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Crude Oil - Does Green Mean Golden?

A study on the relationship of sustainability and financial performance in North American oil and gas companies

by

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Abstract

Sustainability has become an urgent issue for business research. In this regard, many researchers attempted to examine the relationship between sustainability performance and corporate financial performance (CFP). However, the results remain unclear. Thus, this paper contributes with a new perspective on intra-industry performance of the poorly-studied North American oil and gas industry. Using multiple linear regression models, the relationship between the Refinitiv ESG score and corporate financial performance is examined. The authors find no association between ESG score and accounting performance, measured in Return on Assets. However, a significant association of ESG score and tobin's q, as a measure of market performance, is found. In a second step, the authors examine which of the three individual ESG pillars' association with CFP is the strongest. The models suggest ESG pillars, when considered separately, do not show a statistically significant relationship with neither accounting nor market-based measures. The study concludes that investors might value sustainability while sustainability's association with corporate efficiency might be negatable. Based on this, future research is suggested to focus on analyzing panel data to examine change in these relationships.

Keywords: Sustainability, ESG performance, ESG pillars, corporate financial performance, oil and gas industry

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1 Introduction

This chapter first provides a background of sustainability and oil and gas companies to explain why this research is relevant. After that, research aims and objectives as well as this thesis' purpose are developed. Subsequently, delimitations are discussed. The introductory chapter concludes in an outline that will guide through the following chapters.

1.1 Background and Problematization

1.1.1 The pledge to become sustainable

The last few years have directed a lot of attention towards the issue of climate change. Starting with the Fridays for Future movement, countries are facing increasing pressure to shift towards a more sustainable way of living. Usually judged by efforts to operate in line with the Paris agreement, 196 countries signed the agreement in December 2015 in order to limit temperature to 2 degrees, better 1.5 degrees celsius (United Nations, 2015). Countries and federations have presented plans on how to tackle climate change by decarbonizing their economies. For example, the European Union (EU) has presented the European Green Deal under which they plan to promote sustainable development by improving reusability, recycling of products, energy-efficient housing and transition of the energy sector (European Commission, 2022). In contrast, due to a booming industrial production, the world's greenhouse gas emissions reached an all-time high in 2021 despite the Covid pandemic (International Energy Agency, 2022). Within the sectors, the energy industry emits the most carbon dioxide (International Energy Agency, 2022).

Furthermore, not only countries have pledged to become carbon neutral, thus not emitting more greenhouse gasses than what can be stored. Many companies have also signed agreements to contribute their share to reducing greenhouse gas emissions. For example, the United States' most valuable public company, Apple, pledges to reach a sustainable supply chain by 2030 (Apple Inc., 2022). Besides, other companies try to become certified on their sustainable behavior by initiatives such as B Corp (B Lab, 2022).

1.1.2 Changing risk assessment under climate change

Today, many companies face pressure from their stakeholders to transform into a more sustainable company. Oil company Shell for example, aimed to reduce emissions by 20 percent by 2030 (Boffey, 2021). However, the company was sued for not reducing emissions enough and eventually lost in court (Boffey, 2021). While initially Shell had planned to achieve a 45 percent reduction in greenhouse gas intensity by 2035, the court ruled it already had to achieve this goal by 2030 (Boffey, 2021).

One other case is the one of Exxonmobil. Exxonmobil's management argued that they were already investing into less carbon-intensive products and shareholders would reap high profits thanks to their corporate strategy (Hiller & Herbst-Bayliss, 2021). When marketing their strategy, Exxonmobil tried to shift responsibility to consumers and downplayed the risk of climate change to continue operations as before (Supran & Oreskes, 2021). However, a small hedge fund that owned a stake of only 0.02 percent in Exxonmobil challenged the company on the election of board members. Arguing that not investing into more sustainable energy sourcing then Exxonmobil would eventually destroy shareholder value in the long run, the hedge fund managed to conclude with other important investors and ultimately placed sustainability experts in Exxonmobil's supervisory board (Hiller & Herbst-Bayliss, 2021).

This sheds light on a different perception of risks from investors. They care about more than just the reputational risk of a company under the impact of climate change. For institutional investors it is very important to assess climate risks attached to the companies they invest in (Krueger, Sautner & Starks, 2020). This is due to the belief that climate risk will ultimately pose financial risks for the companies and thus negatively affect investor payoff (Krueger, Sautner & Starks, 2020).

In the light of climate change, risk becomes more apparent for other stakeholders as well. According to Nordhaus (2019) "climate change is the ultimate challenge" (p. 24) for modern economics. However, designing economic policies to tackle climate change is difficult (Nordhaus, 2019). In this vein, previous governor of the Bank of England, Mark Carney (2015) stated that climate change imposes a significant risk for financial stability, through physical risks, liability risks and transition risks. Because of its threat to financial stability, regulation through governments is necessary (Carney, 2015).

1.2 The oil & gas industry

1.2.1 The industry's value chain

To understand the oil and gas industry and what its value chain is, it is divided into three segments called upstream, midstream, and downstream as explained in Inkpen and Moffett's (2011) book. The upstream segment is where the exploration for crude oil or fossil fuels start and if found then it will be followed by production which involves drilling into the ground, building a rig if needed, and installing the proper equipment for extraction (Inkpen & Moffett, 2011). The midstream segment is where the transportation of the crude oil or natural gas to refineries happens via pipelines or ships (Inkpen & Moffet, 2011). In some cases the natural gas cannot be transported a long way in pipelines and so it would be converted to liquid natural gas (LNG) instead. The last part of the value chain is the downstream segment which involves refining crude oil to most commonly gasoline or diesel since crude oil has little value otherwise (Inkpen & Moffet, 2011). They can be used for many different products such as soaps, detergents, jet and motor fuels, asphalt, etc. Integrated oil companies are vertically integrated multinational oil companies that operate in the upstream, midstream and downstream (Inkpen & Moffett, 2011). National oil companies (NOCs) on the other hand are run by a government. They can be owned by the state and partially owned by private investors, and they can be national or global with listed shares, an example of a NOC is Petrobras, a Brazilian state owned oil company (Inkpen & Moffett, 2011).

1.2.2 The dilemma of oil and gas reserves

Oil and gas production are important for industrial growth, studies estimate that about 50% of changes in economic growth from 1971-2011 are due to changes in oil consumption alone (Murphy & Hall, 2011). However, one of the challenges that the industry faces is that demand growth for oil is larger than the discovery rate for oil and gas reserves (Inkpen & Moffett, 2011). Global oil discovery is outpaced by demand by 2:1, where 2 barrels of oil are consumed for every 1 barrel of oil discovered (Murphy & Hall, 2011). Peak oil theory entails that oil is finite and after peak oil is reached then the production volumes will decrease (Inkpen & Moffett, 2011). The post peak oil stage would force an economy to grow while decreasing oil consumption which is the opposite of how economic growth has been achieved in the past (Murphy & Hall, 2011). On the other hand, arguments against peak oil theory

suggest that this is not true and that the problem lies in the lack of proper exploration of new oil reserves which requires advanced technology, high costs, and politics (Bardi, 2019).

Murphy and Hall (2011) state that the world's largest oil field was discovered in Saudi Arabia in 1948, but no other oil field of this size was discovered again, Moreover, that the discoveries of new oil and gas reserves are being made in areas which are difficult to produce from such as deep off-shore areas. These discoveries have increased from less than 10% of total discoveries in 1990 to 60% in 2005 (Murphy & Hall, 2011). Inkpen and Moffett (2011), also argue against peak oil that demand for oil will likely decrease in the coming decades. A few factors that can contribute to that is the use of hybrid and electric cars, the rise of alternative energy sources such as solar power and wind power, the switch to smaller, less gas consuming vehicles (Inkpen & Moffett, 2011). However, Lim and Lee (2020) suggest that the increase of renewable energy will allow the oil industry to diversify its uses and enable it to become more efficient. Oil is for now one of the largest energy sources and it is predicted to continue to be so until 2030, since oil and gas usually represent a large contribution to a producing country's GDP (Lim & Lee, 2020). Further, in 2015, the oil industry accounted for 6.7 percent of national labor income in the US (Lim & Lee, 2020).

1.2.3 Investment in renewable energy

Renewable energy such as solar and wind power is expected to be a fast growing primary energy source (Pickl, 2019). The strategic transition of oil companies to renewable energy is motivated by the expected long term cash flow from renewable as opposed to the risk of commodity prices from upstream investments (Pickl, 2019). A study done by Pickl (2019), showed that 8 major oil companies such as Petrobras, Chevron, Shell, among others are investing in assets for wind and solar energy and that 5 out of 8 of the companies have mapped out strategies for the investments in capital and dedicated teams for renewable energy. The study also shows that oil majors with smaller oil reserves are investing into renewables at a faster rate, while the ones with larger reserves are choosing to move into renewable energy at a slower rate.

A study on reframing incentives for climate change policy mentions that if zero net emission is to be globally reached by 2050, then half of fossil fuel assets would lose most of their value by 2036 (Mercure, Salas, Vercoulen, Semieniuk, Lam, Pollitt, Holden, Vakilifard, Chewpreecha, Edwards, Vinuales, 2021). Renewable energy would be cheaper, and more efficient. Countries who import oil will be able to invest in renewable energy in their country instead of buying oil from overseas (Mercure et al, 2021). This scenario would pose substantial risks to the very business of oil and gas companies.

1.3 ESG and corporate financial performance

1.3.1 General ESG

The topic of sustainability has received growing attention over the past decades. This comes with the effect that investors are increasingly conscious about investing into sustainable assets. In 2020, more than 35 trillion US-dollars, about 36 percent of the world's professionally managed financial assets, were invested in a sustainable way (Global Sustainable Investment Alliance, 2022). Investments into sustainable assets have increased by about 15 percent between 2018 and 2020 (Global Sustainable Investment Alliance, 2022). With increasing awareness of the risks of climate change, investors may thus be willing to trade-off some of their financial gains in return for non-financial benefits such as sustainability (Inderst & Stewart, 2018).

Having Friedman (1970) and his famous shareholder theory in mind, one would expect sustainable companies to show financial underperformance against non-sustainable companies as they *waste* their assets for investments that are not central to their business. However, as seen in the previously mentioned Exxonmobil case, investors disagree with Friedman's point of view. Instead they fear that the companies they invest in do *not* transform their business into a more sustainable one. Further, it is difficult to argue that 36 percent of professionally managed assets (Global Sustainable Investment Alliance, 2022) would willingly underperform benchmarks as fund manager's payoff often depends on the fund performance.

Aiming to clarify this ambiguity, literature has examined the relationship between sustainability performance and corporate financial performance (CFP). A few decades ago, studies often examined one sustainability factor and tried to establish links to CFP. For example, 40 years ago, Arlow and Gannon (1982) examined corporate social responsiveness relation to CFP. However, only recently, companies have started reporting more non-financial data like sustainability data.

Making use of increasing data availability, financial performance differences between conventional and sustainable funds across industries has been researched by e.g. Santis, Albuquerque and Lizarelli (2016), Pavlova and Boyrie (2022), Hartzmark and Sussmann (2019), Folger-Laronde, Pashang, Feor and ElAlfy (2022). Other research examined sustainable supply chain practices (Eccles, Ioannou & Serafeim, 2014; Golicic & Smith, 2013). Despite the efforts to report clear links between conducted studies can be categorized into three groups; those that report positive links (Lee, Pati, Roh, 2011; McGuire, Sundgren & Schneeweis, 1988; Klassen & McLaughlin, 1996; Russo & Fouts, 1997) between ESG and CFP, those that state neutral links (Aragón-Correa & Rubio-Lopez, 2007; Arlow & Gannon,

1982; McWilliams & Siegel, 2000) and others that articulate a negative relationship (Duque-Grisales & Aguilera-Caracuel, 2021; Wagner, 2005; Brammer, Brooks & Pavelin, 2006; Lee, Faff & Langfield-Smith, 2009).

1.3.2 ESG pillars

More recently, literature has begun analyzing the different ESG pillars and connecting them to corporate financial performance (Naimy, El Khoury & Iskandar, 2021; Abdi, Li & Càmara-Turull, 2020; Duque-Grisales & Aguilera-Caracuel, 2021). ESG pillars are defined by their three dimensions Environmental (E), Social (S) and Governance (G). Together they comprise the overall ESG score. In contrast to studies on the overall ESG score, the field of ESG pillars received little attention and remains poorly studied.

In recent years, climate change has received growing attention. Many consumers are worried about potential damage from it (Bouman, Verschoor, Albers, Böhm, Fisher, Poortinga, Whitmarsh & Steg, 2020). Because of that, more people have become more conscious about their consumption patterns and have started changing them (Bouman et. al, 2020). Applying Porter's (1980) generic strategies, one would thus expect companies with products or services that are highly sustainable on the E dimension, to show superior financial performance.

Nevertheless, previous literature's results do not allow for a strong conclusion. Some report E to be the most important pillar (Hou, Liu, Fan & Wei, 2016; Lu & Taylor, 2016), others (Habermann, 2021) state governance to be most influential on corporate financial performance. Whereas other studies report non-linear relationships between E, S and G with firms' financial performance. Lastly, others (e.g. Duque-Grisales & Aguilera-Caracuel, 2021) postulate negative interrelation of all three sustainability pillars with corporate financial performance.

1.4 Aim and Objectives

Oil and gas companies, also referred to as energy companies, are facing challenges and external pressure from many different sides. Environmental activists demand sustainable transformation, while investors usually demand long-term financial payoff. Besides, energy companies also face regulatory risk due to climate change. Because of that, considering sustainability and its links to corporate financial performance is becoming increasingly important. While previous studies (Santis, Albuquerque & Lizarelli , 2016; Pavlova & Boyrie, 2022; Hartzmark & Sussmann, 2019; Folger-Laronde et al., 2022) give a good overview on

the topic of sustainability and links to financial performance across industries, they fail to provide strong implications for managers of an *individual* industry. Moreover, the oil and gas industry remains poorly studied on the ESG-CFP topic. In addition, methodological problems and measurement errors in existing studies could explain 15 to up to 100 percent of the differences between the results of different studies (Orlitzky, Schmidt & Rynes 2003).

Thus, this study aims to contribute by examining oil and gas companies with their headquarters in North America (United States of America, Canada and Bermuda, Greenland and Saint Pierre and Miquelon). This paper's definition of oil and gas companies is equal to that of The Refinitiv Business Classification (TRBC). According to the TRBC definition oil and gas companies have a major part of their business in (1) oil and / or gas exploration operations, (2) oil and / or gas refining and marketing, or they are an (3) an integrated oil and gas company. Note that this definition does however exclude companies whose main business is performing oil and gas related services. Based on these companies, the authors aim to exploratively examine the relationship of sustainability performance with corporate financial performance (CFP).

