THE IMPACT OF ENVIRONMENTAL STRATEGIES ON ESG SCORES: A STUDY ON HIGH-EMISSION INDUSTRIES.

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Dissertation submitted in partial fulfilment of requirements for the MSc in International Management, at Universidade Católica Portuguesa and for the MSc in International Business at Smith School of Business, Queen’s University, 31/05/2023.

Abstract

The research thesis “The impact of environmental strategies on ESG scores: A study on high-emission industries” studies the link between environmental strategies and ESG scores. Using a sample of 110 publicly listed companies from high-emission industries and building on a framework by Walls (2011) for encoding environmental strategies based on annual reports and sustainability statements, this research aims to understand how the level of proactiveness of the environmental strategy of each company influences its ESG score. Although no evidence is found that a proactive environmental strategy is linked to overall high ESG scores, evidence for a positive relationship between the Environmental (E) component of ESG scores and proactive environmental strategies is presented.

Keywords: ESG, ESG scores, environmental strategy, proactive

The impact of environmental strategies on ESG scores: A study on high-emission industries by Martin Gaida

Abstracto

A tese de investigação “O impacto das estratégias ambientais nas pontuações ESG: um estudo sobre indústrias de alta emissão” estuda a ligação entre as estratégias ambientais e as pontuações ESG. Usando uma amostra de 110 empresas de capital aberto de setores de alta emissão e com base em uma estrutura de Walls (2011) para codificar estratégias ambientais com base em relatórios anuais e declarações de sustentabilidade, esta pesquisa visa entender como o nível de proatividade da estratégia ambiental de cada empresa influencia sua pontuação ESG. Embora nenhuma evidência seja encontrada de que uma estratégia ambiental proativa esteja vinculada a elevadas pontuações ESG gerais, são apresentadas evidências de uma relação positiva entre o componente Ambiental (E) das pontuações ESG e estratégias ambientais proativas.

Palavras-chave: ESG, pontuações ESG, estratégia ambiental, proactividade

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1 Introduction

As the median global surface temperature has risen throughout the last decades (IPCC, 2023), the way companies in high-emission industries operate is challenged by various stakeholders (Kim, 2018). One channel used to cope with changing stakeholder requirements is an increased reporting effort regarding Environmental, Social, and Governance (ESG) concerns (Krüger, 2015). The environmental dimension often includes factors like resource use and emissions, the social dimension considers factors like workforce matters and human rights, and the governance dimension entails factors like board independence. Rating agencies evaluate the activities of companies across the ESG dimensions and issue so-called ESG scores that can be used, i.e., in investment analysis. ESG scores are usually relative metrics calculated on an industry basis (MSCI Inc., 2023). Rating agencies most often evaluate publicly available data, among others, company communication. Companies acknowledge the need to communicate their ESG actions, as shown in 96% of S&P500 companies publishing sustainability reports in 2022 compared to just 20% in 2011 (Governance & Accountability Institute, Inc., 2022). One driver of companies' actions on the ESG front is the increasing importance placed on ESG by investment companies, as seen by 37bn USD of net inflows in the final quarter of 2022 into sustainability funds, compared to 200bn USD net outflow of cash within the overall fund market (Morningstar, 2023). Sustainability funds globally now have nearly 2.5trn USD in assets under management at the end of December 2022 (Morningstar, 2023).

A broad spectrum of academic research regarding sustainability practices has preceded and accompanied the current attention toward ESG activities and ESG reporting. A company's strategic focus on its relation to the natural environment has a theoretical underpinning in the natural-resource-based view of the firm (NRBV) by Hart (1995). Hart (1995) established the idea that environmental practices, as part of an environmental strategy, can lead to a competitive advantage. Despite the popularity of Hart’s (1995) concept in research, empirical studies examining the performance implications of environmental strategies are still sparse (Chan et al., 2022).

Much research has evolved around the performance implications of high ESG scores, in other words, whether it pays to be green (and socially responsible and well-governed). In addition, many publications study factors that lead to high ESG scores.

These studies often examine external factors that are not in the locus of control of a company. A smaller area of research surrounds the internal decisions of the management to influence and generate high ESG scores. This research thesis aims to tap into the latter research area and is focused on the strategic determinants of high ESG scores. Therefore, this thesis aims to answer the following research question:

What is the impact of environmental strategies on ESG scores?

To answer this research question, the environmental strategies of companies from high-emission industries are recorded, and the influence of the environmental strategies on ESG scores is examined.

This thesis is structured as follows: Chapter 2 includes a literature review and lays the theoretical underpinning of this thesis. The literature review outlines evidence on why ESG scores are important and what factors influence ESG scores that need to be accounted for in a model. Based on the literature review, the hypotheses to be tested are then derived. Chapter 3 describes the methodology of the thesis, including the sampling strategy and the research design, the variables used, and the model. The following chapters, 4 to 6, report the findings from testing the hypothesis, discuss the findings, and conclude this thesis, respectively.

