry where more socially responsible companies are more likely to be perceived as having lower risk than their peers, also supporting our hypotheses $\mathbf{H_1}$ and $\mathbf{H_2}$.

Although most prior work on the effect of ESG/CSR on costs of capital in general support our primary hypotheses, we argue that industries should be considered separately because the direction and rationale surrounding causality, and the size of the effects from ESG/CSR on costs of capital may vary significantly across different business models. Generalizing the relationship, rather than separating them by industry, also limits our ability to make comparisons. Hence, this research paves the way for more industry specific research on ESG/CSR and cost of capital by providing initial evidence for the global oil and gas industry.

3 Research Method

To study the effects of ESG/CSR ratings on the costs of equity capital and costs of debt capital for global oil and gas companies, we must choose an appropriate analytical approach. First, this chapter explains the multivariate linear regression models that are used to analyze the relationships between ESG/CSR and costs of equity and costs of debt. Second, the corresponding asset pricing models are presented. Next, we introduce the ESG/CSR proxies and independent variables that are used in the regressions. Finally, this chapter explains what considerations are made to ensure robustness of the regressions and how the sample is constructed.

3.1 Regression models and variables

The regression analyses in this work are inspired by the study of Bhuiyan and Nguyen (2019) on the impact of CSR disclosure on cost of equity capital and cost of debt capital for companies listed on the Australian stock exchange, and by the study of El Ghoul et al. (2016) on corporate social responsibility and the cost of capital for a large sample of U.S. firms (Bhuiyan & Nguyen, 2019; El Ghoul, et al., 2016).

3.1.1 Regression Models

Similar to the study by Bhuiyan and Nguyen (2019), this work uses Beta, Price to Book ratio, Total Assets, Leverage Ratio and Revenue Growth as control variables. It also includes dummy variables to control for geographic-effects and year-effects. Contrary to their study, the regression models in this work uses the three dimensions of the Refinitiv ESG scores one year prior as independent variables as opposed to Bloomberg ESG scores which measures firms' ESG disclosure.

The regression model for the cost of equity is defined by equation (1) below:

$$
\begin{aligned}
COE_{it} = {} & \beta_0 + \beta_1 BETA_{it} + \beta_2 PB\_RAT_{it} + \beta_3 LN\_TA_{it} + \beta_4 LEV\_RAT_{it} + \beta_5 REV\_GTH_{it} + \beta_6 ENV_{it-1} \\
& + \beta_7 SOC_{it-1} + \beta_8 GOV_{it-1} + \sum_{i=9}^{13} \beta_i DUMMY\_REGION + \sum_{i=14}^{19} \beta_i DUMMY\_YEAR + \varepsilon_{it}
\end{aligned}
\tag{1}
$$

The regression model for the cost of debt is defined by equation (2) below:

$$COD_{it} = \beta_0 + \beta_1 BETA_{it} + \beta_2 PB\_RAT_{it} + \beta_3 LN\_TA_{it} + \beta_4 LEV\_RAT_{it} + \beta_5 REV\_GTH_{it} + \beta_6 ENV_{it-1} + \beta_7 SOC_{it-1} + \beta_8 GOV_{it-1} + \sum_{i=9}^{13} \beta_i DUMMY\_REGION + \sum_{i=14}^{19} \beta_i DUMMY\_YEAR + \varepsilon_{it} \quad (2)$$

Where

$\beta_i = Regression\ coefficients;$

$COE_{it} = Cost\ of\ equity\ in\ percent\ for\ firm\ i\ at\ time\ t, calculated\ by\ equation\ (4);$

$COD_{it} = Cost\ of\ debt\ in\ percent\ for\ firm\ i\ at\ time\ t, calculated\ by\ equation\ (4);$

$BETA_{it} = Beta\ value\ for\ firm\ i\ at\ time\ t;$

$PB\_RAT_{it} = Price\ to\ Book\ ratio\ for\ firm\ i\ at\ time\ t;$

$LN\_TA_{it} = Natural\ logarith\ of\ total\ assets\ in\ USD\ for\ firm\ i\ at\ time\ t;$

$LEV\_RAT_{it} = Leverage\ ratio\ for\ firm\ i\ at\ time\ t;$

$REV\_GTH_{it} = y/y\ revenue\ growth\ for\ firm\ i\ at\ time\ t;$

$ENV_{it-1} = Refinitiv\ Environmental\ Pillar\ Score\ for\ firm\ i\ at\ time\ t-1;$

$SOC_{it-1} = Refinitiv\ Social\ Pllar\ Score\ for\ firm\ i\ at\ time\ t-1;$

$GOV_{it-1} = Refinitiv\ Governance\ Pillar\ Score\ for\ firm\ i\ at\ time\ t-1;$

$DUMMY\_REGION = Dummy\ variable\ that\ controls\ for\ region - effect;$

$DUMMY\_YEAR = Dummy\ variable\ that\ controls\ for\ year - effect;\ and$

$\varepsilon_{it} = Error\ term\ for\ firm\ i\ at\ time\ t.$

Note that for some of the regressions that will be performed, ENV_{it-1}, SOC_{it-1} and GOV_{it-1} are replaced by ESG_COMB_{it-1}[9] to investigate the combined effect from the ESG scores as calculated by Refinitiv's proprietary weighting method.

---

[9] *Refinitiv ESG Combined Score for firm i at time t-1*

3.1.2 Cost of Equity Model

Following Bhuiyan and Nguyen (2019), the cost of equity capital model that is used in this work is the traditional Capital Asset Pricing Model (CAPM) first introduced by Treynor (1961,1962), Sharpe (1964), Lintner (1965a,b) and Mossin (1966):

$$COE = R_f + (\beta * ERP) \tag{3}$$

Where

$COE = Cost\ of\ Equity$;

$R_f = Inflation\ riskfree\ rate$;

$\beta = relative\ volatility; and$

$ERP = \ Equity\ risk\ premium.$

3.1.3 Cost of Debt Model

Also following Bhuiyan and Nguyen (2019), the cost of debt is calculated using weighted average costs of short- and long- term debt (Bhuiyan & Nguyen, 2019):

$$COD = \left[\left[\left(\frac{SD}{TD}\right) * (CS * AF)\right] + \left[\left(\frac{LD}{TD}\right) * (CL * AF)\right]\right] * (1 - TR) \tag{4}$$

Where

$COD = Cost\ of\ Debt$;

$SD = Short - Term\ debt$;

$TD = Total\ Debt$;

$CS = Pre - tax\ Cost\ of\ short\ term\ debt$;

$AF = Debt\ Adjustment\ factor\ (ex. the\ avg\ yield\ above\ government\ bonds\ for\ a\ given\ rating\ class\ which\ is\ used\ when\ a\ company\ does\ not\ have\ a\ fair\ market\ curve)$;

$LD = Long - Term\ debt$;

$CL = Pre - Tax\ Cost\ of\ Long - term\ Debt;\ and$

$TR = Effective\ Tax\ rate.$.

3.1.4 ESG/CSR proxy

The ESG/CSR proxies in this work are the Refinitiv ESG Pillar scores and Refinitiv Combined ESG scores. These scores are calculated based on over 500 company-specific ESG-measures and covers 10 main categories within the 3 ESG pillars (Refinitiv, 2021). Within the environmental pillar, the themes include emissions, innovation, and resource use. In the social pillar, the themes are community, human rights, product responsibility, and workforce. Finally, in the governance pillar we find themes including CSR strategy, management, and shareholders.

The first step in Refinitiv's calculation of ESG scores is to calculate the ESG category scores from relevant underlying metrics. A percentile rank scoring methodology determines the category score based on how many companies are worse, how many companies have the same value and how many companies have a value at all. It is calculated by the following equation (Refinitiv, 2021):

$$score = \frac{no.of\ companies\ with\ a\ worse\ value + \frac{no.of\ companies\ with\ the\ same\ value\ included\ in\ the\ current\ one}{2}}{no.of\ companies\ with\ a\ value} \quad (5)$$

The second step is related to a proprietary materiality matrix. The purpose is to develop an objective and impartial weighting of the different categories in the final ESG scoring calculation for different industries. The materiality matrix is used to calculate the magnitude weights of a category in said industry. The category weight of an industry group is calculated by the following equation (Refinitiv, 2021):

$$Category\ weight\ of\ an\ industry\ group = \frac{Magnitude\ weight\ of\ a\ category}{Sum\ of\ magnitudes\ of\ all\ categories} \quad (6)$$

Finally, the pillar scores are calculated by the relative sum of the category weights. Table 1 below provides an indicative ESG pillar weight for the oil and gas industry (Refinitiv, 2021).

Table 1: Indicative ESG category weights matrix for the oil and gas industry

Pillar	**Category**	**Weight (%)**
Environmental	Emission	0.11
	Innovation	0.10
	Resource use	0.13
Social	Human rights	0.16
	Product responsibility	0.06
	Workforce	0.12
	Community	0.08
Governance	Management	0.16
	Shareholders	0.05
	CSR Strategy	0.03

This table shows illustrative ESG category weightings for the TRBC Oil & Gas industry.
Source: (Refinitiv, 2021)

The Pillar scores are used as independent variables (*ENV*, *SOC* and *GOV*) in the multivariate regression models defined by equations (1) and (2) shown in section 3.1.1. Further, we also use the combined ESG score (*ESG_COMB*) in some regressions as we investigate the combined effect on cost of equity and cost of debt.