Sustainability performance, also referred to as ESG performance, is measured by the Refinitiv (Thomson Reuters) ESG score. CFP is measured in two ways. Firstly, a firm's accounting performance is examined. For this part, the return on asset ratio is used. Secondly, a firm's market performance is examined via the proxy tobin's q. After examining the relationship between ESG performance and CFP, the ESG score will be dismantled into its three different pillars: Environmental (E), social (S) and governance (G). Using these separate pillar scores, the authors aim to examine how they interrelate with CFP. Specifically, the authors aim to find evidence on which of the three ESG pillars is most closely associated with CFP. More detailed descriptions of all variables can be found in the methodology part (3.1.2).

1.5 Research Purpose

Based on the previous discussion, this study aims to contribute in two ways. Firstly, the study provides results for a tightly defined industry which makes the results easier to interpret and apply. Additionally, conducting this analysis *within* the oil and gas industry allows to address concerns of managers that sustainability might worsen financial performance. Secondly, this study aims to provide information to investors that wish to consider sustainability in their investment strategy. Based on this purpose, the research questions were developed in the following way:

Research question 1: *How does North America-based oil and gas companies' ESG performance interrelate with financial performance?*

By answering the previous question, the following question's relevance increases.

Research question 2: *Among the three ESG pillars, which individual pillar interrelates most strongly with financial performance of North America-based oil and gas companies?*

1.6 Delimitations

This study limited its scope in a number of ways. Firstly, due to the difficulty in measuring sustainability, accounting and market performance, the group used proxies for each of them. However, especially ESG scores can differ between each other and thus reflect a somewhat subjective view. In addition, due to time constraints, a convenience sampling method was used that can not be generalized to a larger population. Further, due to the strict time limit, the countries of operation of the chosen companies are not considered. Thus, it is possible that the results might be influenced by variables that were not controlled for. Additionally, even within the chosen North American countries regulation differs and companies produce oil and gas in different ways (shale, offshore, oilsands, etc.). Moreover, the ESG score rates the whole company across industries which might also include business not related to oil and gas. To reduce the possibility of this happening, the sample is strictly defined (see 3.1.1). Coming from the time constraints attached to this paper, it was out of scope to analyze companies deeper, and pool them into groups of e.g. highly sustainable and unsustainable companies that would allow for interesting comparisons. Lastly, research designs that involved the collection of panel data, which would have allowed for more interpretations, were not feasible due to time and methodological difficulties.

1.7 Outline of the Thesis

This thesis is divided into five chapters. Chapter one provided a background to the topic and stated research questions. In chapter two previous literature on the topic will be examined to review sustainable finance and theories, the concept of ESG, and theoretical arguments as well as evidence for the association between sustainable performance and CFP. Chapter three provides an explanation of the variables, methods used to gather data, and analysis. After that, chapter four provides results of the data described in the previous chapter which yields in a discussion in chapter five. Lastly, the sixth chapter concludes what has been developed in this paper and gives ideas for future research.

2 Literature/Theoretical Review

In this chapter, relevant literature on the topic is reviewed. The first part provides an overview of sustainable finance and the concept of ESG. After that theoretical arguments and links between sustainability performance and corporate financial performance will be discussed. Subsequently, ESG pillars and their relationship with accounting and market performance are discussed. The literature review finishes by developing hypotheses based on previous research.

2.1 Theories of sustainable finance

2.1.1 Overview of sustainable finance

The concern of the impact of economic activities on nature and social structures has been noticed and discussed for decades (Migliorelli & Dessertine 2019). One must acknowledge mankind's impatience and the ease to leverage more on short-term interest, which in recent history have caused severe outcomes such as climate change, environment issues, water and air condition, and consumption issues (Fatemi & Fooladi, 2013). Facing those challenges, the theory of sustainable finance urges to establish a sustainability-oriented value together with legal means in the financial sector.

A lot of studies have attempted to define sustainable finance, thus there is not a single, universal definition of sustainable finance that stands out for its clarity. The International Capital Market Association (2020) defines that sustainable finance incorporates climate, green and social finance while also adding wider considerations concerning the longer-term economic sustainability of the organizations that are being funded, as well as the role and stability of the overall financial system in which they operate. Sommer (2020) articulated that sustainable finance is the movement and allocation of capital and resources to support transition towards a more sustainable economy. Ozili (2021) proposed that sustainable finance aims to take climate, green, governance and social consequences into account when making investment decisions in the financial sector.

In this vein, Migliorelli and Dessertine (2019) argued that the financial sector is increasingly more involved with non-financial means in addition to generating profit. And through time, a

number of possibilities to account for the relationship between sustainability and financial performance emerged (Migliorelli, 2021). Among them, the notion of environment, social and corporate governance (ESG) has become an important criterion affecting decision-making in the process of investment (Ozili, 2021). Fatemi and Fooladi (2013) argued that the previous approach of company shareholders maximizing profits and wealth is no longer a valid guide for the support of a sustainable economy because it emphasizes short-termism which has had catastrophic consequences. Thus the authors urged to internalize the social and environmental costs to corporations. Moreover, Ozili (2021) in his publication brought up possible solutions that can promote sustainable finance: (i) only focus on some aspects of finance for purpose of sustainability; (ii) light-touch regulation can help with mitigation of burden on financial institutions; (iii) a bottom-up approach may contribute to a boom in the sustainable finance sector; (iv) render ESG disclosures voluntary due to its credibility and accuracy; and (v) short-term-oriented tools can complement long-term objective in sustainable financing.

The scope of sustainable finance could be categorized in three layers: wider policy context, industry-originated framework and operational and labeling standards, as shown in figure 2.1 (Migliorelli, 2021).

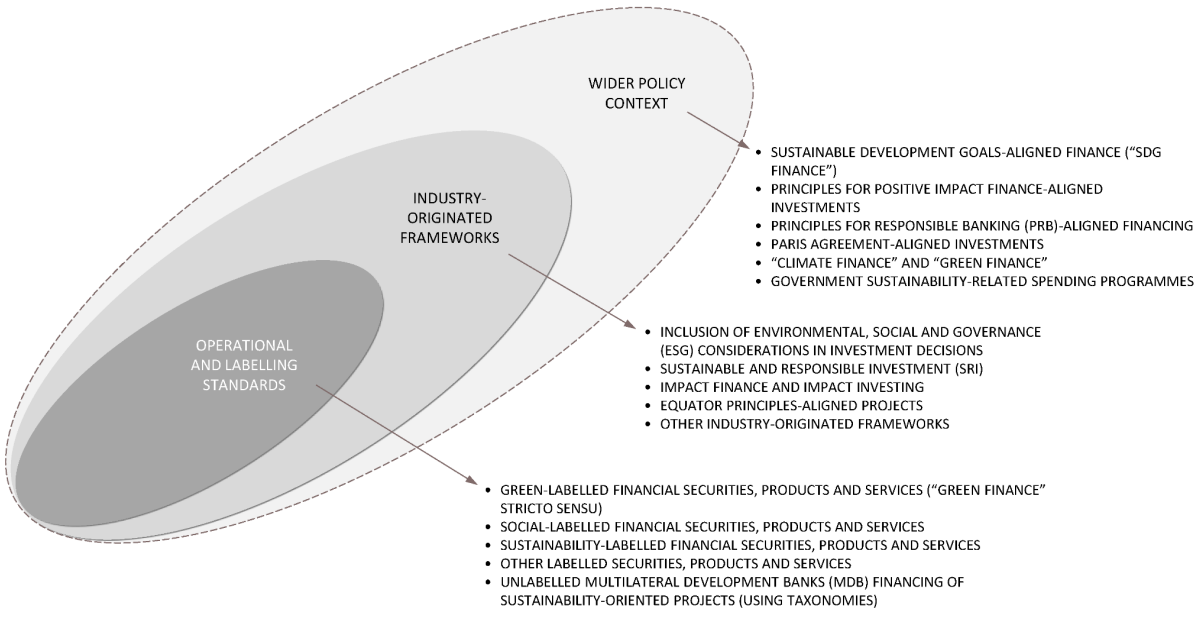

Figure 2.1 Sustainable finance landscape (Migliorelli, 2021).

In respect of industry-originated frameworks, one of the most prominent monuments is the inclusion of ESG reporting. The disclosure of ESG information at corporate level is

increasingly demanded by policy makers in order to create a more transparent market and steer investors' decision-making (Migliorelli, 2021). Some landmarking instances of ESG disclosure standards are the EU non-financial reporting directive (NFRD) or the voluntary guidelines developed by the climate disclosure project (CDP), the climate disclosure standards board (CDSB), the global reporting initiative (GRI), the principles for responsible investment (PRI), the sustainability accounting standards board (SASB) or the task force on climate-related financial disclosures (TCFD) (Migliorelli, 2021). These initiatives are mostly voluntary sets of principles to guide practitioners' actions, so there is risk of opportunism and greenwashing of some corporations (Migliorelli, 2021). Despite that, a study conducted by Contreras, Bos and Kleimeier (2019) reports that companies tend to adopt Equator Principles (EP) when there is peer pressure from those who already adopt, when non-adopters are susceptible to whether their collaborators have already adopted, and when they are the target of controversial deals campaigns exerting external pressure. EP refers to a set of voluntary principles adopted by financial institutions to ensure that corporate operations and behavior take account of their potential impacts on the natural environment and the affected communities. According to Migliorelli (2021), more than a half of the total global institutional assets base are currently managed by institutions formally embracing EP, indicating the widely acknowledged commitment of financial markets towards ESG criteria within investment decisions.

2.1.2 Signaling theory of sustainable finance

In former finance literature, signal theory aims to explicitly reveal the information gap among different parties of a firm (internal officers, shareholders, external parties). The condition in which one party has an excess of information while the other party does not is called information asymmetry (Conelly, Certo, Ireland, & Reutzel, 2011). Positive signaling theory is one of the responses to information asymmetry and is widely used in finance management (Ozili, 2022). It posits that the economic entities that disclose positive information have advantage against those who do not inform the market because external parties' perception of firms varies (Park, 2018). In this vein, corporations can disclose positive information about their sustainable finance objectives by providing voluntary financial or non-financial information in annual reports and making direct public announcements in the media (Ozili, 2022). For instance, companies can release ESG-related data to showcase their ESG effort and publish green bonds in order to raise funds, which in turn enhance firms' market value and financial performance because the gained capital could be reinvested to its operations. Therefore, in this paper, signaling theory may explain why ESG scores could make a difference to energy companies' market performance and accounting performance, since the practitioners in the market might react accordingly to disclosed information.

Nevertheless, it is noteworthy that there is risk of opportunism under the point of view of information asymmetries and opaque information (Migliorelli, 2021). For example, the disclosure of information may turn out to be greenwashing and reinvest the "green fund" to fields unrelated to sustainability. According to Ozili (2022), some corporations can exert the frequent disclosure of positive information about sustainable financing as a tactic to conceal other negative information.

2.2 The concept of ESG

The adoption of the Sustainable Development Goals (SDG) in September 2015 and the Paris Agreement reached in December of the same year in the United Nations Framework Convention on Climate Change (UNFCCC) landmarked the commitment of the international community to the sustainability of human activities and to the fight against climate change (Migliorelli & Dessertine 2019). Since then, ESG has been more recognised as a salient issue.

Developed from the concept of corporate social responsibility (CSR), ESG consideration has a long and wide-ranging history starting from the industrial revolution, one can trace for centuries evidence of the business community's concern for society (Carroll, 2008). According to Porter and Kramer (2006), there are four prevailing motives for companies to engage with CSR: moral obligation, sustainability, license to operate and reputation. In respect of the definition of CSR, it has varied in forms and has been defined in numerous ways depending on time or/and context of the discussion (Rahdari & Rostamy, 2015). CSR started to take shape in the 1950s, Bowen (2013) in his widely praised book defined social responsibilities as "obligation to make decisions which are desirable in terms of the values of our society", which was the pioneering idea to combine corporate behavior with social interest. In a more in-depth view from the famous Brundtland Report, CSR refers more closely to sustainability, which is to preserve natural resources, meet the requirements of current generations and not compromise the needs of generations to come (World Commission on Environment and Development, 1987).

In 1998, Elkington asserted that sustainability will be playing an irreplaceable role in the international agenda, and the future targets of a firm have evolved to triple bottom lines. In a nutshell, the triple bottom line represents cores concerning the pervasive social movements: economic prosperity, environment quality and social justice. Needless to explain, the economics bottom line represents profitability received to maximize shareholders' interest. The social bottom line refers to corporations' role in reallocating resources and providing benefits to different parties in the society, including labor, customers and other interest groups. Lastly, the environmental bottom line suggests business to take responsibility in

reducing ecological footprint of human activity such as toxic emission, overconsumption, toxic and non-degradable products. To achieve that, the triple bottom line implies an obligation to public reporting about the business' impact for the environment, society and people (Elkington, 1998). In this vein, Gray (2010) articulated the necessity of accounting standards for sustainability at organizational level and urged the new narrative of corporate's accountability and responsibility. As the growing importance of CSR awareness, over 360 CSR-related shareholder debate and resolutions were reported on issues ranging from employee treatment to environmental protection in 2005 (Porter and Kramer, 2006). On the basis of prosperous CSR concern in business management, Chandler (2020) proposed the well-known CSR threshold theory. The CSR threshold measures the need of a business to respond to stakeholders for its survival, and the business strategy affects the CSR threshold of different corporations (Chandler, 2020). For example, companies adopting low cost strategy have a higher CSR threshold than companies adopting differentiation strategy, and thus have a lower risk of being vulnerable to stakeholder backlash (Chandler, 2020).

2.3 Links between ESG and financial performance

2.3.1 Theoretical arguments

2.3.1.1 Arguments for better financial performance

Firstly, there are theoretical arguments why sustainability would lead to better financial performance. Inderst and Stewart (2018) propose that sustainable companies and investors in sustainable companies face less reputational risk. In this regard, Russo and Fouts (1997) argue that being proactive in becoming a sustainable company can reduce political and consumer pressure while also reducing the need for lobbying. Further, they argue that a firm can position itself as a sustainable leader of an industry, and increase sales and profits through a better reputation.

This argument would go more in line with stakeholder theory. Stakeholder theory proposed by Freeman (2010) articulated that a company ought to operate based on the interest of all entities affected, called stakeholders. In brief, the relationship with stakeholders is critical to sustain a company's growth. Freeman (2010) argued that only by understanding the needs of every stakeholder, can a company become successful. Thus, companies that involve their stakeholders to a high degree can protect themselves from conflict. One can find the connection between stakeholder theory and positive signaling theory, since they both recognize the relationship with outside parties. It might imply that as more information is

conveyed to stakeholders, the more trust is generated, which could be beneficial to company's profitability.