2 Theoretical Foundation

This chapter introduces the theoretical underpinning of why companies include environmental concerns in their strategy formulation. Secondly, the empirical evidence on the performance implications of ESG scores is reviewed. Thirdly, the empirical research on market and company characteristics influencing ESG metrics is outlined.

2.1 The Natural-Resource-Based View of the Firm

Traditional trade-off theory argues that efforts to mitigate the externalities a company's operations pose to its environment demand financial resources and thereby weaken its financial performance, assuming that the returns from environmental activities do not earn the costs of capital (Friedman, 1970). Theoretical developments and empirical evidence have challenged this conception of environmental activities in the past decades. This has resulted in the conception of environmental activities leading to positive returns as environmental improvements have increasingly been thought of as signs of resource productivity and, therefore, as a basis for competitive advantage (Porter, M. & Van der Linde, C., 1995). Different theoretical conceptions exist to understand why companies would opt for a strategy that considers the externalities a company poses to its environment. One of the most prominent theoretical models developed in this field is the natural-resource-based view (NRBV) of the firm, developed by Hart (1995), which can be seen as an extension of the resource-based view of the firm. Hart (1995) develops a theory of competitive advantage based on the configuration of a firm's resources to its natural environment and therefore accounts for the biophysical (natural) environment previously neglected in theories of competitive advantage. From this perspective, strategy and competitive advantages will be rooted in "capabilities that facilitate environmentally sustainable economic activity" (Hart, 1995, p. 991). The NRBV identifies three key strategic capabilities in pollution prevention, product stewardship, and sustainable development. Each strategic capability is associated with a different type of competitive advantage.

First, pollution prevention, which refers to preventing emissions beforehand instead of cleaning/offsetting emissions ex-post, aims to reduce operating costs through increased efficiency by requiring fewer inputs, simplifying processes that can lead to reduced cycle times, and reducing compliance and liability costs. Cost savings stemming from pollution prevention can result in cost advantages relative to competitors.

Second, product stewardship examines the entire value chain of a product and analyzes products from a life cycle perspective. To lower a product's environmental footprint throughout the life cycle, product design needs to center around the minimization of non-renewable materials, the avoidance of any toxic materials, and the use of renewable resources in accordance with their rate of replenishment. These product design principles can allow for competitive advantages by securing privileged access to essential but scarce resources such as input materials and production capacity or by establishing industry norms and regulations tailored to the firm’s capabilities that need to be followed by competitors.

Third, sustainable development focuses on fundamentally setting up business models to produce in a way that can be continued indefinitely. In addition, sustainable development also expands the focus to include social concerns and economic activity (Hart & Dowell, 2011). Although a sustainable development path may not increase short-term profits, it might raise expectations for future performance, leading to higher valuations.

The NRBV theory lays the theoretical groundwork for why companies invest in environmental activities. Hart (1995) differentiates the three different strategy modes outlined above, while other scholars in subsequent research have conceptualized environmental strategies along a spectrum of activity, differentiating between proactive and reactive strategies. Increased environmental regulations during the 1980s led companies to adopt reactive approaches to comply with regulations at minimal costs. From the 1990s onwards, some companies started to predict new regulations and aligned their operations beforehand to gain an edge over the competition, which is often discussed as the beginning of proactive environmental strategies (Potrich et al., 2019). The classification of whether a company executes a reactive or a proactive environmental strategy has been discussed extensively in the literature. For the purpose of this thesis, the framework by Walls et al. (2011) is used, which will be introduced in Chapter 3.

Next, the theoretical linkages and empirical evidence on the relationship between ESG performance and corporate performance metrics will be examined.

2.2 ESG Performance and Corporate Performance

A vast body of empirical research has emerged in strategy and corporate finance literature, asking whether it pays to invest in ESG activities (Chan et al., 2022). Academics found that the impact of ESG activities on different financial metrics is vastly positive. Overall, positive links between high ESG scores and firm values (Ferrell et al., 2016; Gao & Zhang, 2015; Krüger, 2015) and cost of capital (Breuer et al., 2018; Goss & Roberts, 2011; Ng & Rezaee, 2015; Zerbib, 2019) have been found. These findings are challenged by publications that argue that these positive results are only relevant in the absence of agency problems (Buchanan et al., 2018; Di Giuli & Kostovetsky, 2014). In addition to financial metrics, high ESG scores are also positively linked to risk metrics (Albuquerque et al., 2019; Hong & Kacperczyk, 2009; Stellner et al., 2015).