3.1.5 Control variables

In our regression analyses, we follow prior studies by Bhuiyan and Nguyen (2019), El Ghoul et al. (2016) (among others) in specifying certain control variables that have shown to affect cost of equity and cost of debt. More specifically, we use a measure of relative volatility (*BETA*), the price to book ratio (*PB*_RAT), the natural logarithm of total assets in USD (*LN_TA*), the leverage ratio as measured by total debt divided by total assets (*LEV_RAT*) and 1-year revenue growth (*REV_GTH*)[10]. Further, we also control for region-effects and year-effects by using dummy

[10] Definitions and sources for the dependent variables and control variables are listed in Table 16 in Appendix C.

variables. We control for five regions, namely the Americas, Africa, Oceania, Asia and Europe. For year-effects we control for each year from 2015 to 2020. Table 2 below shows the expected sign of the independent variables, including the proxies for ESG/CSR.

Table 2: Expected sign of independent variables in multivariate regression

Independent Variable	Expected sign in Cost of Equity model	Expected sign in Cost of Debt model
BETA	+	+
PB_RAT	-	-
LN_TA	-	-
LEV_RAT	+	+
REV_GTH	-	-
ENV	-	-
SOC	-	-
GOV	-	-
ESG_COMB	-	-

This table presents the expected signs of the independent variables that are used in the multivariate regression analyses introduced in section 3.1.1.

3.2 Robustness of the regression models

To ensure robustness of the regression analyses, we must consider the biases that may affect our results. More specifically, we want to mitigate the potential biases caused by heteroscedasticity, multicollinearity and endogeneity.

First, to mitigate biases stemming from heteroskedasticity, we follow Hail and Leuz (2006) and El Ghoul et al. (2011,2016) and perform pooled cross-sectional time-series regressions with heteroscedasticity robust standard errors clustered at the firm level. We argue that clustering is justified by the fact that there are clusters in the population of oil and gas companies that are not present in the sample. This argument is supported by a working paper by Abadie et al. (2017) on the adjustment of standard errors by clustering (Abadie, et al., 2017).

Second, we assess multicollinearity by computing the variance inflation factors (VIFs) on our independent variables. The VIFs are calculated by the following equation (Wooldridge, 2014):

$$VIF_i = \frac{1}{1 - R_i^2} \tag{7}$$

Where R_i^2 is the coefficient of determination when regressing an independent variable X_i on the other explanatory variables.

As per Woolridge (2014), if the VIF is at or above 10, we may in most cases conclude that multicollinearity is a problem (Wooldridge, 2014). While many agree, others also argue that a VIF over 5 can be considered problematic. In this work we assume that any VIF over 10 is problematic in terms of multicollinearity.

Finally, to ensure robustness to endogeneity, we perform a series of regressions using the Two Stage Least Square (2SLS) approach (Wooldridge, 2014). The procedure is as follows:

For a given linear regression:

$$y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \tag{8}$$

Where X_1 is an endogenous variable, and X_2 and X_3 are exogenous, we regress X_1 on an instrumental variable Z_1 which is correlated with X_1 and uncorrelated with the error term $\boldsymbol{\varepsilon}$ such that:

$$\widehat{X_1} = \beta_0 + \beta_1 Z_1 + \beta_2 X_2 + \beta_3 X_3 + v \tag{9}$$

Next, we replace X_1 in the structural equation (8) with the fitted values of $\widehat{X_1}$ calculated in equation (9) such that:

$$y_2 = \beta_0 + \beta_1 \widehat{X}_1 + \beta_2 X_2 + \beta_3 X_3 + v \tag{10}$$

Where v is an error term that is not correlated to $\widehat{X_1}$, X_2 or X_3.

To further test for endogeneity, we test whether the differences in estimates between the ordinary least squares (OLS) and 2SLS are significant by conducting a Wu-Hausman test (Hausman, 1978). If the difference between 2SLS and OLS are statistically significant, then X_1 is indeed endogenous. If the difference is not statistically significant, then we cannot conclude on endogeneity of variable X_1.

3.3 Sample construction

The sample of companies was first retrieved using the screener application in Refinitiv Eikon. The global equity universe was filtered to include only oil and gas companies defined by Thomson Reuters Business Classifications (TRBC) from fiscal year 2002 to 2020 (when Refinitiv ESG scores were introduced). The TRBC industries that are included are thus Oil & Gas Refining and Marketing, Oil & Gas Exploration and Production and Integrated Oil & Gas. The raw sample counts 1289 companies whereof 387 are in the Oil & Gas Refining and Marketing industry, 831 are in the Oil & Gas Exploration and Production industry and the remaining 71 companies are in the Integrated Oil & Gas Industry. The sample size was first limited by input variables related to equations (3) & (4), reducing the year-range to include fiscal years 2015 to 2020. Further, firm-year observations with no data available for any of the dependent or independent variables in equations (1) & (2) were also omitted. The data was subsequently winsorized[11] at 1 and 99 percentiles using mean values to minimize the effect of outliers. Still, some outliers that could impact the results of the analysis were observed. More specifically, 6 firm-year observations for two companies had significantly diverging data. Both companies have headquarters in Argentina, a country which has experienced hyperinflation, and thus very high and volatile interest rates. For this reason, the two companies were deemed non-representative for analyses on costs of capital in

[11] Winsorization is a method by which extreme values in a sample are replaced by the sample's n^{th}-percentile value. In this case, all values that were below the 1^{st}-percentile and above the 99^{th}-percentile were replaced.

general and were therefore omitted from the sample. The final sample includes 965 firm-year observations across 231 companies in the TRBC Oil & Gas industry.

Table 17 and Table 18 in Appendix D show the sample distribution by country and by TRBC industry respectively. The United States is the most represented country by number of firms with 74 different companies followed by Canada and Australia represented by 39 and 16 firms respectively. Of the 231 companies in the sample, 78 of these are in the Oil & Gas Refining and Marketing industry, 132 are in the Oil & Gas Exploration and Production industry and 21 are in the Integrated Oil & Gas industry.

4 Empirical Results

The analyses in this work were conducted in either Microsoft Excel or in R. This chapter is divided into four parts, where the first section presents descriptive statistics on the final sample. Further, section 4.2 shows the results found from a univariate test in which we compare the cost of equity and cost of debt between companies scoring above- and below-median ESG/CSR scores. Section 4.3 presents the results from the multivariate regression analyses introduced in section 3.1.1. Finally, section 4.4 presents the results from robustness tests.

4.1 Descriptive sample statistics

Table 3 reports descriptive statistics for the dependent and independent variables in equations (1) and (2) for our sample of 965 firm-year observations. It reports on the mean, median, standard deviation, and minimum and maximum values for the individual variables.

Table 3: Descriptive statistics of dependent and independent variables

Variable	N	Mean	Median	Standard Deviation	Minimum	Maximum
COE	965	11.03	10.00	5.12	1.49	27.70
COD	965	3.50	3.07	2.71	0.00	17.77
BETA	965	1.48	1.22	0.89	-0.07	4.54
PB_RAT	965	1.46	1.13	1.76	-4.64	11.40
LN_TA	965	22.34	22.40	2.08	15.85	26.59
LEV_RAT	965	0.27	0.25	0.18	0.00	1.06
REV_GTH	965	10.66	4.96	49.84	-70.98	301.01
ENV_t-1	965	35.43	35.73	26.90	0.00	91.81
SOC_t-1	965	41.10	35.09	25.51	3.22	91.60
GOV_t-1	965	51.72	51.24	23.77	5.65	94.86
ESG_COMB_t-1	965	39.68	38.53	20.20	5.25	80.88

This table presents descriptive statistics of the dependent and independent variables for our sample of 965 firm-year observations.

Table 4 presents Pearson correlation coefficients for the same dependent and independent variables along with their degree of significance.

Table 4: Pearson correlation coefficients of dependent and independent variables

Variable	*COE*	*COD*	*BETA*	*PB_RAT*	*LN_TA*	*LEV_RAT*	*REV_GTH*	*ENV_t-1*	*SOC_t-1*	*GOV_t-1*
COE	1									
COD	0.31***	1								
BETA	0.92***	0.27***	1							
PB_RAT	-0.11***	-0.17***	-0.12***	1						
LN_TA	-0.09**	-0.12***	-0.16***	-0.09**	1					
LEV_RAT	0.06**.**	0.27***	0.10**	-0.09**	0.02	1				
REV_GTH	0.04	0.09**	-0.01	-0.05	-0.09**	-0.05	1			
ENV_t-1	-0.20***	-0.26***	-0.25***	0.01	0.70***	-0.06**.**	-0.11***	1		
SOC_t-1	-0.14***	-0.22***	-0.21***	0.00	0.63***	-0.04	-0.11***	0.86***	1	
GOV_t-1	-0.01	-0.13***	0.03	-0.03	0.32***	0.00	-0.05**.**	0.40***	0.38***	1

This table presents the Pearson correlation coefficients between the dependent and independent variables.
'***', '**', '*' and '**.**' denote the statistical significance levels at the 0.1%, 1%, 5% and 10% levels respectively.

The Pearson correlation coefficients show that there is generally low correlation between the explanatory variables. This suggests that multicollinearity is likely not a serious concern in the multivariate analyses. The exception is the correlation between the Refinitiv Environmental and Social Pillar scores at 0.86 with a significance level of 0.1%. This will be investigated in section 4.4.

4.2 Univariate Test

Before conducting the multivariate regression analyses, a univariate analysis was conducted to give a preliminary indication on the sign of the relationship between the three ESG pillar scores and the Combines ESG score with cost of equity and cost of debt capital. It was conducted by comparing the mean costs of equity and costs of debt capital for the companies with higher than median ESG/CSR scores with those with lower than median scores. The results of the analysis are presented in Table 5 below.