2.3.1.2 Arguments for worse financial performance

Friedman (1970) in his famous New York Times article argued that businesses' only responsibility is to make profits for their shareholders. When engaging in sustainable activities, unnecessary costs would incur. Instead, businesses should stay within the legal boundaries but not abide by more than the minimum regulation (Friedman 1970). In this vein, Walley and Whitehead (1994) state that whilst there might be a few companies that benefit from becoming sustainable, sustainability is a trade-off for the vast majority of companies. Ultimately, investing in environmental sustainability would lead to competitive disadvantage (Walley & Whitehead, 1994).

Another perspective on this topic is the idea of long-term value maximization. Jensen (2002) recognizes that involving many stakeholders complicates a firm's business as more opinions have to be considered. He argues that because stakeholders have different demands, which are often contradictory, it is not possible to satisfy all their needs. Because of that, he argues that managers are left with many different stakeholders opinions but it is unspecified how trade-offs between stakeholders' needs should be done. Moreover, when abiding by the stakeholder theory, managers would not have clear guidance on how to operate a business which would eventually damage the company (Jensen, 2002). Hence, Jensen (2002) proposes that a firm's success should only be measured in one single dimension. When conflicts among stakeholders arise and trade-offs have to be made, maximizing long-term (shareholder) value creation should be the determining factor. Moreover, he argues that managers' accountability under stakeholder theory is weak. He states that because managers' performance cannot be measured properly, they are more inclined to follow their own short-term interests and misuse the firm's resources. This damages not only the firm, which might ultimately go out of business, but also reduces societal welfare (Jensen, 2002). Arguing in Jensen's (2002) sense, involving ESG achievement as a performance indicator would reduce a firm's value creation and lead to financial underperformance.

Furthermore, sustainable investing can mean excluding whole industries as they are considered unsustainable. Scholars like e.g McGahan and Porter (1997) and Bourgeois III, Ganz, Gonce and Nedell (2014) acknowledge industry as one important determinant of profitability and financial performance. Hou and Robinson (2006) state that higher profits can be earned in industries where competition is intense while in less competitive industries profits are considerably lower. In this vein, Blitz & Swinkels report that excluding oil and gas companies from an investment portfolio reduces return and increases risk most significantly (Blitz & Swinkels, 2021). However, following a best-in-class approach can offset these

weaknesses of a sustainable investment strategy (Statman & Glushkov, 2009). Thus, when excessively restricting freedom of choice, investors might exclude the most financially-attractive industries from their portfolio and eventually suffer from underperformance against a benchmark (Inderst & Stewart, 2018). Lastly, Zerbib (2020) proposes that risk premia exist for unsustainable companies. Similar to previously mentioned arguments, this would in turn mean that sustainable assets might suffer from underperformance.

2.3.2 Evidence

Evidence for ESG performance's relationship with financial performance will be examined in two ways. First literature on ESG performance's relationship with accounting performance will be reviewed. After that the relationship between ESG performance and market performance will be examined.

2.3.2.1 Accounting performance

When examining the relationship between ESG performance and accounting performance, different accounting ratios have been examined. Goll and Rasheed (2004) performed multiple regressions that showed significant positive correlation between sustainability performance and Return on Asset (ROA). This finding is supported by McGuire, Sundgren and Schneeweis (1988) and Lu and Taylor (2016) among many others. Moreover, return on sales (ROS), return on equity (ROE) and earning per share (EPS) correlate positively with ESG performance (Lu & Taylor, 2016). However, there is also evidence for links between sustainability performance and accounting performance to be insignificant (Aragón-Correa & Rubio-Lopez, 2007; Arlow & Gannon, 1982; McWilliams & Siegel, 2000; Santis, Albuquerque & Lizarelli, 2016) or significantly negative (Duque-Grisales & Aguilera-Caracuel, 2021; Wagner, 2005).

Addressing papers that found positive interrelations between ESG performance and financial accounting performance, McWilliams and Siegel (2000) state that a number of studies do not sufficiently account for R&D measures as controlling variables. They argue that firms investing in sustainable business methods are often those firms that have differentiated products and thus already have superior accounting performance to undifferentiated firms. When accounting for R&D intensity, accounting performance of sustainable firms does not significantly differ from unsustainable firms (McWilliams & Siegel, 2000).

Furthermore, the relationship between sustainable supply chain practices, which is a measure of the Refinitiv ESG score, and corporate financial performance, measured in accounting profitability such as ROA and ROE, has been examined. In a meta analysis, Golicic and Smith (2013) reported positive links between sustainable supply chain practices and corporate financial performance on multiple dimensions. Eccles, Ioannou and Serafeim (2014) examined long-term performance, from 1993 to 2010 using data from Thomson Reuters' Asset4 database. Their results indicate that a portfolio with companies which had been performing sustainable supply chain practices, shows superior accounting performance. These differences in accounting performance are both seen when comparing sustainable to unsustainable companies but also when comparing a sustainable portfolio to a regular portfolio that does not consider sustainability in its choice of assets (Eccles, Ioannou & Serafeim, 2014). Performance advantages of a sustainable portfolio are most significant if, in the portfolio, firms are weighted based on their value rather than weighting them equally (Eccles, Ioannou & Serafeim, 2014). While the asset value of a sustainable portfolio weighted equally increased 3.5-fold, a value-weighted portfolio's asset value would have increased more than sevenfold over a duration of 27 years (Eccles, Ioannou & Serafeim, 2014).

2.3.2.2 Market performance

Looking at the relation of sustainability performance and market performance, there have been different results using different ways to measure market performance. Klassen and McLaughlin (1996) report that engaging in environmental sustainability improves a firm's stock performance. They state that when firms win awards for their sustainability efforts, firms' stock prices usually react positively. In contrast, companies that perform poorly on sustainability measures show significantly worse market performance (Klassen & McLaughlin, 1996; Lu & Taylor, 2016). In contrast to that, in Zerbib's (2020) analysis, investors that invest into sustainable companies underperform a benchmark by 1.43 percent annually, largely due to superior returns of unsustainable companies.

Eccles, Ioannou and Serafeim examine the relation between sustainable supply chain practices and stock performance over a duration of 27 years. When investing in a portfolio of highly sustainable companies, investors can gain long-term excess returns compared to investing into a portfolio that is composed of rather unsustainable companies (Eccles, Ioannou & Serafeim, 2014). When comparing the performance of a sustainable portfolio to a standard market portfolio that does not take sustainability measures into account, investors still benefit from excess returns (Eccles, Ioannou & Serafeim, 2014). Outperformance is most significant if companies in the portfolio are weighted on a value-basis rather than if the portfolio weights the different stocks equally (Eccles, Ioannou & Serafeim, 2014). Similarly,

Golicic and Smith (2013) state that engagement in sustainable supply chain practices improves market performance and thus increases investor payoff.

Furthermore, sustainable practices influence risk associated with a stock. McGuire, Sundgren and Schneeweis (1988) report that stocks of firms that are perceived as more sustainable have significantly lower volatility, measured in beta, than average stocks. Lack of data availability on the topic of ESG during their analysis had them choose Fortune 500's rating of corporate reputation which might not fully reflect sustainability performance and thus reduce reliability. However, a negative relationship between ESG performance and volatility has been confirmed in more recent analysis (Ashwin Kumar, Smith, Badis, Wang, Ambrosy & Tavares, 2016; Sudha, 2015). Thus, investors choosing to invest in sustainable companies may face less risk while gaining higher returns (Sudha, 2015). This questions the business narrative that company risk and financial payoff should be positively related.

2.4 ESG pillars' links to corporate financial performance

2.4.1 Links to accounting performance

Whether the separate ESG pillars have comparable significance has been subject to recent debate. Meta-studies by Hou et al. (2016) and Lu and Taylor (2016) both advocate that the environmental pillar has superior importance in its relation with accounting performance. Especially when compared to the social pillar performance of a company, environmental performance shows considerably higher significance (Hou et al., 2016; Lu & Taylor, 2016).

Schanzenbach and Sitkoff (2020) extrapolated that the business case for a firm's governance pillar score and its accounting performance is most significant when compared to social and environmental pillars. However, high environmental and governance pillar scores allow firms to earn higher returns with lower associated risk than firms with low environmental and governance pillar scores (Schanzenbach & Sitkoff, 2020). In contrast, Duque-Grisales and Aguilera-Caracuel (2021) state that all of the three ESG pillars have negative correlation with firms' accounting performance. They state that social scores are the most negatively interrelated with firm performance.

Furthermore, others suggest a different relationship. Naimy, El Khoury and Iskandar (2021) suggest a convex relationship between the environmental pillar and accounting performance of East Asian firms. This would imply that investments have to go beyond a certain tipping point before they pay off financially. The social pillar, however, is reported to have a convex relationship with firms' financial accounting performance (Naimy, El Khoury & Iskandar,

2021). Thus, both underinvestment and overinvestment into the social pillar may destroy value in the East Asian firms. Besides, the governance pillar might have negative interrelation with some accounting ratios like Return on Assets, while no effect is seen when compared to Return on Equity (Naimy, El Khoury & Iskandar, 2021).

2.4.2 Links to market performance

Previous literature has shown a number of different results on the relationship between ESG pillar scores and market performance. Abdi, Li and Càmara-Turull (2020) state that performing well on the environmental and governance pillar enhances corporate market performance in the airline industry. In addition, social score has a negative effect on market performance (Abdi, Li & Càmara-Turull, 2020). In contrast to that, Habermann (2021) finds evidence that especially high scores on the governance pillar are favorable for investors. He states that investing into the social pillar does only pay off until a certain limit. Investing over this limit would worsen firm market performance and reduce investor payoff (Habermann, 2021).

As opposed to the previously introduced literature, Naimy, El Khoury and Iskandar (2021) find evidence for a non-linear relationship of some of the ESG pillars with corporate market performance. Their analysis suggests no interrelation between environmental pillar and CFP. However, for the governance pillar's link with price to book ratio, a market performance measure, their analysis yields a convex relationship. This implies that excess returns may be earned if investors were to invest into companies with very high or low governance scores. Moreover, based on Naimy, El Khoury and Iskandar (2021) investing into businesses with average governance scores may yield lower payoff.

2.5 Summary and hypotheses development

The literature review above encompassed the theoretical foundation of interplay between corporate's ESG performance and financial performance. Theories of sustainable finance reveals how the concept of sustainability started to be binded with responsibility and objective of firms. And through the development of sustainable finance, ESG reporting has become a vital tool to reflect and supervise a company's sustainability development (Migliorelli, 2021). Some studies have proven that there is a trend for corporations to comply with ESG standards especially when under pressure from peers and partners (Contreras, Bos & Kleimeier, 2019; Migliorelli, 2021). In addition, the positive signaling theory of sustainable finance further delves into the relationship between a company's disclosed information and its

market performance. It argues that companies with conspicuous ratios and numbers tend to attract market attention and affect investor's perception (Park, 2018; Ozili, 2022). This theory might be the explanation of the correlation between ESG performance and financial performance.

Literature on conceptualization of ESG was reviewed as well. It has briefly witnessed the development of CSR and the rising concern of the whole society to sustainability. A number of scholars and their theories have made considerable contributions in this field, a few remarkable instances would be Freeman's stakeholder theory, principle of triple bottom line, and Porter and Kramer's discussion on competitive advantage and CSR (Freeman, 2010; Elkington, 1998; Porter & Kramer, 2006). That literature has accelerated the inclusion and importance of ESG consideration in business administration.

After that, theoretical reasons why ESG performance might be positively (negatively) related to corporate financial performance were discussed. Some scholars (Russo & Fouts, 1997; Freeman 2010) argue that involving stakeholders may lead to superior performance. Others (Friedman, 1970; Walley & Whitehead, 1994) state that a firm solely exists for making profit for its shareholders. Jensen (2002) proposes that stakeholder management is not necessarily bad but may lead to inefficiencies. Thus, firms should solely strive for long-term value maximization.

Testing these theoretical reasons, scholars have conducted a number of studies. They examined links between ESG performance and accounting performance of companies, using ratios such as Return on Assets, and firms' market performance, using stock performance measures or tobin's q. Nevertheless, their results are still inconclusive. While the majority of scholars (Eccles, Ioannou & Serafim, 2014; Lu & Taylor, 2016; Russo & Fauts, 1997; Klassen & McLaughlin, 1996) seems to argue in favor of a positive relationship of sustainability performance and corporate financial performance, other scholars do not find significant (Arlow & Gannon, 1982; McWilliams & Siegel, 2000) or even negative (Duque-Grisales & Aguilera-Caracuel, 2021; Wagner, 2005) relations. However, intra-industry analysis could provide a new point of view on the topic. Therefore the following hypotheses were developed.

Hypothesis 1a: North America-based oil and gas companies' ESG scores are positively related with the firms' accounting performance.

Hypothesis 1b: North America-based oil and gas companies' ESG scores are positively related to the firms' market performance.

While the overall ESG score has received a lot of attention in previous literature, ESG pillar scores have not been studied much. Nevertheless, previous literature found evidence that the

environmental pillar is most strongly related to accounting and market performance of companies (Hou et al., 2016). There is also evidence that the governance pillar is of high importance. Lastly, Naimy, El Khoury and Iskandar (2021) proposed a nonlinear relationship between ESG pillar performance and corporate financial accounting and market performance. Based on that, the following two hypotheses are to be tested.

Hypothesis 2a: Among the three ESG pillars, environmental sustainability has the strongest association with accounting performance of North America-based oil and gas companies.

Hypothesis 2b: Among the three ESG pillars, environmental sustainability has the strongest association with market performance of North America-based oil and gas companies.

3 Methodology

What follows is the account of data and analytical tools used to answer the research question presented in this study. The research approach of data selection is presented first, followed by research design and method of data collection. Last but not least, the process of data analysis and its validity and limitations are discussed.

3.1 Research Approach

3.1.1 Sample Definition

This paper intends to study the oil and gas industry. In sample selection, this paper employs a convenience sampling method which is a popular choice for researchers if the time to conduct a study is short (Greener, 2008). Five criteria to determine suitable companies were established. Involved companies have to:

1. be publicly-traded,
2. be classified as oil and gas companies (industry code: 501020) by The Refinitiv Industry Classification (TRBC),
3. have their headquarters in North America (USA, Canada, Bermuda, Greenland, Saint Pierre and Miquelon),
4. be ESG-rated by Refinitiv Eikon for the calendar year 2019,
5. have minimum annual turnover of 100mn US-dollars for the calendar year 2019.