Theoretically, ESG investments can result in value maximization and value destruction (Gillan et al., 2021). ESG activities can increase shareholder value, i.e., through increased cash flows based on customers who value buying products from responsible companies or employees being more productive and motivated working for a responsible organization. In addition, shareholder value can be increased through a lower discount rate based on lower capital costs. Furthermore, investment in ESG activities can also increase shareholder utility as shareholders may value investing in responsible firms even if cash flows do not outperform irresponsible firms (Gillan et al., 2021). Conversely, it is argued that investments in ESG activities reflect managerial agency problems. Managers use these investments to increase their utility, not the utility of shareholders (Bénabou & Tirole, 2010). ESG investments are only feasible if a company has the resources to engage in ESG activities. Therefore, the managerial agency problem is often associated with a free cash flow agency problem.

To understand the practical relevance of ESG scores, the empirical research on the relationship between ESG performance and firm value is outlined in the next section, followed by sections examining the links between ESG performance and the cost of capital and between ESG performance and various risk metrics.

2.2.1 ESG Performance and Firm-Value

Most studies report positive relationships between ESG investments and corporate performance. Ferrell et al. (2016) report evidence of a positive correlation between ESG activities and Tobin's q (as a measure of firm value) in companies that have few agency problems. This finding is confirmed by Gao & Zhang (2015), who researched earnings-smoothing, ESG, and valuations and concluded that companies that practice earnings-smoothing also report higher ESG ratings and profit off of a higher earning-return relationship and a greater Tobin's q. The authors underline that ESG adds a "quality dimension" to earnings and positively influences firm valuation. Using an event study data set to understand corporate goodness and shareholder wealth, Krüger (2015) found that a strong negative market reaction follows the reporting of adverse events. Only for companies with a poor ESG track record investors value positive ESG news. The strongest negative reactions are observed when the topic concerns the environment or communities. Stronger investor reactions are also observed if the ESG news contains more details on legal and quantitative information.

Various studies report empirical evidence for investments in ESG activities being a consequence of agency problems. Analyzing firm-level ESG ratings, Di Giuli and Kostovetsky (2014) report that increases in ESG ratings are associated with negative future stock returns and declines in firm ROA. The authors go as far as suggesting that benefits to stakeholders from ESG are directly linked to a depletion of firm value. Using a difference-in-difference model, Buchanan et al. (2018) analyze ESG, firm value, and influential institutional ownership and show that firms with high ESG ratings had higher market valuations before the financial crises in 2008 but experienced more severe losses in firm value during the crises. The relative importance of conflict resolution and an overinvestment effect explain the greater loss in firm value. The amount of influential institutional ownership moderates this linkage between ESG and firm value. It must be noted that the authors did not use ESG ratings but a Bloomberg ESG metric that assesses ESG disclosure quality instead of ESG quality.

Although there are mixed findings on the relationship between ESG performance and firm value, most authors find positive links given constraints like the absence of agency problems. Additional research that will be outlined next has examined the influence of ESG metrics on capital costs.

2.2.2 ESG Performance and Cost of Capital

Numerous theoretical models conclude that given a sufficient number of investors looking for green investment opportunities, companies with high ESG performance will have lower costs of capital (Gillan et al., 2021).

These models are consistent with empirical findings, i.e., by Ng & Rezaee (2015), that found a negative relationship between environmental and governance performance and the cost of equity, but not for social performance. Similarly, using a sample with over 19,000 firm-year observations across 39 countries between 2002 and 2015, Breuer et al. (2018) found that ESG activities can decrease the equity costs of a firm if investor protection – mechanisms that protect the interests of investors – is high. In countries that have low investor protection, that relationship is reversed. The reduction in the cost of equity mainly functions through the channel of a large investor base. Companies in countries with better investor protection profit from wider bases of investors.

For the cost of debt, empirical evidence also shows that high ESG cores can lead to lower costs of debt. Using a sample of almost 4000 loans to US firms, Goss & Roberts (2011) found that companies rated with low ESG scores pay between 7 and 18 basis points more on their borrowings when compared with companies that score high on ESG metrics. Especially if there is no collateral backing a loan, lenders consider ESG scores to a greater extent. The authors conclude that these findings only apply to low-quality borrowers, as lenders are indifferent towards ESG investments by high-quality borrowers. In a different study analyzing yield differentials between green and conventional bonds between 2013 and 2017, Zerbib (2019) only reported a small negative premium. Green bonds have lower yields but only around -2 basis points. Although small, this negative premium is more distinct for bonds issued by companies operating in the financial sector and low-rated bonds (Zerbib, 2019).

All in all, these findings suggest that, especially in well-functioning capital markets, riskier companies can profit from lower costs of capital when investing in ESG. Lastly, the empirical findings of ESG performance on risk metrics will be examined.

2.2.3 ESG Performance and Risk

In addition to the firm value and the cost of capital, ESG performance has also been studied in relation to different risk measures, i.e., systematic, credit, and legal risks. Albuquerque et al. (2019) report that systematic risk levels (measured by a firm's beta) are statistically and economically significantly lower for companies with high ESG scores. The authors found that this is particularly true for companies with high degrees of product differentiation.