Table 5: Univariate test of means

Univariate test of means				
		N	COE	COD
ENV_t-1 ≥ median	(1)	483	10.10	2.87
ENV_t-1 < median	(2)	482	11.96	4.13
Difference	(1)-(2)		-1.86	-1.25
T-Stat			5.70***	7.36***
SOC_t-1 ≥ median	(1)	483	10.30	2.95
SOC_t-1 < median	(2)	482	11.75	4.05
Difference	(1)-(2)		-1.45	-1.09
T-Stat			4.49***	6.42***
GOV_t-1 ≥ median	(1)	483	10.80	3.16
GOV_t-1 < median	(2)	482	11.25	3.84
Difference	(1)-(2)		-0.45	-0.67
T-Stat			1.34**.**	3.86***
ESG_COMB_t-1 ≥ median	(1)	483	10.24	2.91
ESG_COMB_t-1 < median	(2)	482	11.81	4.09
Difference	(1)-(2)		-1.57	-1,18
T-Stat			4.81***	6.93***

This table presents the results from a univariate test of means by which higher than median ESG Pillar scores are compared with lower than median ESG Pillar scores in our sample of 965 firm-year observations.
'***', '**', '*' and '**.**' denote the statistical significance levels at the 0.1%, 1%, 5% and 10% levels respectively.

The table shows that companies that score at or above the median Refinitiv Environmental Pillar score experience 186 basis points lower costs of equity capital and 125 basis points lower costs of debt capital than the companies scoring below the median. The differences are significant at the 0.1% level for both cost of equity and cost of debt capital. Similarly, it shows that the companies that score at or above the median Refinitiv Social Pillar score experience 145 basis points lower costs of equity capital and 109 basis points lower costs of debt capital than the companies scoring below the median, with the differences statistically significant at the 0.1% level. For the Refinitiv Governance Pillar score, the table shows that companies that score at or above the median Refinitiv Governance Pillar score experience 45 basis points lower costs of equity capital and 67 basis points lower costs of debt capital. The difference is significant at the 10% level for cost of equity capital and 0.1% for the cost of debt capital. Lastly, for the Combined ESG score, the table shows that companies that score at or above the median Combined ESG score experience 157 basis points lower costs of equity capital and 118 basis points lower costs of debt capital compared with the companies that score below the median level. The difference is statistically significant at the 0.1%

level of significance. In line with our expectations, the overall results suggest that companies with higher scores have lower costs of equity and costs of debt capital. The same is true when looking at the individual Pillar scores.

4.3 Multivariate Regression Analyses

In this work pooled cross-sectional time-series regressions with heteroscedasticity robust standard errors clustered at the firm level were used. The results from the multivariate regressions on cost of equity capital and cost of debt capital are presented in Table 6 and Table 7 respectively.

Table 6: Multivariate regression results for cost of equity capital

Variable	**ESG**	**COE**	**2015-2017**	**2018-2020**	**ESG***	**ESG_COMB**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Intercept	11.3690***	-1.6989	-2.1430	-1.3239	-1.7558	-0.4066
	(1.2765)	(1.3739)	(1.5079)	(1.5363)	(1.4851)	(1.2265)
BETA		5.7520***	5.5311***	5.7514***	5.7648***	5.7674***
		(0.0859)	(0.1103)	(0.0762)	(0.0970)	(0.0848)
PB_RAT		0.0311	-0.0055	0.0356	0.0228	0.0247
		(0.0360)	(0.0461)	(0.0341)	(0.0412)	(0.0363)
LN_TA		0.2685***	0.2841***	0.2341**	0.2761***	0.1970**
		(0.0712)	(0.0815)	(0.0817)	(0.0765)	(0.0635)
LEV_RAT		-0.6245	-0.2556	-1.5116*	-0.6965	-0.5715
		(0.4659)	(0.4795)	(0.6752)	(0.5306)	(0.4591)
REV_GTH		0.0017*	0.0107***	0.0036**	0.0018**.**	0.0016**.**
		(0.0008)	(0.0018)	(0.0013)	(0.0009)	(0.0008)
ENV_t-1	-0.0548**	-0.0302**	-0.0284**	-0.0381**	-0.0318**	(See note below)
	(0.0173)	(0.0092)	(0.0089)	(0.0130)	(0.0096)	
SOC_t-1	0.0321**.**	0.0219*	0.0250*	0.0265**	0.0226*	(See note below)
	(0.0183)	(0.0089)	(0.0104)	(0.0095)	(0.0090)	
GOV_t-1	0.0086	-0.0086	-0.0083	-0.0100	-0.0091	(See note below)
	(0.0122)	(0.0053)	(0.0059)	(0.0063)	(0.0056)	
Region effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	No	No	Yes	Yes
N	965	965	514	451	901	965
Adj. R^2	0.1002	0.8869	0.8467	0.8914	0.8788	0.8810

This table presents the results from 6 different analyses where cost of equity (COE) was regressed on different independent variables. In model 1, COE was regressed on the Environmental, Social and Governance pillar scores. In model 2, COE was regressed on the independent variables as per equation (3). In models 3 and 4, the sample was divided into two subsamples representing the periods 2015-2017 and 2018-2020 respectively; COE is regressed on the same independent variables as in Model 2. Model 5 replicates Model 2 on a sample in which observations where any of the three ESG variables are equal to 0 are removed. Finally, Model 6 replicates Model 2, but replaces the independent variables of ESG with an independent variable representing the combined ESG score *ESG_COMB_t-1*. The coefficient for *ESG_COMB_t-1* is -0.0117**.** and the standard error is (0.0062). '***', '**', '*' and '**.**' denote the statistical significance levels at the 0.1%, 1%, 5% and 10% levels respectively. The standard errors are reported in parenthesis.

The dependent variable in all models presented in Table 6 is the cost of equity capital (COE) as defined by equation (3). In Model 1, we look at the effect from the Environmental, Social and Governance Pillar scores on the cost of equity when controlling for region- and year-fixed effects. The results show a negative coefficient on the Environmental Pillar score and a positive coefficient on the Social Pillar score, statistically significant at the 1% and 10% level respectively. The coefficient on the Governance Pillar score is not significant. Hence, the model suggests that firms showing higher environmental performance have a lower cost of equity while firms with higher social performance have a higher cost of equity, although the latter only being significant at the 10% level. The findings are further reinforced by our findings in the following models 2 through 6. Similarly to Model 1, Model 2, which also includes company-specific control variables, demonstrates a negative coefficient on the Environmental Pillar score and a positive coefficient on the Social Pillar score, statistically significant at the 1% and 5% level respectively. Economically, the findings suggest that for every additional score-unit in the Environmental Pillar score, the cost of equity capital is expected to decrease by 3.02 basis points, and for every additional score-unit in the Social Pillar score, the cost of equity capital is increased by 2.19 basis points, *ceteris paribus*.

In models 3 and 4, we look at the periods ranging from 2015 to 2017 and 2018 to 2020. For both periods, the coefficients of the Environmental Scores were also negative and statistically significant at the 1% level. Further, the coefficients of the Social Pillar scores were positive and statistically significant at the 5% level. Interestingly, the magnitudes of the coefficients increased for both the Environmental Pillar score and the Social Pillar score from the first period to the next.

The coefficient of the Environemtal Pillar score decreased from -0.0284 to -0.0381 and the coefficient of the Social Pillar score increased from 0.0250 to 0.0265. For the latter, the statistical significance also increased from the 5% level to the 1% level. The increase in magnitudes may indicate that these ratings may have become more important for costs of equity.

In Model 5, all observations that scored 0 in any of the three ESG Pillar scores were removed from the sample to adjust for possible measurement errors. This resulted in a sample size of 901 firm-year observations. The coefficient for the Environmental Pillar score is -0.0318 and is significant at the 1% level of significance. Further, the coefficient of the Social Pillar score is 0.0226 and is significant at the 5% level of significance. The results are very comparable to the results from Model 2.

In Model 6, the independent variables representing the Environmental, Social and Governance Pillar scores were replaced by an independent variable representing the Combined ESG score, which is weighted by Refinitiv's prorpietary weighting method. The coefficient of the Combined ESG score is -0.0117 and is significant at the 10% level of significance. Economically, the findings suggest that for every additional score-unit in the Combined ESG score, the cost of equity is expected to decrease by 1.17 basis points, *ceteris paribus*.

For Models 2 through 6, company-specific variables are included in the regression analysis. Not surprisingly, Beta consistently demonstrates the highest coefficient and is significant at the 0.1% level of significance in all models. The coefficients of Beta range from 5.5311 to 5.7674. Further, the natural logarithm of total assets also demonstrated a positive coefficient in all the models. It is statistically significant at the 0.1% level in models 2, 3 and 5, and statistically significant at the 1% level in models 4 and 6. The magnitude of the coefficients range from 0.1970 to 0.2841. Revenue growth also showed positive coefficients in all models, however the level of significance varied. In Models 2, 3 and 4, the levels of significance were 5%, 0.1% and 1% respectively. In Models 5 and 6, the levels of significance were at 10%. The coefficients of the Price to Book ratio and the leverage ratio were in a vast degree non-significant, with the exception of the leverage ratio in Model 4, being significant at the 5% level of significance.

For our primary cost of equity models, Model 2 and 6, the adjusted R^2 is 0.8869 and 0.8810 respectively, suggesting that around 88 percent of the variation in cost of equity is explained by the independent variables in equation (3).