It was initially discussed to include a minimum annual turnover of 100mn US-dollars for 2019. However, the data were collected *without* this criterion in place. Nevertheless, after an initial screening of the data, the values for companies below this threshold were very noisy which might have reduced interpretation of the results. Thus it was decided to use (5) 100mn US-dollar minimum turnover for 2019 as the fifth criterion. The year of 2019 is chosen for this analysis in order to control for the effects from the Sars CoV-2 pandemic in 2020 and 2021, where the demand for oil and gas decreased due to lockdowns and slow industrial operations (Norouzi, 2021).

3.1.2 Variables

Dependent Variables

Firstly, accounting performance with the proxies return on asset (ROA) will be measured and interpreted. ROA has been a popular choice amongst researchers (table 3.1) ROA measures how much profit a firm can earn from its used assets. In general, high, positive values are preferable and indicate efficient usage of assets. Secondly, the relation of sustainability and market performance is examined. To measure market performance, tobin's q will be used as a proxy. Tobin's q, among other market performance measures such as stock market performance and market share, has been a popular choice for researchers (table **3.1**). A value below one indicates that a company is undervalued while a value above one signals that a stock might be overvalued. The calculation of the dependent variables can be seen in table 3.1.

	Return on Assets (ROA)	**Tobin's q (TQ)**
Proxy for	Accounting performance	Market performance
Calculation	$\frac{Annual\ net\ income}{Average\ total\ assets} * 100$	$\frac{Market\ Cap + Total\ liabilities + Preferred\ Equity + Minority\ Interests}{Total\ Assets}$
Previous Studies	Eccles, Ioannou & Serafeim (2014); Santis, Albuquerque & Lizarelli (2016); Goll & Rasheed (2004); Russo & Fouts (1997)	Velte (2017); Lu & Taylor (2016); Lee, Pati & Roh (2011)

Table 3.1 Dependent variables

Independent Variables

Environmental, social, and governance score (overall score)

The primary objective of ESG conception is to report environmental, social and governance performance subjectively when values of ESG conception come to the fore, hence the identification of measurable and relevant data for sustainability and appropriate metrics are of utmost importance (Kocmanová, Karpíšek & Klímková, 2012). The past fifteen years have witnessed a surge in indicators and rating systems for ESG, there are numerous ways of rating

measured by a number of institutions (Rahdari & Rostamy, 2015; Herva, Franco, Carrasco & Roca, 2011). In this study, the ESG score by Refinitiv Eikon is employed, a database which covers 80% market capitalization, and more than 630 different metrics (Refinitiv, 2022). It is a popular choice for researchers for its extensive ESG scores dating back to 2002 (Bătae, Dragomir & Feleagă, 2021). The ESG score reflects ESG performance of a company based on verifiable reported data, it is calculated based on the relative sum of the 10 category weights which varies across different industries (Refinitiv, 2022). The score is a percentage from 0 to 100. A score of 0-25% indicates poor ESG performance, 25-50% means a satisfactory ESG performance, 50-75% is a good ESG performance, and 75-100% is an excellent ESG performance with a high degree of transparency in ESG reports (Refinitiv, 2022). The categories pertaining to ESG score can reformulate three pillar scores of environment, social, and governance (Refinitiv, 2022).

The ESG score is composed of the three pillars environmental (E), social (S) and governance (G). Similar to the overall ESG score, it is also measured on a scale from zero to 100 (table 3.2). A description of the different pillars is given below.

Environmental pillar score

Environmental protection encompasses a number of subjects like natural resources preservation, pollution prevention, conserving water and energy, reducing greenhouse gas (GHG) emission, and ecosystem impact. Take GHG emission as an example, studies show that emission of toxic gasses including carbon dioxide are associated with photochemical smog, acid rain, ecosphere variation and climate change (Zvereva, Hunter, Zverev, Kruglova & Kozlov, 2019). These emissions may cause harmful consequences for animals, humans and even biomes in a broad region (Zvereva et al., 2019; Jonsson, MacLeod, Hayward, McNeilly, Ferguson & Skuce, 2022). Thus, there is a growing consensus among institutions and communities that corporations must meet environmental requirements and publish their environment-relevant data periodically. The environmental pillar score captures category weights of environment-related metrics, it is calculated based on 3 dimensions which includes: 20 metrics on resource use, 28 metrics on emissions, and 20 metrics on innovations (Refinitv, 2022).

Social pillar score

The social pillar concerns how business practices bring benefits toward labor,community and the society in which a firm operates. Related to the stakeholder theory and triple bottom line, the social pillar of ESG evaluates a company's contribution to its stakeholders and seeks to build a reciprocal structure in which the well-being of business, labor and other stakeholders are interdependently binded (Elkington, 1998). The relevant issues are human rights, product quality, working conditions and data privacy (Refinitiv, 2022). Albeit quantifying these issues

is relatively difficult and subjective, the Global Reporting Initiative (2022) has developed guidelines to conduct comparative analysis of the social impact in ESG reports of different companies.The social pillar score is calculated based on 4 dimensions which includes: 30 metrics for workforce, 8 metrics for human rights, 14 for community, and 10 for product responsibility (Refinitv, 2022).

Governance pillar score

Unlike environment and social pillar, the corporate governance pillar pertains to ethnicity of internal control of the business. According to the stakeholder theory, the management of a corporation has an obligation to respond to stakeholder's demand and interest, and corporate governance provides a lens to watch over the CEO and other employees' behavior. MSCI (2022) counts corporate behavior practices, executive pay, ownership and control, auditing accounting, and transparency in the bucket of corporate governance. In addition, some other issues could also be included, such as board composition, shareholder rights, and employee compensation (Refinitiv, 2022). The governance pillar score is based on 3 dimensions which includes: 35 metrics on management, 12 metrics for shareholders, 9 metrics for CSR strategy (Refinitv, 2022).

Independent variable	**Scale**
ESG score	0-100
Environmental pillar score	0-100
Social pillar score	0-100
Governance pillar score	0-100

Table 3.2 Independent variables

Controlling Variables

Control variables are important for empirical research in order to limit any bias from the independent variables (Nielsen & Raswant, 2018). The variables used in this study are revenue, total debt to total equity, asset turnover (table 3.3). Revenue is a popular control variable in ESG / CFP research. It is used in order to account for size of the companies, as large firms might have an easier time adapting good ESG behavior. It is common to use the logarithm of revenue to reduce the influence of large companies on this control variable compared to when it were measured in a linear way. Asset turnover was suggested as a ratio to measure Capital intensity by Russo & Fouts (1997) , Since it has been employed in different studies of this field (table 3.3). Although this study intends to examine only one industry, capital intensity is likely to differ among the sub industries. Thus, Asset turnover is included as the second variable.

Furthermore, companies with high financial leverage might perform worse (McGuire, Sundgren & Schneeweis, 1988). To account for this, this paper employs the total debt to total equity ratio as a controlling variable to measure financial leverage. While previous literature often accounted for financial leverage in their research, ratios used might differ slightly. Lastly, the authors assume that there could be some differences between the sub industries: (oil and gas) exploration and production, refining and marketing, and integrated oil. Thus, a dummy variable is employed.

Controlling variable	**Proxy for:**	**Calculation**	**Previous studies**
Revenue	Firm size	log(annual net revenue)	Duque-Grisales & Aguilera-Caracuel (2021); Eccles, Ioannou & Serafeim (2014); Lee, Pati & Roh (2011); Russo & Fouts (1997)
Asset turnover	Capital intensity	$\frac{Total\ sales}{Average\ total\ assets}$	Russo & Fouts (1997); Wagner (2005); Lee, Pati & Roh (2011)
Total debt to total equity	Financial leverage	$\frac{Total\ liabilities}{Total\ shareholder's\ equity}$	Lee, Pati & Roh (2011); Wagner (2005); McGuire, Sundgren & Schneeweis (1988)
Dummy	Sub Industry	0 or 1	/

Table 3.3 Controlling variables

3.2 Research Design

A quantitative approach for the data collected and analysis seemed appropriate in order to attempt to explain the relationship between the variables while maintaining objectivism (Bryman & Bell, 2011). Quantitative studies most commonly follow a deductive research design for testing a hypothesis(es) that has been deduced based on existing theory (Bryman & Bell, 2011). A cross sectional design in which a sample of the variables in question were collected at a single point in time was the approach for this analysis. In that sense, in review of the aim of this study, which is to test the relationship between ESG performance and corporate financial performance, this paper employs a multiple regression model as performed by previous studies (Yang, Du, Razzaq, & Shang, 2022; Lee, Pati & Roh 2011). Testing for hypothesis 1 and 2 presented in section 2.5 will be done with the regression analysis of firm performance as a function of ESG scores and control variables shown in the tables above.

In order to explore the relationship between the dependent and independent variables a popular statistical method is using multiple linear regression (Chao, Zhao, Kupper, & Nylander-French, 2010). The independent variables act as explanatory variables with a regression coefficient Beta (ß) which represents the relative importance of the independent variable to the model (Chao et al., 2010). According to the hypotheses shown in 2.5, four propositions are proposed to adjust to different hypotheses.

For *hypothesis 1a*: **North America-based oil and gas companies' ESG scores have positively significant association with their accounting performance**. Corresponding model is shown in (1a):

$$Y_{ROA} = ß_0 + ß_1 x_{ESGi} + ß_2 x_{Ri} + ß_3 x_{D/Ei} + ß_4 x_{ATi} + ß_5 x_{INDi} + \epsilon_i \quad (1a)$$

The variables in this equation are:

- i is the number of samples.
- $ß_0$ is the intercept, the value of Y when every x is equal to zero.
- $ß_1$, $ß_2$, $ß_3$ ... are the estimated regression coefficients. Each coefficient represents the amount of change in Y when x changes by one unit.
- ϵ_p is the error term that represents deviation of observed values Y from their means.
- Y_{ROA} is the dependent variable in this model: ROA
- x_{ESGi}, x_{Ri}, $x_{D/Ei}$, x_{ATi}, and x_{INDi} are independent variables and control variables: ESG score, revenue (log), debt to equity ratio, asset turnover and sub-industry.

For *hypothesis 1b*: **North America-based oil and gas companies' ESG scores have positively significant association with their market performance.** The model for this hypothesis is in (1b):

$$Y_{Tobin'sq} = ß_0 + ß_1 x_{ESGi} + ß_2 x_{Ri} + ß_3 x_{D/Ei} + ß_4 x_{ATi} + ß_5 x_{INDi} + \epsilon_i \quad (1b)$$

The variables in this equation are:

- $Y_{Tobin'sq}$ is the dependent variable in this model: Tobin's q.

- x_{ESGi}, x_{Ri}, $x_{D/Ei}$, x_{ATi}, and x_{INDi} are independent variables and control variables: ESG score, revenue (log), debt to equity ratio, asset turnover and sub-industry.

For *hypothesis 2a*: **Among the three ESG pillars, environmental pillar scores have the strongest association with accounting performance of North America-based oil and gas companies.** The model is shown in (2a):

$$Y_{ROA} = ß_0 + ß_1x_{Ei} + ß_2x_{Si} + ß_3x_{Gi} + ß_4x_{Ri} + ß_5x_{D/Ei} + ß_6x_{ATi} + ß_7x_{INDi} + \epsilon_i \quad (2a)$$

The variables in this equation are:

- Y_{ROA} is the dependent variable in this model: ROA.

- x_{Ei}, x_{Si}, $x_{Gi,}$ x_{Ri}, $x_{D/Ei}$, x_{ATi}, and x_{INDi} are independent variables and control variables: environment pillar score, social pillar score, governance pillar score, revenue (log), debt to equity ratio, asset turnover and sub-industry.

For *hypothesis 2b*: **Among the three ESG pillars, environmental pillar scores have the strongest association with market performance of North America-based oil and gas companies.** Corresponding model is shown in (2b):

$$Y_{Tobin'sq} = ß_0 + ß_1x_{Ei} + ß_2x_{Si} + ß_3x_{Gi} + ß_4x_{Ri} + ß_5x_{D/Ei} + ß_6x_{ATi} + ß_7x_{INDi} + \epsilon_i \quad (2b)$$

The variables in this equation are:

- $Y_{Tobin'sq}$ is the dependent variable in this model: Tobin's q.

- x_{Ei}, x_{Si}, $x_{Gi,}$ x_{Ri}, $x_{D/Ei}$, x_{ATi}, and x_{INDi} are independent variables and control variables: environment pillar score, social pillar score, governance pillar score, revenue (log), debt to equity ratio, asset turnover and sub-industry.

3.3 Data Collection Method

Previous highly-cited studies such as Eccles, Ioannou and Serafeim (2014) and Duque-Grisales and Aguilera-Caracuel (2021) used Refinitiv Eikon's ESG score to analyze interrelation with corporate performance. Moreover, according to Dorfleitner, Halbritter and Nguyen (2015) Refinitiv (Thomson Reuters) and Bloomberg are more reliable for ESG ratings than MSCI. Thus, to improve reliability, this study derives ESG score and ESG pillar scores from Refinitiv. The initial screening yields a total of 119 companies. However due to the implementation of the fifth criterion (5) 100mn US-dollar turnover for 2019, 113 companies remained.

The authors tried accessing financial data like accounting ratios from Refintiv as well. However, available data was considered insufficient which led the authors to gather the financial data from Bloomberg instead. The data were accessed via a Bloomberg terminal. Data accessed included (1) the dependent variables return on assets, return on common equity and tobin's q and sustainable growth rate. However, sustainable growth rate was only available for about half of the sample. Because this would reduce the sample size substantially, it was excluded from the analysis. In addition, (2) controlling variables from different categories were retrieved. The data included (I) measures for firm size: revenue and cost of revenue, data measuring (II) operational efficiency / capital intensity: sales per employee, asset turnover, cost of revenue; (III) financial health: Total debt to equity and (IIII) R&D intensity as a variable to measure differentiation of a firm's products were retrieved.

However, some of the controlling variables were excluded. Firstly, R&D intensity data was only available for seven of the 113 companies which was considered insufficient. Besides, sales per employee missed 12 data points, while asset turnover provided data for all companies. Thus, asset turnover was chosen as the variable to account for differences in operational efficiency between the companies while sales per employee was disregarded. Further, in initial tests, cost of revenue showed very high correlation with revenue. Because of that, revenue was chosen as a proxy for firm size while cost of revenue was excluded.

Furthermore, the authors intended to reduce the probability of mistakes arising from errors in data collection or incompatibility of databases. Although Refinitiv provided an ESG score for all 113 companies, Bloomberg did not have revenue data for the following six companies for the calendar year 2019: Alimentation Couche-Tard Inc., Erin Energy Corporation, Evolution Petroleum Corporation, Exco Resources Inc., PHX Mineral Inc. and Star Group L.P.. Erin Energy Corporation was liquidated due to bankruptcy, while Exco Resources Inc. retrieved their listing in order to be traded over the counter (OTC). Alimentation Couche-Tard Inc., Evolution Petroleum Corporation, PHX Mineral Inc. and Star Group L.P. have a broken fiscal year which does not equal a calendar year. Their fiscal years end e.g. in April, June or

September of the respective year. As this would reduce the scope of interpretation for the calendar year 2019, the four companies were excluded.

Lastly, even after excluding whole variables with too little data availability, there were still some missing data points for the remaining variables. For some companies, multiple data points were missing. For example, for tobin's q Bloomberg did not have available data for five companies while Refinitiv provided an environmental pillar score of zero for six companies. Having an environmental pillar score of zero might indicate data insufficiency which is why those six observations were excluded from the analysis. Moreover, as companies without a full dataset would be disregarded by the statistical program in a regression, it was decided to exclude all observations that did not provide a full dataset. This left the sample with 94 companies.

3.4 Data Analysis

Quantitative research often requires delicate processing of data to ensure its rigorous and reliability. After collecting the data from databases, raw data was saved in the consolidated spreadsheet in Excel, which allows for a simple way of data collection, transferring and coding. The whole manual process of data collection and transfer was checked by different individuals to avoid errors. The regression model was coded in R statistical software, a commonly used tool for statistical modeling that is freely available (Braun & Murdoch, 2021).

The multiple regression model will then form the equation for line of the best fit of inputs, which is determined by least-square method, and produce results including regression coefficient estimates (ß) of independent variables and their statistical significance to the model. Those statistical results will be analyzed and consequently determine if the hypotheses hold. However, before coming to that conclusion, the validity and reliability of the regression model must be tested. Necessary procedures including linearity check, normality assessment, and multicollinearity check must be undertaken. Descriptive statistics can be found in appendix E, the table in shows the descriptive statistics for the variables used in this study. The mean for ESG score was 39.2 where the highest ESG score in the dataset was 82.1 and the lowest was 4.5. The highest mean of 56.1 for the pillar scores belonged to governance score while social score and environmental scores were respectively lower.

3.5 Validity and Reliability

The validity and reliability in a quantitative research refers to the accuracy and the consistency of the measurement respectively (Bryman & Bell, 2011). All the secondary sources like literature and empirical studies were conducted systematically, all those articles are publications of highly rated journals with peer review systems. On the other hand, the data in this study were collected from the Refinitiv database and Bloomberg terminal, which have been used in highly-cited studies such as Eccles, Ioannou & Serafeim (2014). Although ESG ratings differ between large rating agencies, they are reliable at least to a certain degree (Rahdari & Rostamy, 2015). Hence, the sources used in this paper are considered credible. Furthermore, since no panel data is used in this study, survivorship bias and autocorrelation issues are not in consideration of validity check.

Regarding the reliability of the regression analysis, although the standard linear regression model usually provides useful insights for real-world problems, it makes several restrictive assumptions (James, Witten, Hastie & Tibshirani, 2021). Firstly, independent variables ought to have a linear relationship with dependent variables; secondly, the residuals of regression follow normal distribution; thirdly, it is expected to have no multicollinearity in the data (James et al., 2021). In order to verify these assumptions, various tests and procedures were applied to secure the statistical significance of this paper.

The residual analysis was drawn to take a closer look at the data and secure the linearity. Residual in a statistical model refers to the difference between predicted values and the observed values, thus it can evaluate the accuracy of the model (James et al., 2021). The linearity assumption will be tested by observing to what extent the residuals match with the prediction line.

Normality is a vital assumption to test skewness and kurtosis of the dataset, as skewness mainly measures the dataset's deviation from normal distribution and kurtosis measures weights of distribution's tails (Heckert, Filliben, Croarkin, Hembree, Guthrie, Tobias & Prinz, 2002). A proper normal distribution is supposed to look like a bell curve, with most data distributed at the center of the curve (Heckert et al., 2002). Usually, one can use histogram or Q-Q plot to check normality (James et al., 2021). In this paper, Q-Q plots are used to test for normality.

Additionally, multicollinearity should not exist in the data. The term "multicollinearity" has been used to describe correlation among independent variables (James et al., 2021). Since there are several independent variables in the model, it is expected that every independent variable has a limited influence on each other. Correlation matrix and variance inflation factor

(VIF) are the most common tools to test multicollinearity (James et al., 2021). Both correlation matrix and VIF are adopted in this research.

3.6 Limitations

Discussing external validity, due to strict time constraints, this study employed a convenience sampling method. That means that its results are largely not generalizable (Greener, 2008). Moreover, Rost and Ehrmann (2017) claim to find effects of reporting bias. They argue that with reporting bias considered the relationship between ESG performance and financial performance is less positive. This may also be true for the results presented in the following section. Adding on to this, the oil and gas industry is very distinct, as for example high long-term investments are necessary to operate. This implies the results may not allow for interpretation outside the oil and gas industry. Thus, the results from this paper can be interpreted as an overview of the North American oil and gas industry without claiming to perfectly present it.

When it comes to internal validity, there are some limitations to consider. Firstly, there might be controlling variables that were not controlled for but still have an effect on the dependent variable. This could involve for example R&D intensity (McWilliams & Siegel, 2020). However, in the case of R&D intensity, we claim that the oil and gas industry is highly competitive and strongly driven by low-cost (and not differentiation) strategies. This might mean that not controlling for R&D intensity does not limit the scope of interpretation of the results.

Furthermore there could be variables that impact the relationship between independent and dependent variables (moderators) that are not examined in this paper. Potential moderators could for example be geographic international diversification (GID) (Duque-Grisales & Aguilera-Caracuel, 2021). While the definition of North America based companies in this paper relates to their headquarters, many firms are active all around the globe.

Lastly, variables that are impacted by the independent variables and influence the dependent variable (mediators) could be present. Sustainable firms have access to capital at a lower price (Eliwa, Aboud & Saleh, 2021). This may mean that the relation of ESG performance and CFP is actually mediated by a lower cost of capital for sustainable firms.

There is a possibility for other controlling variables, moderators and mediators, that we did not mention, to be present. In addition, due to this study using linear regression models, causality can *not* be proven (Studenmund, 2014). Instead interpretations can only be drawn on

the relation between dependent and independent variables. Thus, when trying to interpret the results of this study, previously mentioned limitations should be kept in mind.

3.7 Chapter Summary

This chapter started with the research approach and research design, where the process of sample and variable selection were described. Eventually, 94 out of 119 samples' data in the calendar year 2019 were chosen for the analysis in accordance with the best fit to the objective of this paper. ESG overall score and three ESG pillar scores were used to predict accounting performance (ROA) and market performance (tobin's q) of oil companies. Moreover, variables such as revenue and asset turnover were included as control variables to limit bias from other factors such as firm size, capital intensity and financial leverage. The selected data were then processed in multiple linear regression models with help of R software, in which different equations were applied to examine four hypotheses mentioned in 2.5. Before coming to the analysis of statistical results, the subsequent sections stated details of securing validity of research. On the one hand, data was collected from credible sources and was featured with prudence to best suit the purpose of this paper. On the other hand, the dataset had to undergo various tests in order to fulfill assumptions of regression analysis. Nevertheless, there are some limitations to consider. The results give an overview of the topic but do not prove causal relationships and cannot be generalized. Thus, any interpretation of the results should be conducted in a strictly careful manner.

4 Analysis

4.1 Data screening

Data screening is a vital preparatory step to take before data analysis, because irrelevant data would cause unexpected effects to model results (James et al. 2021). As discussed in 3.3, the pre-processing of data in 3.3 has already excluded 25 observations out of the initial dataset of 119 samples due to the missing value or the failure to meet criterion. One step further than that, this chapter filters data by verifying the validity of the regression model through checking linearity, normality and multicollinearity assumptions.

4.1.1 Linearity assumptions

As stated in 3.5, residual analysis in scatter plots is applied to inspect linearity assumption of four models (1a), (1b), (2a), and (2b).

Model (1a): ESG score - ROA

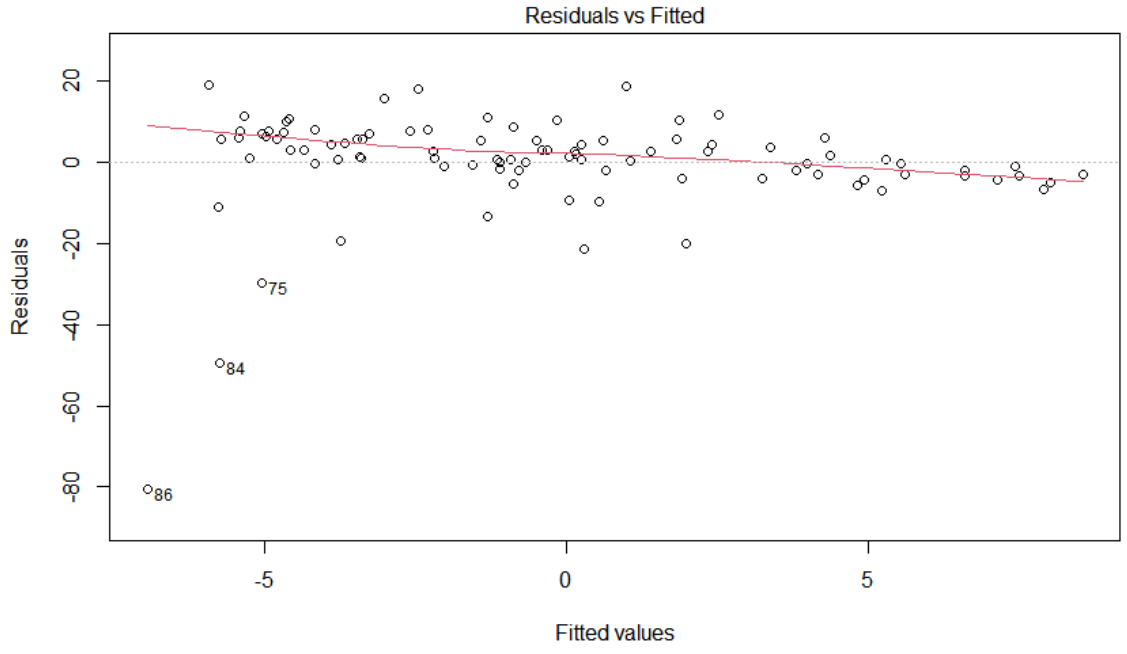

Figure 4.1 Residuals plot of ROA and ESG score

As seen in figure 4.1, most of the residuals for ROA are located alongside the prediction line, except for the outlier at the left bottom of the graph, namely sample 86. The abnormal data point might be due to endogenous factors that considerably affect the value of samples, for example, unexpected events or business decisions could affect a company's ROA enormously, and thus the outlier can make inappropriate influence on the regression model.

Model (1b): ESG score - tobin's q

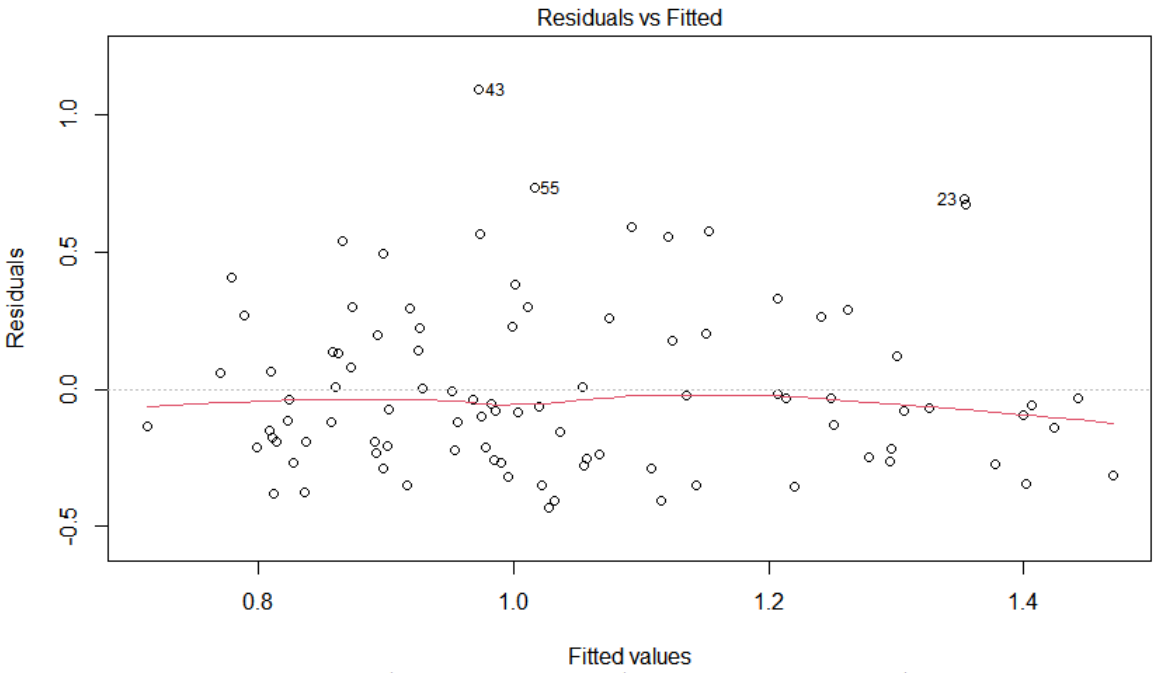

Figure 4.2 Residuals plot of Tobin's Q and ESG score

As for tobin's q, figure 4.2 presents its residual attribution, in which most of the residuals disperse evenly across the prediction line and roughly shows linear relationship. One exception is sample 43, which is located farthest from the prediction line than other dots. Thus it might influence the results to a high degree which makes exclusion necessary.