Table 7: Multivariate regression results for cost of debt capital

Variable	**ESG**	**COD**	**2015-2017**	**2018-2020**	**ESG***	**ESG_COMB**
	(7)	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Intercept	1.8620***	0.3950	-0.5639	4.2485*	1.2149	1.7964
	(0.4082)	(1.3347)	(1.3950)	(2.1515)	(1.4773)	(1.2512)
BETA		0.5363***	0.3302**	0.7323***	0.5311***	0.5522***
		(0.1338)	(0.1106)	(0.2154)	(0.1506)	(0.1313)
PB_RAT		-0.1566*	-0.0606	-0.2439*	-0.1352*	-0.1611*
		(0.0670)	(0.0531)	(0.1076)	(0.0687)	(0.0672)
LN_TA		0.0194	0.1507*	-0.1413	-0.0081	-0.5665
		(0.0723)	(0.0763)	(0.1023)	(0.0776)	(0.0649)
LEV_RAT		3.3941***	2.2360***	5.7462***	3.4596***	3.4463***
		(0.7282)	(0.6270)	(1.2208)	(0.8218)	(0.7447)
REV_GTH		0.0027	0.0050***	0.0013	0.0026	0.0028
		(0.0019)	(0.00132)	(0.0034)	(0.0020)	(0.0019)
ENV_t-1	-0.0266**	-0.0205**	-0.0184*	-0.0225**.**	-0.0201**	(See note below)
	(0.0085)	(0.0075)	(0.0071)	(0.0120)	(0.0076)	
SOC_t-1	0.0009	-0.0010	0.0002	-0.0046	-0.0007	(See note below)
	(0.0088)	(0.0085)	(0.0087)	(0.0107)	(0.0086)	
GOV_t-1	-0.0051	-0.0076	-0.0080**.**	-0.0067	-0.0093**.**	(See note below)
	(0.0054)	(0.0049)	(0.0048)	(0.0065)	(0.0051)	
Region effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	No	No	Yes	Yes
N	965	965	514	451	901	965
Adj. R^2	0.1225	0.2118	0.1994	0.2495	0.2004	0.2053

This table presents the results from 6 different analyses where cost of debt (COD) was regressed on different independent variables. In Model 7, COD was regressed on the Environmental, Social and Governance pillar scores. In Model 8, COD was regressed on the independent variables as per equation (4). In Models 9 and 10, the sample was divided into two subsamples representing the periods 2015-2017 and 2018-2020 respectively; COD is regressed on the same independent variables as in Model 8. Model 11 replicates Model 8 on a sample in which observations where any of the three ESG variables are equal to 0 are removed. Finally, Model 12 replicates Model 8, but replaces the independent variables of ESG with an independent variable representing the combined

ESG score *ESG_COMB_t-1*. The coefficient for *ESG_COMB_t-1* is -0.0251*** and the standard error is (0.0067). '***', '**', '*' and '.' denote the statistical significance levels at the 0.1%, 1%, 5% and 10% levels respectively. The standard errors are reported in parenthesis.

The dependent variable in all models represented in Table 7 is the cost of debt capital (COD) as defined in equation (4). Similar to what was done in Table 6, in Model 1 we look at the effect from the Environmental, Social and Governance Pillar scores on the cost of debt when controlling for region- and year-fixed effects. The results show a negative coefficient of -0.0266 on the Environmental Pillar score and is statistically significant at the 1% level. The Social and Governance Pillar scores were not significant. Hence, the model suggests that firms showing higher environmental performance have a lower cost of debt. These findings are backed by the other models, all demonstrating a negative coefficient at different levels of significance. In Model 8, which also includes company-specific control variables, the Environmental Pillar score is also negative. It is statistically significant at the 1% level of significance. Economically, the findings suggest that for every additional score-unit in the Environmental Pillar score, the cost of debt capital is expected to decrease by 2.05 basis points, *ceteris paribus*.

In models 9 and 10, we investigate the two sub-periods ranging from 2015 to 2017 and 2018 to 2020. The coefficient of the Environmental Pillar score is negative for both periods. In the first period the coefficient is significant at the 5% level, and in the second period it is statistically significant at the 10% level. The coefficients of the Social Pillar Score were statistically non-significant for any of the two models. Further, the coefficient of the Governance Pillar score was negative and statistically significant at the 10% level for the period 2015-2017 but was non-significant for the next period. Like our observations for the cost of equity capital, the magnitude of the coefficients for the Environmental Pillar scores increased from the first period to the next. More specifically, it decreased from -0.0184 to -0.0225. As with cost of equity, the increase in magnitudes may indicate that these ratings have become more important for costs of debt.

In Model 11, all observations that scored 0 in any of the three ESG Pillar scores were removed from the sample to adjust for possible measurement errors, leaving us with a sample size of 901 firm-year observations compared with 965 firm-year observations. Like our other models, we observe a negative coefficient on the Environmental Pillar, and it is significant at the 1% level of significance. We also observe a negative coefficient on the Governance Pillar score, and it is significant at the 10% level of significance. The results are very comparable to the results observed in Model 8.

In our final model, Model 12, the independent variables representing the Environmental, Social and Governance scores were replaced by an independent variable representing the combined ESG score, which is weighted by Refinitiv's proprietary scoring method. The Combined ESG score has a coefficient of -0.0251 and is statistically significant at the 0.1% level of significance. Economically, the results suggest that for every additional score-unit in the Combined ESG score, the cost of debt capital is expected to decrease by 2.51 basis points, *ceteris paribus*.

In Models 8 through 12, company-specific control variables were included in the regression analyses. Similarly to our results for cost of equity, the coefficients of Beta were consistently positive and statistically significant at the 0.1% level for all models except for Model 9 where the level of significance was 1%. The leverage ratios have the highest coefficients for these models, ranging from 2.2360 to 5.7462. They are all statistically significant at the 0.1% level of significance. Further, the price to book ratio is statistically significant at the 5% level for all models except for Model 9 where it is non-significant. The coefficients are consistently negative ranging from -0.1352 to -0.2439 for models 8, 10, 11 and 12. For the natural logarithm of total assets and revenue growth, the coefficients were only significant in model 9. The coefficient of the natural logarithm of total assets is 0.1507 and is statistically significant at the 5% level. The coefficient of revenue growth is 0.0050 and is statistically significant at the 0.1% level.

For our primary cost of debt models, Model 8 and 12, the adjusted R^2 is 0.2118 and 0.2053 respectively, suggesting that around 21 percent of the variation in costs of debt capital can be explained by the independent variables in equation (4).

4.4 Robustness checks

Before interpreting and discussing the findings of our multivariate regression analyses, we must consider whether the models are subject to biases. Biases may stem from different sources, but the most common are related to heteroskedasticity, multicollinearity and endogeneity.

Firstly, following Hail and Leuz (2006) and El Ghoul et al. (2011,2016), the analyses in this work use clustered heteroskedasticity robust standard errors, thus accounting for heteroskedasticity across "clusters" of observations. Clustering is done at firm level.

Secondly, to assess whether there are problems with multicollinearity in our models, we compute the variance inflation factors (VIFs) on our independent variables.

We see from Table 4 in section 4.1 that the Environmental Pillar score and Social Pillar score have a correlation of 0.86 at a 0.1% level of significance. The high correlation may be a reason for concern. Results from computation of VIFs are presented in Table 8 below.

Table 8: VIF results

Independent Variable	**Variance Inflation Factor**
BETA	1.2981
PB_RAT	1.0636
LN_TA	2.2694
LEV_RAT	1.0517
REV_GTH	1.3272
ENV_t-1	5.1344
SOC_t-1	4.0768
GOV_t-1	1.2853

This table presents the variance inflation factors for the different independent variables used in the multivariate regression analyses introduced in section 3.1.

As expected, the VIFs of the Environmental and Social Pillar scores are higher than the rest at 5.1344 and 4.0768 respectively. In this work we interpret the independent variables representing the Environmental and Social Pillar scores as moderately colinear and accept the moderate degree of bias caused by this.

Finally, we also wish to ensure robustness of our results to endogeneity concerns stemming from omitted variables, measurement errors and/or simultaneity. Consequently, we use the 2 Stage Least Squares (2SLS) estimation approach where the endogenous variable is replaced in the second stage by an estimated coefficient that only contains exogenous information from instruments and exogenous variables, but not the endogenous part that is correlated with the error term, as described in section 3.2. The IVs must be correlated with the endogenous variable and uncorrelated with the error term. Many potential IVs were considered, such as CEO compensation, institutional ownership percentage, government ownership percentage, percentage of independent board members, however none of the above had a high enough correlation with the endogenous variable and were therefore deemed inappropriate.

Consequently, we follow studies by El Ghoul, et al. (2016) and Attig, et al. (2013) in using the firm level initial value of the individual ESG Pillar scores (*ENV_INI*, *SOC_INI*, *GOV_INI)* and the combined ESG score (*ESG_COMB_INI*) (El Ghoul, et al., 2016; Attig, et al., 2013). To evaluate the robustness of the IVs, we perform a weak instruments test for correlation and a Wu-Hausman test for endogeneity. The results of the 2SLS regressions on cost of equity and cost of debt are presented in Table 9 and in Table 10 respectively.