Model (2a): ESG pillar scores - ROA

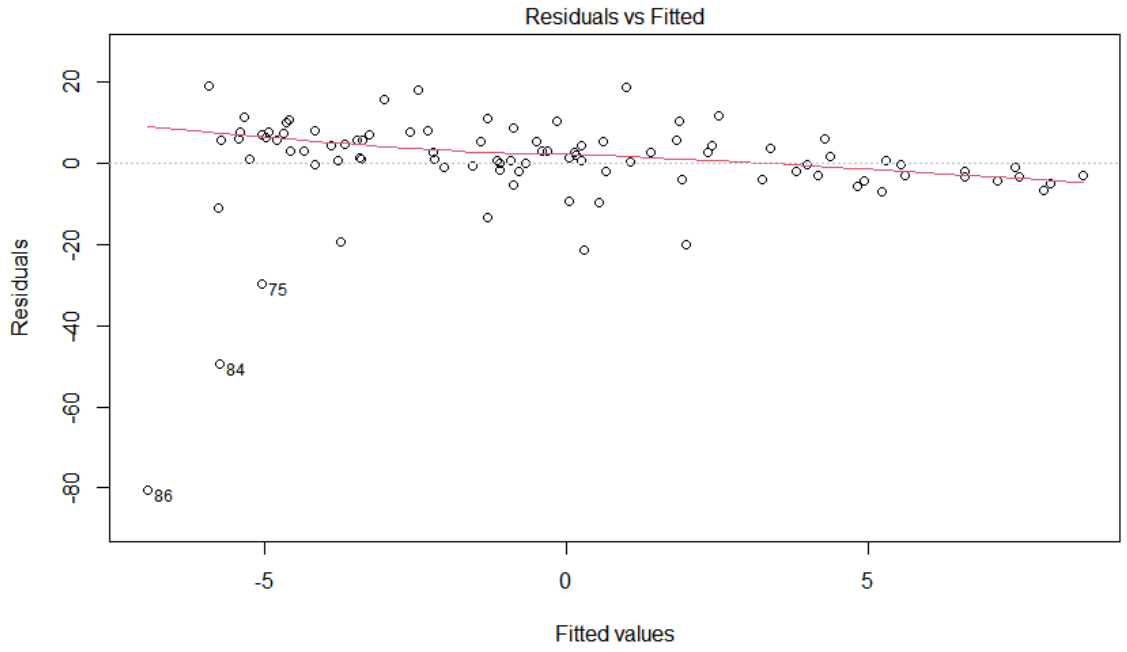

Figure 4.3 Residuals plot of ROA and pillar scores

In figure 4.3 above, it can be observed that residual analysis of model (2a) is similar to residual plots of (1a) (figure 4.1). The majority of data shows linear formation except for sample 86 at the bottom left. Sample 86 shows a value of minus 80 which can be considered extreme and thus is an outlier.

Model (2b): ESG pillar scores - tobin's q

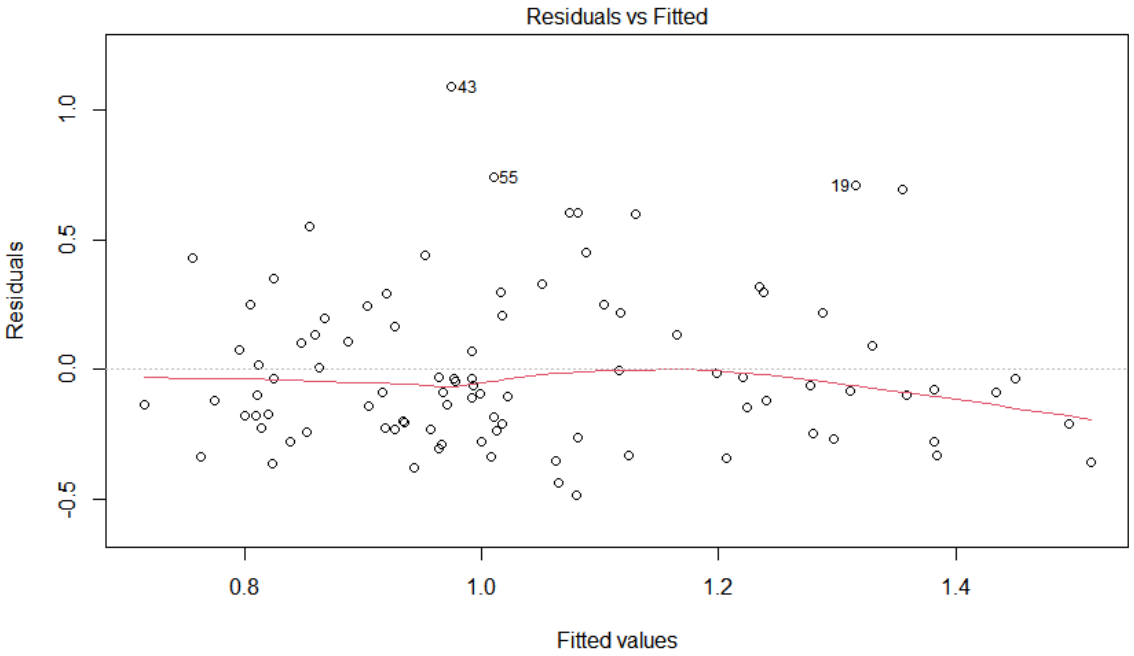

Figure 4.4 Residuals plot of Tobin's Q and pillar scores

The last plot in figure 4.4 gives a similar result to figure 4.2 for (1b) as well, sample 43 is the sole data point residing far from the prediction line.

In conclusion of four residual plots, sample 86 and 43 are regarded as outliers and were excluded from the dataset, which makes 92 observations left in the dataset. The regression after removal of these two outliers comports with linearity assumption.

4.1.2 Normality test

Mentioned in 3.5, quantile-quantile plot (Q-Q plot) is the method to check normality in this study. Plots are shown for each of the four models.

Model (1a): ESG score - ROA

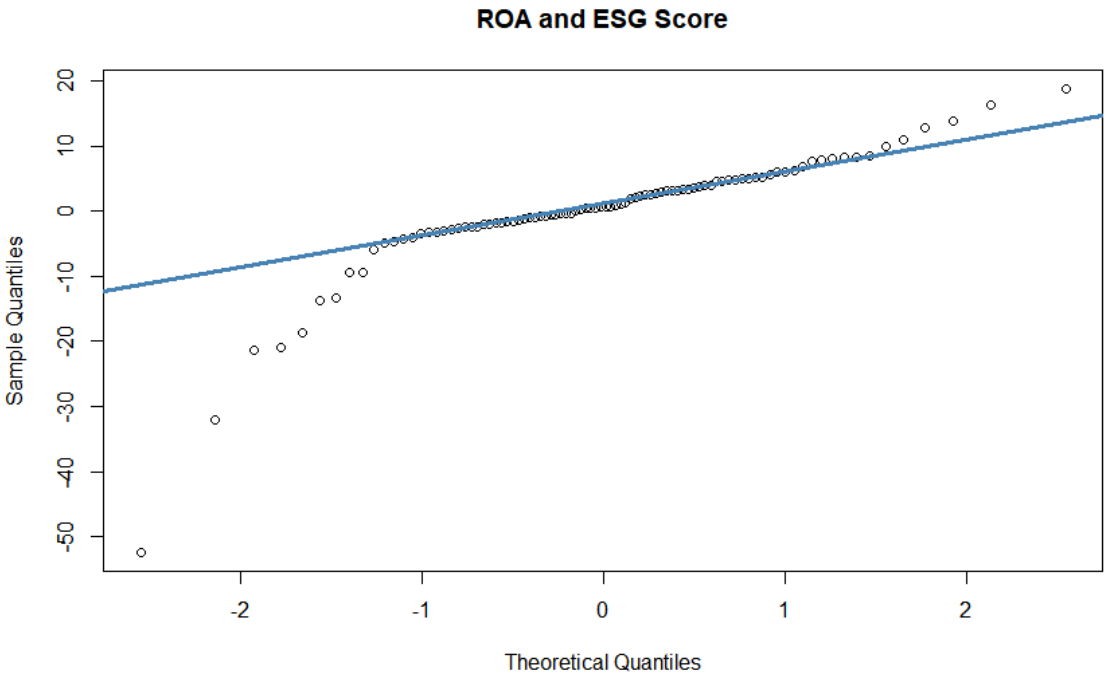

Figure 4.5 Normal Q-Q plot of ROA and ESG score

In figure 4.5 that presents the Q-Q plot for model (1a), most of the sample dots follow the prediction line while a few are distributed further to the line, forming an arced shape. It indicates that the distribution is slightly skewed and does not completely comport with normal distribution. Nevertheless, the extent of skewness shown in figure 4.5 is considered acceptable.

Model (1b): ESG score - tobin's q

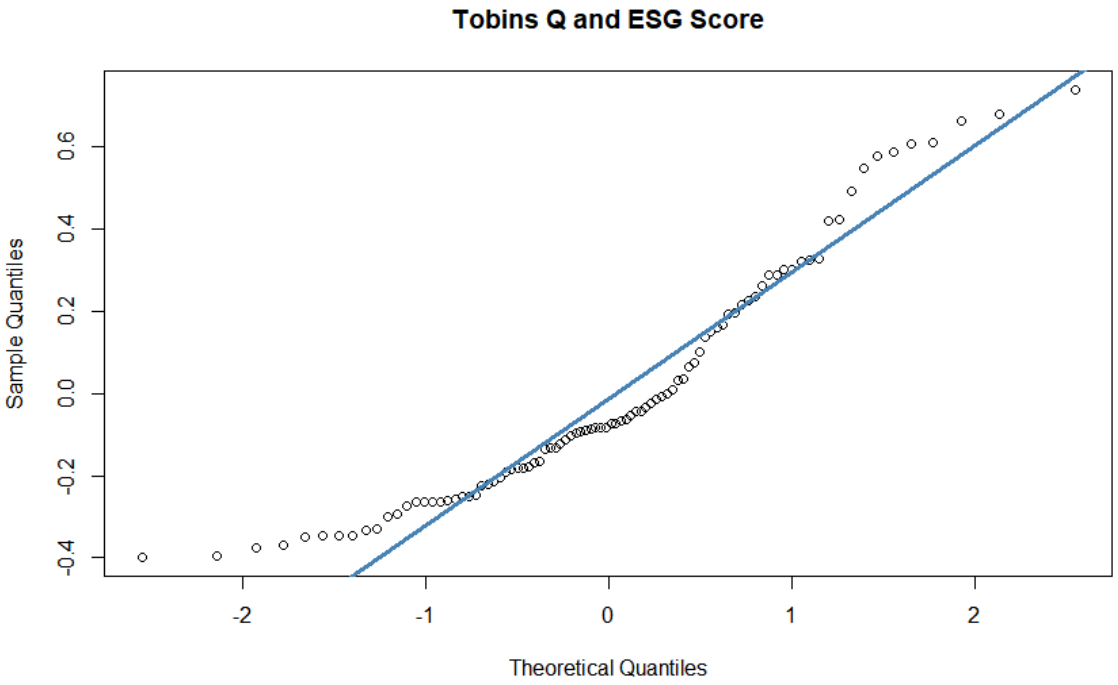

Figure 4.6 Normal Q-Q plot of Tobin's Q and ESG score

Presented in figure 4.6, the Q-Q plot has an "S" shape with most points dispersed closely to the prediction line. What is noteworthy to point out is the tail at left bottom of the plot, which could indicate some skewness in sample distribution. But the slight skewness in this case is not significant enough to affect model results.

Model (2a): ESG pillar scores - ROA

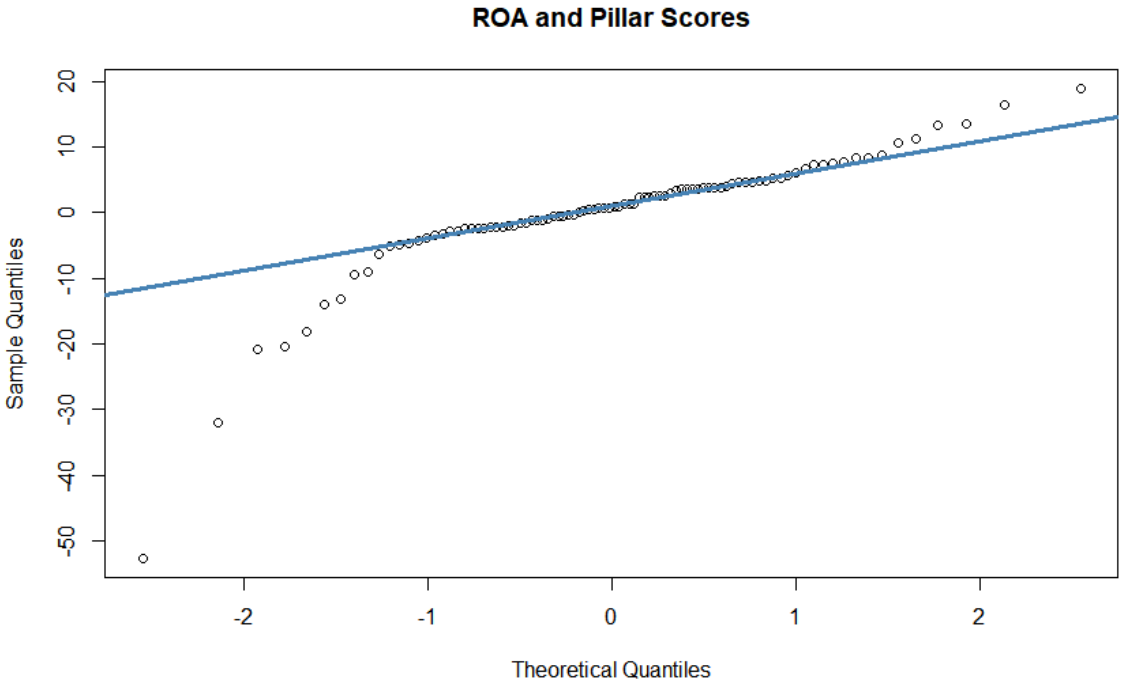

Figure 4.7 Normal Q-Q plot of ROA and pillar scores

As shown in figure 4.7, minor deviation between data points and prediction is detected, but the deviation is not supposed to critically affect model results.