Table 9: 2SLS regression results for cost of equity capital

Variable	**IV=*ENV_INI***	**IV=*SOC_INI***	**IV=*GOV_INI***	**IV=*ESG_COMB_INI***
	(13)	**(14)**	**(15)**	**(16)**
Intercept	-1.9535	-1.6432	-1.7092	-0.2201
	(1.4651)	(1.3921)	(1.4083)	(1.3109)
BETA	5.7474***	5.7476***	5.7502***	5.7677***
	(0.0860)	(0.0871)	(0.0889)	(0.0858)
PB_RAT	0.0330	0.0307	0.0313	0.0229
	(0.0373)	(0.0367)	(0.0368)	(0.0366)
LN_TA	0.2814***	0.2608***	0.2675***	0.1843***
	(0.0748)	(0.0739)	(0.0729)	(0.0689)

Variable	IV=*ENV_INI*	IV=*SOC_INI*	IV=*GOV_INI*	IV=*ESG_COMB_INI*
LEV_RAT	-0.6389	-0.6456	-0.6259	-0.5369
	(0.4797)	(0.4908)	(0.4771)	(0.4694)
REV_GTH	0.0017.	0.0019*	0.0017*	0.0016.
	(0.0008)	(0.0009)	(0.0008)	(0.0008)
ENV_t-1		-0.0391***	-0.0305**	
		(0.0113)	(0.0096)	
SOC_t-1	-0.0245*		0.0218*	
	(0.0098)		(0.0091)	
GOV_t-1	-0.0082	-0.0091.		
	(0.0053)	(0.0054)		
$\widehat{VAR}$	-0.0342**	0.0034*	-0.0077	-0.0092
	(0.0108)	(0.0130)	(0.0067)	(0.0083)
Region effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Corr. of IV	0.9458	0.9327	0.8531	0.9152
Weak instruments test	424.717	440.050	868.367	1131.148
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)
Wu-Hausman test	0.187	4.219	0.113	0.269
(p-value)	(0.665)	(0.041)	(0.737)	(0.604)
N	965	965	965	965
Adj. R^2	0.8869	0.8860	0.8869	0.8810

This table shows the results from the 2SLS regressions on cost of equity that were performed using the firm level initial value of the individual ESG Pillar scores (*ENV_INI, SOC_INI, GOV_INI*) and the combined ESG score (*ESG_COMB_INI*) as IVs. $\widehat{VAR}$ represents the 2SLS estimator for the given IVs.
'***', '**', '*' and '.' denote the statistical significance levels at the 0.1%, 1%, 5% and 10% levels respectively. The standard errors are reported in parenthesis.

In Table 9, only one model passes the Wu-Hausman test for endogeneity, namely model 14 with a significance level of 5%, where *SOC_INI* is used as an IV. The 2SLS estimator for this regression is preferred over the original estimator in Model 2 presented in Table 6.

Table 10: 2SLS regression results for cost of debt capital

Variable	**IV=ENV_INI**	**IV=SOC_INI**	**IV=GOV_INI**	**IV=ESG_COMB_INI**
	(17)	**(18)**	**(19)**	**(20)**
Intercept	-0.2035	0.3919	0.4874	1.0084
	(1.4305)	(1.3668)	(1.3833)	(1.3193)
BETA	0.5253***	0.5365***	0.5523***	0.5510***
	(0.1356)	(0.1357)	(0.1411)	(0.1350)
PB_RAT	-0.1520*	-0.1565*	-0.1582*	-0.1535*
	(0.0685)	(0.0682)	(0.0690)	(0.0686)
LN_TA	0.0496	0.0198	0.0284	-0.0027
	(0.0765)	(0.0741)	(0.0750)	(0.0694)
LEV_RAT	3.3602***	3.3952***	3.407***	3.4269***
	(0.7408)	(0.7437)	(0.7335)	(0.7542)
REV_GTH	0.0027	0.0027	0.0027	0.0026
	(0.0019)	(0.0019	(0.0019)	(0.0019)
ENV_t-1		-0.0200*	-0.0180*	
		(0.0098)	(0.0078)	
SOC_t-1	0.0051		0.0001	
	(0.0098)		(0.0086)	
GOV_t-1	-0.0067	-0.0076		
	(0.0051)	(0.0050)		
$\widehat{VAR}$	-0.0030**	-0.0016	-0.0016**	-0.0355***
	(0.0098)	(0.0116)	(0.0060)	(0.0084)
Region effects	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes
Corr. of IV	0.9458	0.9327	0.8531	0.9152
Weak instruments test	424.717	440.050	868.367	1131.148
(p-value)	(0.000)	(0.000)	(0.000)	(0.000)
Wu-Hausman	1.44	0.009	7.753	5.4
(p-value)	(0.231)	(0.924)	(0.006)	(0.021)
N	965	965	965	965
Adj. R^2	0.210	0.2118	0.2077	0.2019

This table shows the results from the 2SLS regressions on cost of debt that were performed using the firm level initial value of the individual ESG Pillar scores (*ENV_INI, SOC_INI, GOV_INI*) and the combined ESG score (*ESG_COMB_INI*) as IVs. $\widehat{VAR}$ represents the 2SLS estimator for the given IVs.

'***', '**', '*' and '.' denote the statistical significance levels at the 0.1%, 1%, 5% and 10% levels respectively. The standard errors are reported in parenthesis.

In Table 10, two models pass the Wu-Hausman test for endogeneity, namely Model 19 and Model 20 with a significance level of 1% and 5% respectively. *GOV_INI* and *ESG_COMB_INI* are used as an IV in the respective models. The 2SLS estimators for these regressions are preferred over the estimators found in Model 8 and 12 presented in Table 7.

5 Discussion

This chapter discusses the results that are presented in chapter 4 in relation to the hypotheses mentioned in section 2.2. Further we discuss the validity of our research method along with possible shortcomings, present causality concerns in our research and finally discuss the importance of the findings and their implications.

5.1 Results and hypothesis evaluation

Overall, the results from our analyses show that there is a statistically significant relationship between ESG/CSR scores and both costs of equity capital and costs of debt capital for oil and gas companies. This was demonstrated by both the univariate tests and our multivariate regressions.

For cost of equity, Model 6 is preferred over the 2SLS estimation in Model 16 as the 2SLS regression did not pass the Wu-Hausman endogeneity test. Model 6 yielded a coefficient of -0.0117 and was statistically significant at the 10% level of significance. Economically, the results suggest that for every additional score-unit in the Combined ESG score, the cost of equity is expected to decrease by 1.17 basis points, *ceteris paribus*. This finding supports hypothesis $\mathbf{H_1}$ described in section 2.2.

For cost of debt, the 2SLS estimation in Model 20 was preferred over the original regression in Model 8 because it passed the Wu-Hausman endogeneity test at a significance level of 5%. Model 20 yielded a coefficient of -0.0355 and was significant at the 0.1% level of significance. Economically, the results suggest that for every additional score-unit in the Combined ESG score, the cost of debt is expected to decrease by 3.55 basis points, *ceteris paribus*. This finding supports hypothesis $\mathbf{H_2}$ described in section 2.2.

Looking further into the regression results on cost of equity, we find that that the estimated coefficient of the Environmental Pillar score in Model 2 is preferred over the 2SLS estimation in Model 13 as the latter does not pass the Wu-Hausman endogeneity test. The coefficient of the Environmental Pillar score is -0.0302 and is significant at the 1% level of significance. For the

Social Pillar score, the estimated Social Pillar score in Model 14 is preferred over the original estimation in model 2. The coefficient of the Social Pillar score is 0.0034 and is significant at the 5% level of significance. For the Governance Pillar score, the estimated Governance Pillar score is not significant for the original model, nor the 2SLS model. Economically, the results suggest that for every additional score-unit in the Environmental Pillar score, the cost of equity is expected to decrease by 3.02 basis points, *ceteris paribus*; and for every addition score-unit in the Social Pillar score, the cost of equity is expected to increase by 0.34 basis points, *ceteris paribus*. The expected effect from the Governance Pillar score on cost of equity is inconclusive. The findings support hypothesis $\mathbf{H_{1.1}}$, contradict $\mathbf{H_{1.2}}$, while no significant evidence is found for $\mathbf{H_{1.3}}$.

Looking further into the regression results on cost of debt, we find that that the estimated coefficient of the Environmental Pillar score in Model 8 is preferred over the 2SLS estimation in Model 17 as the latter does not pass the Wu-Hausman endogeneity test. The coefficient of the Environmental Pillar score is -0.0205 and is significant at the 1% level of significance. For the Social Pillar score, the estimated Social Pillar score is not significant for the original, nor the 2SLS model. For the Governance Pillar score the 2SLS estimation in Model 19 is preferred over the original estimation in Model 8 as Model 19 passes the Wu-Hausman endogeneity test at a significance level of 5%. The coefficient of the Governance Pillar score is -0.0016 and is significant at the 5% level of significance. Economically, the results suggest that for every additional score-unit in the Environmental Pillar score, the cost of debt is expected to decrease by 2.05 basis points, *ceteris paribus*; and for every addition score-unit in the Governance Pillar score, the cost of debt is expected to decrease by 0.16 basis points, *ceteris paribus*. The expected effect from the Social Pillar score on cost of debt is inconclusive. The findings support hypothesis $\mathbf{H_{2.1}}$ and $\mathbf{H_{2.3}}$, while no significant evidence is found for $\mathbf{H_{2.2}}$.

5.2 Research validity

The results show that there is a statistically significant relationship between ESG/CSR ratings and costs of capital, but the analyses are subject to certain assumptions and limitations. These assumptions and limitations affect the validity of our results and are therefore an important consideration. The assumptions and limitations are summarized below.

First, the sample that is analyzed in this work has been greatly reduced from an initial sample of 1289 to 231 companies in the TRBC Oil & Gas industry. The initial year-range of the sample was also reduced from 2002-2020 to 2015-2020 due to limiting data for variables in equations (3) and (4). The reduction in sample size induces bias to the regression, as the sample is most likely not representative for the entire population. Companies with missing data are likely to be smaller companies that are less transparent concerning ESG/CSR activities and policies, or smaller companies with less strict reporting requirements. The results in this work should therefore be more representative for larger companies.