Model (2b): ESG pillar scores - tobin's q

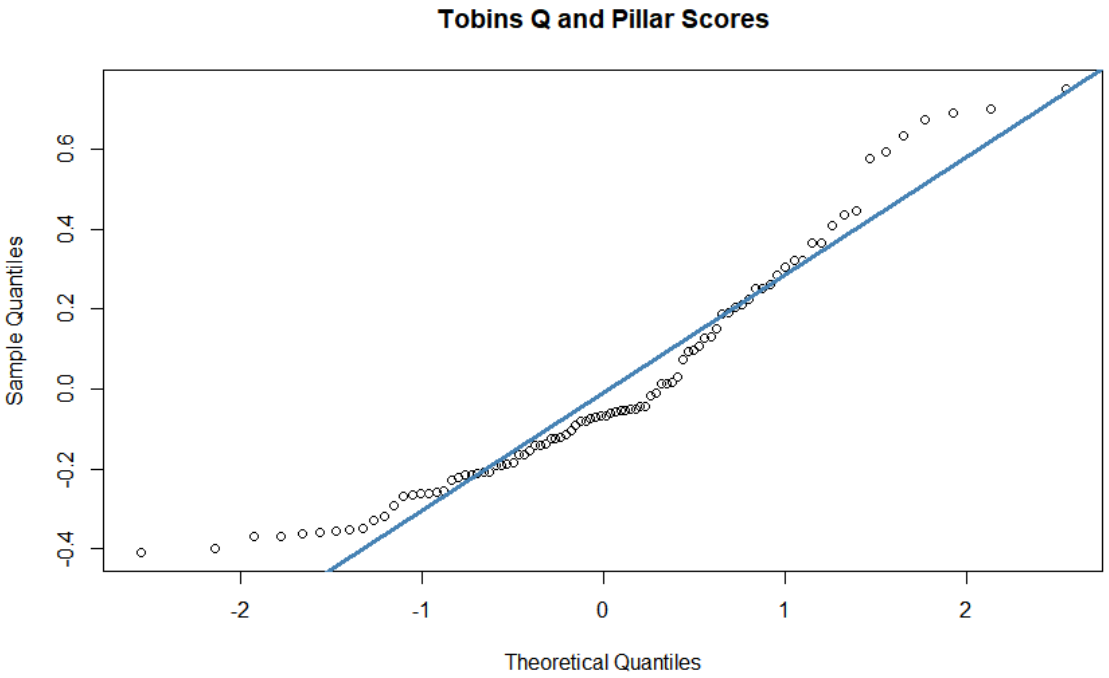

Figure 4.8 Normal Q-Q plot of Tobin's Q and pillar scores

Content shown in figure 4.8 is also similar to the Q-Q plot in figure 4.6 for (1b), and it basically comports with normality assumption.

Conclusively, although there is a weak trend of skewness in the dataset, all the models pass the normality check because the skewness here would not significantly change the model result.

4.1.3 Multicollinearity

To find out whether the data suffers from multicollinearity, different tests can be performed. Table 4.1 presents a correlation matrix of all variables. Sub-industry's dummy variables 'oil & gas exploration and production' and 'oil & gas refining and marketing' show high correlation (-0.922). This is likely to be due to the fact that there are only three options for the dummy variable which makes it rather easy to predict the other options. Therefore, high correlation related to dummy variables is considered less influential to the regression model. Moreover, note that correlation between different dependent variables, such as ESG score and pillar

scores, would not affect regression results because they belong to different models. As this might weaken the results, another test to check for multicollinearity will be run. Other than that, the correlation matrix does not show other significant signs of multicollinearity of variables.

	ROA	TQ	Lev	CI	ESG	Env	Soc	Gov	Ref	Exp	Int	Rev
ROA	1.000	0.333	-0.001	0.166	0.160	0.169	0.158	0.067	0.193	-0.200	0.036	0.229
TQ	0.333	1.000	0.172	0.362	0.268	0.297	0.295	0.036	0.423	-0.377	-0.079	0.492
LEV	-0.001	0.172	1.000	0.368	-0.232	-0.184	-0.161	-0.309	0.344	-0.310	-0.055	0.124
CI	0.166	0.362	0.368	1.000	-0.178	-0.182	-0.154	-0.120	0.704	-0.652	-0.068	0.420
ESG	0.160	0.268	-0.232	-0.178	1.000	0.939	0.937	0.675	0.002	-0.061	0.152	0.452
Env	0.169	0.297	-0.184	-0.182	0.939	1.000	0.859	0.495	0.075	-0.132	0.153	0.520
Soc	0.158	0.295	-0.161	-0.154	0.937	0.859	1.000	0.446	0.024	-0.078	0.141	0.442
Gov	0.067	0.036	-0.309	-0.120	0.675	0.495	0.446	1.000	-0.150	0.109	0.092	0.128
Ref	0.193	0.423	0.344	0.704	0.002	0.075	0.024	-0.150	1.000	-0.922	-0.109	0.613
Exp	-0.200	-0.377	-0.310	-0.652	-0.061	-0.132	-0.078	0.109	-0.922	1.000	-0.285	-0.606
Int	0.036	-0.079	-0.055	-0.068	0.152	0.153	0.141	0.092	-0.109	-0.285	1.000	0.039
Rev	0.229	0.492	0.124	0.420	0.452	0.520	0.442	0.128	0.613	-0.606	0.039	1.000

Table 4.1 *Correlation matrix: The table shows correlations of the different variables with each other. Values >0.9 / <-0.9 show statistically significant correlations (10% significance level). The variables are defined as: ROA - Return on Assets, TQ - Tobin's q, Lev - Total debt to total equity, CI - Asset Turnover, ESG - ESG score, Env - Environmental pillar score, Soc - Social pillar score, Gov - Governance pillar score, Ref - Oil and gas refining and marketing sub industry, Exp - Oil and gas exploration and production, Int - Integrated oil and gas, Rev - log (revenue)*

As variance inflation factors (VIF) is a relatively more reliable tool at discovering multicollinearity compared to correlation matrix (James et al., 2021), VIFs are calculated for both hypothesis 1a/b and 2a/b. For models 1a/1b, the VIFs can be found in table 4.2. Table 4.3 provides results of the VIF analysis for models 2a/2b. As in the correlation matrix, the sub-industry dummy variables show small signs of multicollinearity as their VIF is above 5. Additionally, the VIF value for environmental pillar score scores slightly above 5. However, all VIFs are still below 10 which is usually considered acceptable (James et al., 2021). Thus, multicollinearity is not expected to influence the model significantly.

Variables	VIF
ESG score	1.6943
Log(rev)	2.4399
Debt to equity	1.2309
Asset turnover	2.2084
Oil refining	8.0906
Oil exploration	6.8502

Table 4.2 VIF for model 1(a) & 2(a)

Variable	VIF
Environmental score	5.3095
Social score	3.8677
Governance score	1.5280
Log(rev)	2.6911
Debt to equity	1.2775
Asset turnover	2.5521
Oil refining	8.1231
Oil exploration	6.8760

Table 4.3 VIF for model 1(b) & 2(b)

To conclude, the tests performed above can indicate validity and reliability of statistical models. In the linearity assumption check, two outliers, which are sample 86 and 43 were suggested to be removed, which leaves 92 samples for regression analysis. Having all statistical assumptions met, running the multiple linear regression was appropriate.

4.2 Results

For each multiple linear regression model, a few indicators could help to evaluate the performance of the model. Firstly, residual standard error (RSE) is the standard deviation of residuals, and a small RSE entails better prediction of a model (James et al., 2021). Secondly, the F test assesses the linearity of all variables in a linear model, its null hypothesis looks like: $ß_1 = ß_2 = \ldots = 0$. And the p-value of the F test determines whether or not to reject the null hypothesis, if the null hypothesis is rejected, it entails that variables in the model have linear relationship with dependent variable (James et al., 2021). Thirdly, R^2 can be used to measure how accurately the linear model can predict the dependent variable, a R^2 close to 100% indicates that 100% of variation in dependent variables can be explained by predictors in the model. Lastly, t test is an important procedure to compare significance of every individual coefficient to dependent variables. It has a null hypothesis shown as: $ß_1 = 0$, and rejection of the null hypothesis entails a significant relationship between this predictor and dependent variable.

The discussion in 3.5 has come to a conclusion of removing outliers based on validity consideration. Thus, only models after removal of outliers are used in the analysis of this

study. The initial results of regressions before removal of outliers can be found in the appendix A to D.

4.2.1 ESG score and CFP

4.2.1.1 (1a) ESG score and ROA

	ROA ~ ESG score	
Predictors	*Estimates*	*p*
(Intercept)	-4.5300	0.576
ESG Score	0.0700	0.329
Log(rev)	0.8800	0.658
Debt to equity	0.0000	0.662
Asset turnover	0.9600	0.433
Oil refining ind.	0.31	0.962
Oil exploration ind.	-1.51	0.794
Observations	92	
R2 / R2 adjusted	0.075 / 0.010	
F- statistic	1.15	
Residual standard error	9.657	
P-value	0.339	

Table 4.4 Regression of ROA and ESG Score

Results for model (1a) are presented in table 4.4. It can be seen that: (1)RSE is 9.657; (2)F test does not reject the null hypothesis because p-value 0.339 > 0.1 (0.1 is minimum threshold in R); (3)adjusted R^2 = 0.01; (4)t test for ESG score does not reject null hypothesis because p-value 0.329 > 0.1. The adjusted R^2 and the result of the F test indicates that the ESG scores and control variables are insufficient to correctly predict ROA, meaning that there is no significant relationship between them. And the t test of the ESG score also shows no significance between ESG score and ROA.

4.2.1.2 (1b) ESG score and tobin's q

	Tobin's Q ~ ESG score	
Predictors	*Estimates*	*p*
(Intercept)	0.253	0.313
ESG score	0.00409	0.054 *
Log(rev)	0.104	0.092 *
Debt to equity	0.00025	0.398
Asset turnover	0.0548	0.148
Oil refining ind.	0.261	0.198
oil exploration ind.	0.183	0.308
Observations	92	
R2 / R2 adjusted	0.314 / 0.265	
F-statistic	6.472	
Residual standard error	0.2985	
P- value	1.19E-05	

Table 4.5 Regression of Tobin's Q and ESG Score

The regression on ESG score and tobin's q shown in table 4.5 has resulted in: (1)RSE = 0.2985; (2)F test rejects the null hypothesis because p-value 1.194e-05 < 0.1; (3)adjusted R^2 = 0.265; (4)t test for ESG score rejects null hypothesis because p-value 0.0539 < 0.1. The RSE of 0.29 is much lower than that of (1a) in 4.2.1.1, which means this model is better at predicting the dependent variable. The F test shows that the whole model follows a linear relationship, and the t test articulates that among all variables, ESG score and revenue are most significantly associated with tobin's q. To be more concise, the coefficient estimate ($ß_1$) for ESG score is 0.004, which indicates that every unit increase in ESG score would lead to 0.004 unit of increase in company's tobin's q. As for control variables, revenue has a positive linear relationship with tobin's q with coefficient estimate of around 0.105.

4.2.2 ESG pillar scores and CFP

4.2.2.1 (2a) ESG pillars scores and ROA

	ROA ~ Pillar scores	
Predictors	*Estimates*	*p*
(Intercept)	-3.4	0.701
Environmental Score	0.04	0.683
Social Score	0.03	0.779
Governance Score	-0.0033	0.955
Log(rev)	0.68	0.75
Debt to equity	- 0.0048	0.629
Asset turnover	1.11	0.401
Oil refining ind.	0.17	0.98
Oil exploration ind.	-1.4	0.812
Observations	92	
R2 / R2 adjusted	0.077 / -0.012	
F-statistic	0.8661	
Residual standard error	9.766	
P- value	0.5526	

Table 4.6 Regression of ROA and pillar scores

Results for model (2a) can be observed in table 4.6. It shows that: (1)RSE is 9.766; (2)F test does not reject the null hypothesis because p-value 0.0.5526 > 0.1 ; (3)adjusted R^2 = -0.01; (4)t test for environmental, social and governance score all do not reject their null hypothesis because p-value 0.683, 0.779, 0.955 > 0.1. The adjusted R^2 and the result of the F test indicates that three ESG pillar scores and control variables are not a good fit in explaining variation of ROA. The t test also confirms that none of the environment, social and governance score has significant association with ROA.

4.2.2.2 (2b) ESG pillar scores and tobin's q

Tobin's Q and pillar scores		
Predictors	*Estimates*	*p*
(Intercept)	0.36	0.187
Environmental Score	0.0022	0.482
Social Score	0.0027	0.335
Governance Score	-0.0011	0.525
Log(rev)	0.09	0.182
Debt to equity	0.00018	0.554
Asset turnover	0.068	0.094 *
Oil refining ind.	0.25	0.222
Oil exploration ind.	0.19	0.287
Observations	92	
R2 / R2 adjusted	0.326 / 0.261	
F-statistic	5.026	
Residual standard error	0.2992	
P- value	4.2e-05	

Table 4.7 Regression of Tobin's Q and pillar scores

The last model examined the relationship between the ESG pillar scores and market performance, measured in tobin's q. As in table 4.7, the overall model has a R^2 of 32.63 percent and an adjusted R^2 of 26.14 percent, meaning that the model explains one quarter up to one third of the variation in tobin's q. Its F test has a p-value of 4.2e-05 which makes it significant at the 0.001 significance level. Thus, the independent and controlling variables of this model are quite good predictors of tobin's q. Besides, the RSE of 0.2992 is considerably smaller compared to model (2a), indicating that the dataset fits this model better.

Among the independent variables, asset turnover is significantly correlated with tobin's q at the 10 percent significance level according to the t test (p value 0.0941 < 0.1). And the correlation is of positive nature, an increase of one unit in asset turnover is thus expected to

lead to an increase of 0.068 in tobin's q. In addition, although not significant, revenue seems to be positively correlated with tobin's q to some extent because its p-value (0.1823) is very close to the threshold of 0.1. This would imply that firms with higher revenue may be likely to be valued higher. Other than expected, all three ESG pillars fail to be significant predictors of tobin's q. Moreover, among the three pillars, environmental score does not show the strongest relation to market performance as formulated in *Hypothesis 2b*.

5. Discussion

5.1 Research question 1

Research question 1: *How do North America-based oil and gas companies' ESG scores interrelate with financial performance?*

The first research question aimed to investigate the relationship between ESG overall performance and corporate financial performance from an accounting and a market perspective. The indicators that represent accounting and market performance in this paper are ROA and tobin's q. The purpose of research question 1 was pursued by conducting statistical analysis as model 1a shown in 4.2.1.1 and model 1b in 4.2.1.2 respectively. As stated in the results, model 1a turned out to be an unsatisfactory model to predict ROA, and ESG score was proven to have no significant relationship with ROA (ß = 0.066, p-value > 0.1), rejecting the hypothesis 1a in 2.5. This result is also supported by Santis, Albuquerque and Lizarelli (2016) and Habermann (2021). On the contrary, model 1b appeared to be a good and reliable model with significant linear relationship between ESG score and tobin's q (ß = 0.004, p-value < 0.1), and refused to reject hypothesis 1b. In addition, among the control variables, revenue as the proxy of firm size has a positive influence on tobin's q (ß = 0.105, p-value < 0.1) as already found in previous work (Lee et al., 2011).