Second, costs of equity and costs of debt are only calculated by the models in equations (3) and (4). In some research, other models are used to calculate costs of capital. For example, El Ghoul et al. (2011,2016) estimate the cost of equity capital by analysts' earnings forecasts and stock prices using four different models developed by Claus and Thomas (2001), Gebhardt et al. (2001) Ohlson and Juettner-Nauroth (2005) and Easton (2004). They argue that traditional asset pricing models fail to capture the cost of equity, and therefore implicit models constitute an appealing alternative (El Ghoul, et al., 2016). The argument for the implied cost of capital approach by Hail and Leuz (2006,2009) and Chen et al. (2009) is that it attempts to isolate the cost of capital effects from growth and cash flow effects (Hail & Leuz, 2006; Hail & Leuz, 2009; Chen, et al., 2009). We are unable to replicate these model because of lack of data, and consider the traditional asset pricing models in equations (3) and (4) as sufficient for the scope of this work.

Third, we use only one proxy for ESG/CSR, namely the Refinitiv ESG ratings. Prior research mostly use the KLD STATS database (now called MSCI ESG STATS) for their ESG proxies. Different calculation methods and weightings between the two may considerably affect the results in a regression analysis, and therefore results may be non-appropriate for comparison. However, if both the Refinitiv ESG ratings and the KLD scores are good proxies for ESG/CSR activities, the signs of the relationships should not be affected.

Fourth, the analyses performed in this work assume that the relationship between ESG/CSR and costs of equity capital and cost of debt capital is linear for our sample of companies. This assumption is consistent with prior research on ESG/CSR and costs of capital and is therefore considered to be appropriate. It is however important to acknowledge that this may not be the case.

Fifth, in our regression analyses, we look at the degree in which our independent variables are colinear and find that the Environmental Pillar score and the Social Pillar score have a correlation of 0.86. The VIF for the Environmental Pillar score and Social Pillar score are 5.1344 and 4.0768 respectively. We accept the moderate collinearity and accept the degree of bias resulting from this.

Finally, we did not find appropriate IVs other than the firm level initial value of the individual ESG Pillar scores and the combined ESG score when entering the sample. Other IVs or omitted variables may exist and would, possibly to a significant degree, improve the models in this work. Also, the 2SLS regressions assume that the other independent variables are exogenous, which may not necessarily be the case.

The abovementioned assumptions and limitations restrict our ability to draw detailed conclusions about reality. Statistics and mathematics are our best tools to quantify the relationship between ESG/CSR and costs of equity and costs of debt capital, but our results should not be interpreted as an exact description of this relationship. Therefore, we do not interpret the coefficients in our regression analyses as exact, but we rather focus on the sign of the relationship.

5.3 Causality concern

When looking at ESG/CSR ratings and costs of capital, it is important to consider the direction and rationale behind causality. In the literature, two alternative causality hypotheses are often referred to, namely the good management hypothesis and the slack resource hypothesis by Waddock and Graves (1997). The good management hypothesis argues that enhancing ESG/CSR performance betters the companies' relationships with key stakeholders and ultimately leads to superior financial performance (Waddock & Graves, 1997). On the other hand, the slack resource hypothesis argues that better financial performance results in resource slack, which allows firms to increase their CSR performance (Waddock & Graves, 1997). In this work, better financial performance would be analogous to lower costs of capital.

Other causality hypotheses also exist, such as the hypotheses of investors' preferences and investors' role as active owners. Investors' choice of high scoring ESG/CSR companies over low scoring ESG/CSR companies may drive costs of capital downwards as higher ESG/CSR scoring companies may be perceived as having lower risk (often on several levels). Investors' role as active owners may also contribute to changes in ESG/CSR scores through adoption of ESG/CSR activities and thereby affect companies' costs of equity and costs of debt capital.

To infer causality for our work, more research on the relationship between ESG/CSR and costs of capital needs to be conducted. More specifically, research should attempt to eliminate bias and measurement errors by improving the statistical models used.

5.4 Other considerations

Although not the basis for this work, the results also suggest that ESG/CSR has become more important for both costs of equity and costs of debt capital in recent years as the magnitudes of the coefficients in our multivariate regression analysis increase from the period 2015-2017 to 2018-2020. This is particularly visible through the expected Environmental Pillar scores. Our findings could be linked to investor's increasing preference and/or awareness of socially responsible companies versus non-socially responsible companies, however, further research need be conducted to draw any causal conclusions. Analogically, the increase in coefficients over time could also clutter our estimates of "correct" effects from ESG/CSR ratings on costs of equity and costs of debt capital. It is not known whether these effects will increase, decrease, or remain the same in the future. Consequently, this also means that our results could be subject to over- or underestimating.

5.5 Importance and implications

As existing research on the effects of ESG/CSR on costs of equity and costs of debt capital is scarce compared to its effect on company value and stock performance, this research adds to the discussion on whether ESG/CSR has a positive or negative effect on equity and debt financing. This research answers prior calls to investigate effects from ESG/CSR on costs of capital and further paves the way for more industry specific research on the topic by providing initial evidence for the global oil and gas industry. Although the reported size of the effects from ESG/CSR on costs of capital in this work is subject to some degree of bias, and possibly over- or underestimation as explained in section 5.2 and 5.4, the findings of this research can still have important and practical implications for managers of oil and gas companies by providing information on how ESG/CSR has affected equity and debt financing in the reporting period that was studied. It should be noted that the companies' costs of investing in ESG/CSR are not considered in this work. In decision-making, managers should therefore consider the costs versus the potential benefits gained. Finally, as costs of capital are important in the pricing of companies' future cash flows, and subsequently company value, the research can also help investors make better informed investment decisions.

6 Conclusion

This work examined the relationships between ESG/CSR scores and costs of equity and costs of debt for companies in the global oil and gas industry. The final sample consisted of 965 firm-year observations across 231 companies in the TRBC Oil & Gas industry from 2015 to 2020. To analyze the relationship, we follow prior research and perform pooled cross-sectional time-series regressions with heteroscedasticity robust standard errors clustered at the firm level. The regression models for cost of equity and cost of debt are defined by equations (1) and (2) respectively. As a proxy for ESG/CSR, the Refinitiv Combined ESG scores and the Refinitv ESG Pillar scores were used. Costs of equity and costs of debt were calculated using traditional asset pricing models described by equations (3) and (4). Consistent with prior work on ESG/CSR and costs of capital, the control variables that were used in the models were Beta, Price to book ratio, the natural logarithm of total assets, leverage ratio and revenue growth. Further, we also control for fixed year-effects and fixed regional effects, and perform 2SLS regressions to ensure robustness to endogeneity.

We hypothesized that, *ceteris paribus*, the cost of equity capital and cost of debt capital is lower for high-scoring ESG/CSR firms than for low-scoring ESG/CSR firms in the global oil and gas sector. This expectation was grounded in former studies on the effects from ESG/CSR on costs of capital in general, which mostly show a significantly negative relationship, meaning higher ESG/CSR scores are an indication of lower costs of capital.

The main results of this work show that there is a statistically significant negative relationship between ESG/CSR and cost of equity. Similarly, there is also a statistically significant negative relationship between ESG/CSR and cost of debt. Although the models used in the analysis are subject to some degree of bias from sampling and multicolinearity, and could be subject to over- or underestimation, the results support our primary hypothesis. Economically the findings suggest that global oil and gas companies with higher ESG/CSR ratings are expected to have lower costs of equity capital and lower costs of debt capital, *ceteris paribus*.

By further studying the Environmental, Social and Governance Pillar scores, we also find a significant relationship from the Environmental and Social Pillar scores on cost of equity, but results are not conclusive for the Governance Pillar score. The relationship between the Environmental Pillar score and cost of equity is negative, whilst the relationship is positive for the Social Pillar score. We also find a significant negative relationship from the Environmental Pillar score and the Governance Pillar score on cost of debt. Again, the models are subject to some degree of bias from multicolinearity and could be subject to over- or underestimation. However, the results support three of our six subhypotheses, namely that global oil and gas companies with higher Environmental Pillar scores have lower costs of equity, global oil and gas companies with higher Environmental Pillar scores have lower costs of debt, and finally, global oil and gas companies with higher Governance Pillar scores have lower costs of debt, *ceteris paribus*. Further, our results contradict our subhypothesis that companies in the global oil and gas industry with higher Social Pillar Scores have lower costs of equity.

We deem it necessary to conduct further research on ESG/CSR and costs of capital to draw more detailed conculsions, and are particularly cautious to draw any conclusions on the causality of the relationship. Still, this work represents an important contribution to an understudied part of the literature by providing industry specific evidence, and paving the way for more industry specific research relating to ESG/CSR and costs of capital. In addition to contributing to existing literature, this work also has practical implications. Our results should encourage socially responsible managers in global oil and gas companies to evaluate investments in ESG/CSR activities as it is expected to lower costs of equity and costs debt capital. Further, this research can also help investors make better informed investment decisions. It should however be noted that the extent of the effect from ESG/CSR activities is not entirely conclusive, as the analyses in this work could be subject to some degree of bias from sampling, multicolinearity and under- or overestimation.

7 Further research

On the topic of ESG/CSR and its effect on costs of equity and debt capital in the global oil and gas industry, there are still uncertainties regarding the results and causality of the relationship. Further research can help narrow these uncertainties and shed light on the direction and rationale surrounding causality. The following summarizes our suggestions for further research.

First, the analyses in this work are subject to some degree of bias from multicollinearity and could also be subject to estimation errors, meaning the size of the effect from ESG/CSR on costs of equity capital and costs of debt capital could be cluttered. Further research should attempt to correct these sources of error by improving the regression models. This may include finding and adding more control variables that have an impact on costs of equity and costs of debt or finding suitable IVs for 2SLS regressions.

Second, while most former research is conducted using KLD scores as ESG/CSR proxies, Refinitiv ESG Scores were used as proxies in this work. By performing similar research using KLD scores, comparison of the magnitude of the effect from ESG/CSR on costs of equity and costs of debt capital is facilitated. Research using other ESG/CSR data providers can also be interesting and could strengthen our views by reducing measurement and calculation errors.

Third, we use traditional asset pricing models as opposed to implicit asset pricing models. Some research argue that traditional asset pricing models are inappropriate because they do not isolate cost of capital effects from growth or cash flow effects. Consequently, research conducted using other asset pricing models, such as the four models used by El Ghoul et al. (2016), may further reduce measurement errors and uncertainty.

Fourth, this work is dedicated to researching the global oil and gas industry. Future research could include investigating the relationship between ESG/CSR and costs of equity and costs of debt capital in other industries for purpose of comparison. Such research could contribute to understanding the causality behind the relationship.

Fifth, future research could also go deeper into the effect from underlying ESG/CSR factors. If using Refinitiv ESG scores, research into the categories constituting each ESG Pillar can provide more information that could be useful in drawing causal conclusions. The same is true when using other ESG/CSR data providers.

Sixth, only listed oil and gas companies have been researched in this work. Further research could include looking at private companies which have slightly different financing mechanics. Doing this could further our understanding surrounding the causality of the relationship and provide managers information on the potential benefits or disadvantages in being listed versus being private in relation to ESG/CSR and costs of equity and costs of debt.

Finally, further research could also include looking at marginal increases/decreases in ESG/CSR ratings and their effect on costs of capital. This could help us understand whether already high-scoring companies continue to benefit from further investing in ESG/CSR activities, or if they should abstain from such investments.

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Appendix A

Table 11: Market characteristics and ESG/CSR

Primary Variable	Independent/Dependent Variable	Sign	Citation
Country and Economic developemnt	Independent	+	Cai et al. (2016)
Lack of civil and politival rights	Independent	+	Cai et al. (2016)
Harmony	Independent	+	Cai et al. (2016)
Autonomy	Independent	+	Cai et al. (2016)
Country legal origin: Civil	Independent	+	Liang and Renneboog (2017b)
Cross-listing	Independent	+	Boubakri et al. (2016)
Multinational indicator	Independent	+	Cai et al. (2016)
Political leanings of state's citizens	Independent		
Democrat		+	Di Giuli and Kostovetsky (2014)
Republican		-	Di Giuli and Kostovetsky (2014)
Social capital of county	Independent	+	Jha and Cox (2015)
Industry	Independene	+/-	Borghetsi et al. (2014)
Source: (Gillan, et al., 2021)			

Table 12: Firm leadership characteristics and ESG/CSR

Primary Variable	Independent/Dependent Variable	Sign	Citation
Multinational board members	Independent	+	Iliev and Roth (2020)
Woment leaders	Independent	+	Borghesi et al (2017)
	Independent	+	McGuinness et al. (2017)
	Independent	+	Cronqvist and Yu (2017)
	Independent	+	Dyck et al. (2020)
CEOs with daughters	Independent	+	Cronqvist and Yu (2017)
Married CEOs	Independent	+	Hegde and Mishra (2019)
CEO age	Independent	-	Borghesi et al. (2014)
Political leanings of CEO and board			
Democrat	Independent	+	Di Giuli and Kostovetsky (2014)
Republican	Independent	-	Di Giuli and Kostovetsky (2014)
Political leanings of CEO	Independent	0	Borghesi et al. (2014)
CEO confidence	Independent	-	McCarthy et al. (2017)
Employee geography	Independent	+	Landier et al. (2007)
CEO pay	Dependent	+	Gillan et al (2010)
	Independent	+	Ferrell et al. (2016)
	Dependent	+	Jian and Lee (2015)
	Independent	0/-	Borghesi et al. (2014)
	Independent	+	Ikram et al. (2019)
	Dependent	0	Masulis and Reza (2015)
Source: (Gillan, et al., 2021)			

Table 13: Ownership characteristics and ESG/CSR

Primary Variable	Independent/Dependent Variable	Sign	Citation
Size of instl Ownership	Independent	-	Borghesi et al (2017)
	Independent	+/-	Nofsinger et al. (2019)
	Independent	+	Chava (2014)
	Independent	+/-	Fernando et al (2017)
	Independent	-	Gillan et al. (2010)
	Independent	+	Chen et al. (2020)
Size of social-norm-constrained instl ownership	Dependent	+	Hong and Kacperczyk (2009)
Size of Democratic-leaning instl ownership	Dependent	+	Hong and Kostovetsky (2012)
Size of long-term instl ownership	Independent	+	Gloßner (2019)
	Dependent	+	Starks et al. (2019)
Instl investor engagement	Independent	+	Dyck et al. (2019)
	Independent	+	Dimson et al. (2015)
	Independent	+	Barko et al. (2018)
	Independent	+	Hoepner et al. (2019)
	Independent	+	Dimson et al. (2018)
	Independent	+	Naaraayanan et al. (2019)
	Independent	+	Cao et al. (2019)
Change in instl ownership horizon	Independent	+	Kim et al. (2019)
Change in instl ownership	Independent	-	Hwang et al. (2017)
Family ownership	Independent	+	Abeysekera and Fernando (2020)
	Independent	+	Gillan et al. (2020)
	Independent	-	El Ghoul et al. (2016)
State Ownership	Independent	+	Hsu et al. (2018
	Independent	+	Boubakri et al. (2019)
	Independent	-	McGuinnes et al. (2017)
Source: (Gillan, et al., 2021)			

Table 14: Risk, cost of capital and ESG/CSR

Primary Variable	Independent/Dependent Variable	Sign	Citation
Systematic risk	Dependent	-	El Ghoul et al. (2016)
	Dependent	-	Okikonomou et al. (2012)
	Dependent	-	Albuquerque et al. (2019)
Credit risk	Dependent	-	Jiraport et al. (2014)
	Dependent	-	Seltzer et al. (2020)
	Dependent	0/-	Stellner et al. (2015)
Legal risk	Dependent	-	Schiller (2014)
	Dependent	-	Hong and Liskovich (2015)
Downside risk	Dependent	-	Hoepner et al. (2019)
	Dependent	-	Ilhan et al. (2019)
Idiosyncratic risk	Dependent	+	Becchetti et al. (2015)
	Dependent	0	Humphrey et al. (2012)
Equity cost of capital	Dependent	-	El Ghoul et al. (2011)
	Dependent	+/-	Breuer et al. (2018)
	Dependent	-	Hong and Kacperczyk (2009)
	Dependent	-	Chava (2014)
	Dependent	0/-	Ng and Rezaee (2015)
Debt Cost of capital	Dependent	-	Chava (2014)
	Dependent	-	Goss and Roberts (2011)
	Dependent	-	Ng and Rezaee (2015)
	Dependent	-	Zerbib (2019)

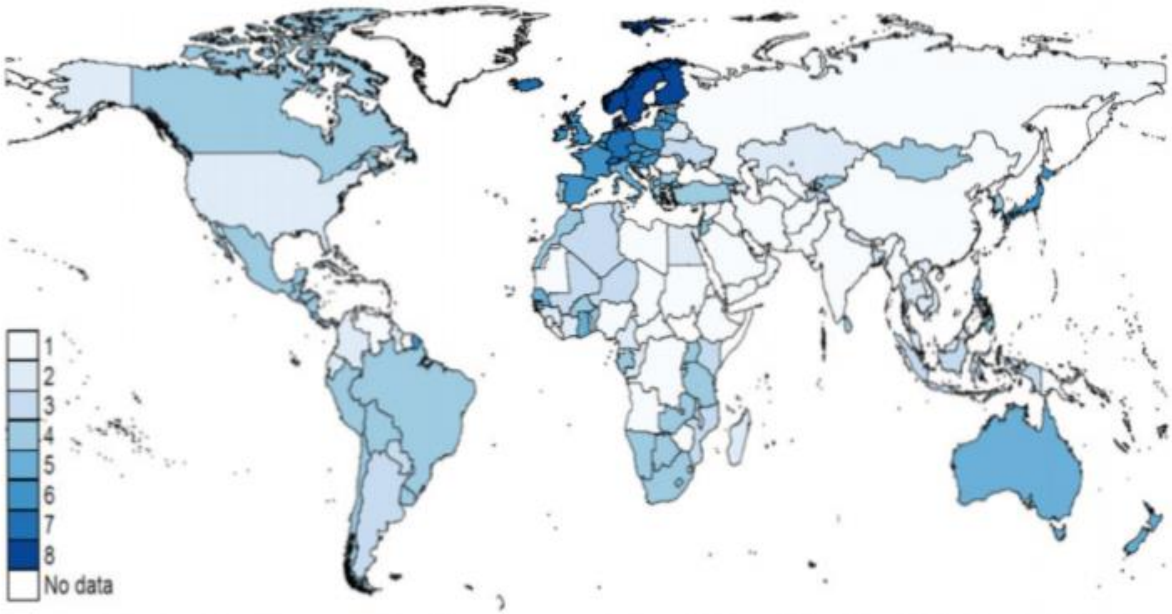
Source: (Gillan, et al., 2021)