The first finding in terms of accounting performance may entail that profitability and sustainability are two unrelated objectives for business management in the oil/gas industry. Since investment and effort in sustainability would not necessarily bring financial return for stockholders, it could impede the incentive for energy companies to proactively respond to CSR. Given this result, one would wonder why the finding of the ROA-ESG relationship in this paper is counterintuitive because a number of scholars argued that this relationship should be positive (Eccles, Ioannou & Serafeim, 2014; Russo & Fouts, 1997) or negative (Duque-Grisales & Aguilera-Caracuel, 2021; Walley & Whitehead 1994)). Moreover, Jensen (2002) articulated on the basis of stakeholder's theory that business managers should prioritize firm value maximization The engagement with ESG would only cause confusion and thus will cause underperformance in profitability. In contrast, Velte stated in 2017 that ROA is positively correlated with ESG performance. However, this paper concludes this relationship as unrelated, and the reason might be manifolded.

Firstly, sustainability investment may pay off from a long-term perspective and thus shows no trend in short-term time scope. A previous study of Santis, Albuquerque and Lizarelli (2016) found that sustainable companies averagely have a higher ratio in long-term profitability and liquidity than traditional companies. This research is unable to detect that long-term advantage because no panel data is used in this research. Secondly, the unique characteristics of the oil and gas industry is an important factor. The term “CSR threshold” introduced by Chandler (2020) could explain some of the results. A number of oil and gas companies adopt a low cost strategy because barely no differentiation can be applied to oil and gas products (Inkpen & Moffett, 2011). Firms pursuing low cost strategy have a relatively higher CSR threshold, which means stakeholders have rather low expectations for those firms to have strong CSR performance (Chandler, 2020). Thus, the profitability of this industry could be hardly related to its ESG performance. Also, since most oil and gas companies do not directly sell to end users, it is very difficult to visualize the ESG endeavor of oil/gas companies to consumers, and hence consumers fail to make their purchase decision to affect profitability in accordance with sustainability performance (Inkpen & Moffett, 2011). In addition, as described in 1.2, oil and gas are fundamental energy products that play a vital role in industrialization, which makes them basic necessities in daily lives and this situation is predicted to continue until 2030 (Murphy & Hall, 2011; Lim & Lee, 2020). Therefore, the demand for oil and gas is thought to be rigid and insensitive contemporarily, and make profitability of oil/gas companies less vulnerable to ESG performance.

The second finding in research question 1 indicates that the market valuation of oil/gas companies is positively associated with ESG score and revenue. In other words, investors prefer to invest into big oil/gas firms with better ESG scores. This result is in line with Lee et al. (2011) but goes against Velte (2017) and Habermann (2021). It is noteworthy that in the study performed by Habermann (2021), although tobin’s q was found to be insignificant with ESG measures, it was articulated that this result might be due to the lack of observations and time-delayed effect, and a value-enhancing effect on tobin’s q was detected. Recalling the positive signaling theory, the positive relationship between tobin’s q and ESG score could be explained by the information gap between company and investors. The disclosure of positive information, which is a good-looking ESG score in this case, could change investors’ perception of a company 's profile and thus give rise to tobin’s q. Unlike ROA, tobin’s q can partly reflect investors’ expectation on profitability of a company in the future. Hence, the result of this paper also implies that sustainable oil/gas companies have greater business potential from an investor’s point of view. However, one should keep in mind that the linear regression model in this study cannot prove causality between variables, so the result might suffer from reverse causality. In this vein, it is possible to deduce that oil/gas companies with already high Tobin's q tend to invest more and have a high ESG score.

5.2 Research question 2

Research question 2: *How do the individual ESG pillar scores interrelate with financial performance of North America-based oil and gas companies?*

The second research question shifts the emphasis from ESG overall score to individual pillar scores. Model 2a and 2b were applied to quantify the contribution of environmental score, social score and governance score to oil/gas companies' accounting performance measured by ROA and market performance measured by tobin's q. From the results listed in 4.2.2.1 and 4.2.2.2, the ESG pillar scores showed no significant relationship with both accounting and market performance, thus failing to support the hypotheses 2a and 2b which stated that environmental score has the strongest association with the financial performance. However in model 2b, asset turnover as one of the control variables shows positive significant association with tobin's q (ß = 0.068, p-value < 0.1). Since asset turnover in this study is a proxy for capital intensity, it implies that oil/gas companies with higher capital intensity tend to have higher tobin's q. Note that in the previous model 1b, asset turnover also had a rather strong but not statistically significant association with tobin's q (ß = 0.0548, p-value = 0.148 > 0.1). The difference of results in the two models is the change of independent variables from synthesis of ESG score to pillar scores.

The findings in this study that none ESG pillar scores have a linear relationship with ROA or tobin's q is partly in line with Naimy et al. (2021) and Habermann (2021), but is against results found by Duque-Grisales and Aguilera-Caracuel (2021) and Schanzenbach and Sitkoff (2020). Naimy et al. (2021) further articulated that ESG individual scores instead of a linear relationship, have a concave relationship with accounting performance and no relationship with market performance. Nevertheless, Schanzenbach and Sitkoff (2020) claimed that the governance pillar score is positively and more significant than the environmental and social score in relation to the firm's accounting performance. Duque-Grisales and Aguilera-Caracuel (2021) also found that the all ESG pillar scores have a negatively significant relationship with a company's financial performance, reasoning that high investments in ESG would mean diverting the cash flow from their main operations and thus decreasing profitability.

The reason our findings differ with many other researches might be, as mentioned earlier, the time-delayed effect of sustainability paying off in the long term. A methodology based on panel data could be more suitable to capture that lagging, which is used by many other studies. In addition, there could be divergence in ESG measurement in different studies, and as suggested by Dorfleitner, Halbritter and Nguyen (2015), some choice of ESG measurement could be unreliable.

6 Conclusion

6.1 Reflection and summary

Previous literature has provided numerous studies on links between ESG performance and corporate financial performance. As explained earlier by the authors, these studies focus largely on very broad analyses that do not allow for conclusions for managers from specific industries. Moreover, due to the very nature of their business, the oil and gas industry is at the core when it comes to the emission of greenhouse gasses and thus environmental sustainability. The authors were motivated by the aims to contribute tangible implications for managers and information to sustainability-conscious investors. The aim for this paper was twofold.

First, this paper aimed to explore how well sustainability performance, proxied by the Refinitiv (Thomson Reuters) ESG score, can explain corporate financial performance for North American oil and gas companies. Corporate financial performance was measured in two ways: accounting performance, proxied by return on asset ratio, was measured while market performance was proxied by tobin's q. Controlling variables for leverage number of controlling variables for firm size, financial leverage, capital intensity, and sub-industry were used.

Based on the results from these first two models, sustainability was divided into its three dimensions environmental (E), social (S) and governance (G). Using these three dimensions, the authors aimed to examine which sustainability dimension showed the strongest links to corporate financial performance. The appropriate way to analyze the relationship between variables was deemed to be multiple linear regression. In total, four linear regressions were performed, with two of them employing ESG score as the independent variables and the other two using the three ESG pillar scores as independent variables. The results showed no relationship between ESG score and accounting performance, while ESG score and tobin's q were significantly related at the 0.1 significance level. For ESG pillar scores, no significant relationship between independent and dependent variables were found.

6.2 Practical Implications

Firstly, managers in the North American oil and gas industry should consider sustainability as an important dimension of their business. No support for managers' fears that investments into sustainability worsen a firm's financial performance is found. Instead, the results provide explorative evidence that sustainability and corporate financial performance do not have to be seen as trade-offs. Moreover, good sustainability performance might even have possible effects on market valuation, however, this result might suffer from reverse-causality. This provides support for managers to consider ESG as an integral part of their business - less because of idealistic reasons but more due to potentially better financial performance.

Secondly, the results of the multiple linear regressions show a statistically significant relation of ESG score and corporate market valuation. This indicates that stocks with higher ESG scores are also valued higher. These findings could mean that the sustainability trend has aged and reached the mainstream. For investors, higher company valuation could indicate that current investors already accounted for better business possibilities of more sustainable companies. Nevertheless, it could also indicate that investors are willing to pay more sustainable assets solely due to them being sustainable. Under these circumstances, this might open up possibilities for arbitrage - if investors decide to invest in less sustainable companies. However, due to the unpredictability of the future, more research is needed in order to properly examine this.

Lastly, the results have policy implications in multiple directions. Firstly, the results indicate that reliance on ESG scores is high, while regulation in this area is weak. This shows that depending on the provider, ESG ratings for companies can differ which questions how sustainability can be measured appropriately. Additionally, a number of companies do not publish sufficient non-financial data to calculate trustworthy scores. Moreover, measuring non-financial data is rather unregulated which hinders stakeholders from comparing their company with competitors. Thus, regulators should be encouraged to set reporting guidelines similarly to financial data and encourage firms to publish more non-financial data.

6.3 Future Research

Future research could examine multiple shortcomings of previous research. Firstly, research is heavily focused on the ROA ratio when measuring firms' accounting performance. However, using other accounting ratios such as return on equity and a focus on measuring operational performance could benefit the ESG-CFP research. Ways to measure operational performance could involve ratios such as returns on invested capital, profit margins and others. Besides,

similar to Naimy, El Khoury and Iskandar (2021) future research could also involve more advanced methods to examine the ESG-CFP relationship without simply assuming linear association of the two. Analyzing the ESG-CFP relationship behind the assumptions of linearity could also test for whether Porter's (1980) generic strategies also apply for firms on the topic of sustainability.

When examining the relationship of ESG and CFP in the oil and gas sector, studies using panel data are necessary. When using panel data, change in ESG score rather than the absolute score could be examined. This could allow for new interpretations while also linking to signaling theory. Based on that, scholars could try understanding why ESG and corporate market performance show a significant positive relationship. For this topic it could be interesting to dig into relations of more sustainable companies with their stakeholders and compare them with how less sustainable companies manage their stakeholders. A qualitative study interviewing a variety of interest groups would be the most suited way to address this question.

Furthermore, the relationship between ESG and CFP might be influenced by moderators as suggested by Duque-Grisales and Aguilera-Caracuel (2021). In addition, mediators might also be involved between ESG and CFP. Thus, valuable contributions would address these difficulties and try to examine, or at least account for them. While the ESG-CFP topic has been widely studied, analysis of moderators has been poor and could thus allow for new perspectives and interpretations of the results in this area of research.

Lastly, there are three main constraints studies examining the ESG-CFP relationship. Firstly, the analysis can only be as good as the data it uses. Companies that have low disclosure of ESG data reduce the reliability of results by making results less generalizable for whole industries. Secondly, large resources have been used to analyze the actual relationship of ESG and CFP while the reliability of the variables remains poorly studied. As postulated by Dorfleitner, Halbritter and Nguyen (2015), at least some ESG scores are less reliable, which will eventually weaken the results gained by studies using these data. Thirdly, measuring causality in the relationship between ESG and CFP is difficult. Future research could thus try to use time lags or consider using different methodologies.

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Appendix

Appendix A. Regression of ROA and ESG score before removing outliers

Predictors	*Estimates*	*p*
(Intercept)	-1.065e+01	0.332
ESG score	1.341e-01	0.143
Log(rev)	1.451e+00	0.591
Debt to equity	-3.567e-04	0.978
Asset turnover	1.435e+00	0.386
Oil refining ind.	-2.899e-01	0.974
Oil exploration ind.	-1.079e+00	0.891
Observations	94	
R2 / R2 adjusted	0.090 / 0.027	
F-statistic	1.431	
Residual standard error	13.13	
P- value	0.2121	

Appendix B. Regression of Tobin's Q and ESG score

Tobin's Q and ESG score before removing outliers

Predictors	*Estimates*	*p*
(Intercept)	0.23	0.395
ESG score	0.003	0.14
Log(rev)	0.13	0.057 *
Debt to equity	0.00023	0.48
Asset turnover	0.05	0.181
Oil refining ind.	0.24	0.268
Oil exploration ind.	0.2	0.303

Observations	94
R2 / R2 adjusted	0.274 / 0.224
F-statistic	5.484
Residual standard error	0.3181
P- value	7.473e-05

Appendix C. Regression of ROA and pillar scores

Predictors	*Estimates*	*p*
(Intercept)	-12.81	0.283
Environmental Score	0.04	0.782
Social Score	0.02	0.859
Governance Score	0.08	0.305
Log(rev)	1.79	0.532
Debt to equity	0.00135	0.92
Asset turnover	1.15	0.523
Oil refining ind.	-0.01	0.999
Oil exploration ind.	-1.27	0.873

Observations	94
R2 / R2 adjusted	0.095 / 0.010
F-statistic	1.113
Residual standard error	13.24
P- value	0.3628

Appendix D. Regression of Tobin's Q and Pillar scores

Tobin's Q and pillar scores before removing outliers

Predictors	*Estimates*	*p*
(Intercept)	0.34	0.242

Environmental Score	0.0037	0.299
Social Score	0.00069	0.814
Governance Score	-0.001	0.593
Log(rev)	0.1	0.134
Debt to equity	0.00017	0.589
Asset turnover	0.07	0.107
Oil refining ind.	0.23	0.301
Oil exploration ind.	0.21	0.278
Observations	94	
R2 / R2 adjusted	0.284 / 0.216	
F-statistic	4.211	
Residual standard error	0.3198	
P- value	0.0002765	

Appendix E. Descriptive Statistics

Statistics	ROA	Tobin's Q	Debt to equity	Asset turnove	ESG Score	Environmenta Score	Social Score	Governance Score	Log(rev)
Mean	0.4	1	88.5	0.8	39.2	29.5	37.7	56.1	3.3
Standard Error	1	0	12.1	0.1	2	2.3	2.3	2.3	0.1
Median	2	1	58.3	0.3	36.4	29.6	30.8	57.6	3.2
Mode	19.7	2	902.9	0.1	28.5	1.6	23.8	46.3	5.4
Standard Deviat	9.7	0.3	116.3	1.2	19.5	22.5	22.1	21.9	0.8
Sample Variance	94.2	0.1	13 534.6	1.5	378.7	507.7	486.9	480.7	0.6
Kurtosis	12.9	0.2	27.5	8.2	-0.8	-0.5	-0.6	-0.5	-0.5
Skewness	-2.9	0.7	4.6	2.8	0.3	0.6	0.7	-0.3	0.5
Range	74.8	1.6	902.8	6.2	77.6	85.4	84.3	89.3	3.3
Sum	41	94.7	8 138.5	75	3 607.8	2 714.7	3 472.5	5 159.0	307.9
Count	92	92	92	92	92	92	92	92	92

Largest(1)	19.7	2	902.9	6.3	82.1	86.7	89.6	91.6	5.4
Smallest(1)	-55.1	0.4	0.1	0.1	4.5	1.2	5.3	2.3	2.1