Table 15: Performance, value and ESG/CSR

Primary Variable	Independent/Dependent Variable	Sign	Citation
Financial constraints	Independent	-	Hong et al. (2012)
Revenue growth	Dependent	0	Di Giuli and Kostovetsky (2014)
ROA	Dependent	-	Di Giuli and Kostovetsky (2014)
	Dependent	+	Gillan et al (2010)
	Dependent	0	Hsu et al. (2018)
	Dependent	+	Lins et al. (2017)
	Dependent	+	Liang and Renneboog (2017a)
	Dependent	+	Iliev and Roth (2020)
	Independent	+	Borghetsi et al. (2014)
Free cash flow	Independent	+	Borghetsi et al. (2014)
Long-run returns	Independent	+	Hong et al. (2012)
	Dependent	-	Di Giuli and Kostovetsky (2014)
	Dependent	0	Humphrey et al. (2012)
	Dependent	-	Hong and Kacperczyk (2009)
	Dependent	-	Bolton and Kacperczyk (2020)
	Dependent	+	Dimson et al. (2015)
	Dependent	+	Edmans (2011)
	Dependent	+	Lins et al. (2017)
	Dependent	+	Barko et al. (2018)
	Dependent	+	Statman and Glushkov (2009)
Short-run returns	Dependent	-	Masulis and Reza (2015)
	Dependent	+/-	Krüger (2015)
	Dependent	+	Deng et al. (2013)
	Dependent	+	Tang and Zhang (2020)
	Dependent	+	Flammer (2015)
	Dependent	+	Flammer (2021)
Tobin's q	Dependent	+	Gillan et al. (2010)
	Dependent	-	Buchanan et al. (2018)
	Dependent	0	Hsu et al. (2018)
	Dependent	+	Albuquerque et al. (2019)
	Dependent	+/-	Servaes and Tamayo (2013)
	Dependent	+	Gao and Zhang (2015)
	Dependent	+	Liang and Renneboog (2017a)
	Dependent	+	Ferrell et al. (2016)
Cash value	Dependent	+	Chang et al. (2019)
ROE	Dependent	+	Cornett et al. (2016)
Bond values	Dependent	+	Amiraslani et al. (2017)
Bond returns	Dependent	-	Amiraslani et al. (2017)

Source: (Gillan, et al., 2021)

Appendix B



Panel A. Adjusted country-level sustainability ratings around the world (Source: Vigeo Sustainable Country Ratings)

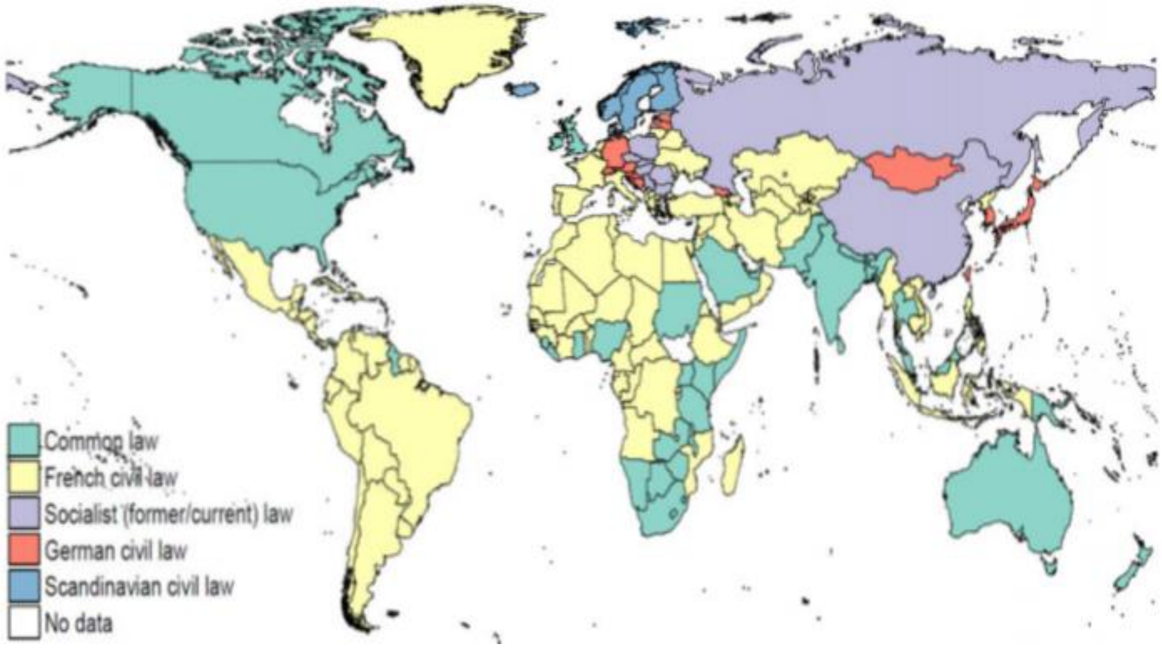


Figure 1: Legal origins around the world (Source: Liang & Renneboog, 2017)

Appendix C

Table 16: Variable definitions and data sources

Variable	Definition	Source
Panel A. Dependent variables		
COE	The return a firm theoretically pays its equity investors. It is calculated by multiplying equity risk premium of the market with the beta of the stock plus an inflation adjusted risk free rate. Equity risk premium is expected market return minus inflation adjusted risk free rate. Please see Equation (3).	Extract from Refinitiv Valuation data
COD	Cost of debt represents the marginal cost to the company of issuing new debt. It is calculated by adding weighted cost of short-term debt and weighted cost of long-term debt, adjusted for tax deductibility. Please see Equation (4).	Author's own calculations based on Refinitiv Valuation data
Panel B. ESG/CSR variables		
ENV	The Environmental Pillar measures a company's impact on living and non-living natural systems, including the air, land and water, as well as complete ecosystems. It reflects how well a company uses best management practices to avoid environmental risks and capitalize on environmental opportunities in order to generate long term shareholder value.	Extract from Refinitiv ESG Scores & Grades

Variable	Definition	Source
SOC	The Social Pillar measures a company's capacity to generate trust and loyalty with its workforce, customers, and society, through its use of best management practices. It is a reflection of the company's reputation and the health of its license to operate, which are key factors in determining its ability to generate long term shareholder value.	Extract from Refinitiv ESG Scores & Grades
GOV	The Governance Pillar measures a company's systems and processes, which ensure that its board members and executives act in the best interest of its long-term shareholders. It reflects a company's capacity, through its use of best management practices, to direct and control rights and responsibilities through the creation of incentives, as well as checks and balances in order to generate long term shareholder value.	Extract from Refinitiv ESG Scores & Grades
ESG_COMB	The Refinitiv ESG Combined Score is an overall company score based on the reported information in the environmental, social and governance pillars (ESG score) with an ESG Controversies overlay.	Extract from Refinitiv ESG Scores & Grades
Panel C. Control variables		
BETA	CAPM BETA. A measure of how much the stock moves for a given move in the market. It's the covariance of the security's price movement in relation to the market's price movement.	Extract from Refinitiv StarMine Models & Analytics

Variable	Definition	Source
	Based on data availability, various look back periods can be used to calculate it. In order of preference, Beta 5Y monthly, Beta 3Y weekly, Beta 2Y weekly, Beta 180 daily, Beta 90 daily are used in the calculation.	
PB_RAT	Price to book value per share is calculated by dividing the company's closing price at the end of the fiscal period by its book value per share. Book value per share is calculated by dividing total book value from latest fiscal period by total shares outstanding.	Extract from Refinitiv Histrorical Time Series Ratios
LN_TA	Represents the natural logarithm of the total assets of a company.	Author's own calculations based on Refinitiv Financials data
LEV_RAT	Represents the total debt outstanding, including notes payable/short-term debt, current portion of long-term debt/capital leases and total long-term debt, divided by total assets.	Author's own calculations based on Refinitiv Financials data
REV_GTH	Represents the year over year revenue growth in percent from a company's operating activities.	Author's own calculation based on Refinitiv Financials data

Source: All data that pertains hereto are available by use of a Refinitiv Eikon license.

Appendix D

Table 17: Sample distribution by country

	Number of countries					
Country	**Americas**	**Asia**	**Europe**	**Oceania**	**Total**	**%**
Australia				16	16	6.93
Austria			1		1	0.43
Bermuda	2				2	0.87
Brazil	6				6	2.60
Canada	39				39	16.88
Chile	3				3	1.30
China		4			4	1.73
Colombia	2				2	0.87
Finland			1		1	0.43
France			3		3	1.30
Greece			2		2	0.87
Hong Kong		1			1	0.43
Hungary			1		1	0.43
India		7			7	3.03
Indonesia		1			1	0.43
Ireland; Republic of			1		1	0.43
Israel		1			1	0.43
Italy			2		2	0.87
Japan		6			6	2.60
Korea; Republic of		6			6	2.60
Malaysia		1			1	0.43
Mexico	1				1	0.43
Netherlands			2		2	0.87
New Zealand				2	2	0.87
Norway			3		3	1.30
Pakistan		1			1	0.43
Papua New Guinea				1	1	0.43
Peru	1				1	0.43
Philippines		1			1	0.43
Poland			3		3	1.30
Portugal			1		1	0.43
Qatar		1			1	0.43

	Number of countries					
Russia			7		7	3.03
Saudi Arabia		1			1	0.43
Singapore		1			1	0.43
Spain			1		1	0.43
Sweden			1		1	0.43
Taiwan		1			1	0.43
Thailand		8			8	3.46
Turkey		2			2	0.87
United Kingdom			12		12	5.19
United States	74				74	32.03
Total	128	43	41	19	231	100

Table 18: Sample distribution by TRBC industry and Year

TRBC Industy	**N**	**%**
Integrated Oil & Gas	21	9.09
Oil & Gas Exploration and Production	132	57.14
Oil & Gas Refining and Marketing	78	33.77
Total	231	100

Year	**N**	**%**
2015	148	15.34
2016	172	17.82
2017	194	20.10
2018	207	21.45
2019	221	22.90
2020	23	2.38
Total	965	100