Regarding credit risk, Stellner et al. (2015) find only limited evidence that higher ESG scores would reduce systematic credit risk. But a country's ESG performance moderates that relationship: in countries with high overall ESG scores, greater corporate social performance will reduce risk and yield better credit ratings.

In an effort to isolate the halo effect – the tendency to make specific inferences based on a general impression – as a strategy channel used by companies, Hong & Liskovich (2015) focus on federal prosecutors who, in their role, are not susceptible to product signaling or delegated giving. Using Foreign Corrupt Practices Act enforcement, these scholars reported that companies with more socially responsible activities pay less in fines and argue that this bias is indeed based on the halo effect and not on prosecutorial conflict of interest.

To summarize, a great body of research reports evidence that ESG performance is relevant for companies as it positively affects corporate performance. Particularly in well-functioning capital markets, companies – especially risky ones – can have substantial returns on investments in ESG activities with increased firm value, lower cost of capital, and lower systematic, credit, and legal risk levels. Next, empirical findings on the market, firm leadership, and ownership characteristics that influence ESG scores will be examined.

2.3 Characteristics Influencing ESG Scores

An extensive body of research exists regarding which variables influence ESG scores. Researchers have, among others, examined the effects of market, firm leadership, and ownership characteristics.

2.3.1 Market Characteristics and ESG Performance

Researchers have studied various market characteristics that may predict ESG performance in given contexts, including country factors, law system types, cross-listings, political affiliation, and firm size.

A critical determinant for ESG ratings is country factors. Often, country factors are cited to be even more critical than individual firm characteristics (Cai et al., 2016). Country factors that Cai et al. (2016) have found to affect ESG ratings include the economic development stage (measured by income per capita), culture, and institutions. All in all, high-income countries with strong liberties, political rights, and an orientation towards harmony and autonomy are associated with companies presenting high ESG scores (Cai et al., 2016). This effect is particularly strong for companies operating only domestically and that are not cross-listed.

Connected to country-specific characteristics, a country's law system also determines ESG ratings. ESG scores are higher in civil law countries (rule-based regime restricting adverse behaviors ex-ante) than in common law countries (ex-post-settling mechanisms for adverse behaviors) (Liang & Renneboog, 2017). The authors found that this finding is supported by demand-side arguments that firm behaviors in line with ESG standards reflect a social preference for stakeholder consideration. These preferences tend to be more present in civil law-based countries. Other reasons that explain higher ESG scores in civil law countries are shareholder litigation risk, supermajority rule in a firm, stronger labor regulations, and a high degree of state involvement in the business (Liang & Renneboog, 2017).

Concerning cross-listings – the listing of a company on more than one stock exchange, often in different countries – of companies, Boubakri et al. (2016) found that cross-listed firms are associated with better ESG performance than non-cross-listed domestic firms. This holds true, especially for cross-listed companies operating in industries with high litigation risks with an inherent incentive to invest in ESG to mitigate the higher litigation costs. In line with a positive conception of ESG, cross-listing in the US motivates companies to increase their ESG performance as improved governance is needed to comply with US regulations. In addition, high ESG scores will lead to reputational gains associated with a higher appeal to (potential) investors and stakeholders and therefore function as a channel to overcome the liability of foreignness.

Another study exploring ESG performance builds on the literature studying the influence of political affiliation on company preferences and decisions. Using firm-level ratings, Di Giuli & Kostovetsky (2014) found that firms have higher ESG scores when they have Democratic-leaning founders, CEOs, and directors when compared to Republican-leaning counterparts. The authors also conclude that a company's ESG scores are higher in Democratic rather than Republican-leaning states.

Another relevant variable in determining ESG performance is firm size. Borghesi et al. (2014) found that larger firms and firms with higher free cash flows score higher on ESG metrics when the accounting value of the assets is used to measure firm size.

2.3.2 Firm Leadership and ESG Performance

Apart from market characteristics, the literature provides extensive research on the relationship between firm leadership characteristics, including the gender, age, and compensation of top management, and ESG performance.

In general, it has been found that ESG activities are often linked to female leaders on boards or in executive roles. For US firms, Borghesi et al. (2014) found that female CEOs are significantly more likely to invest in ESG activities. This finding is replicated by McGuinness et al. (2017), who showed that more gender balance in top-management positions supports stronger ESG performance. In addition to the gender mix, an even greater effect on ESG performance is observed when the CEO and/or vice CEO are women.

Additional attributes that are linked to high ESG scores are the age of CEOs as well as CEOs' confidence levels. Younger CEOs are more likely to be leading companies with high ESG scores (Borghesi et al., 2014). McCarthy et al. (2017) report a negative relationship between CEO confidence and ESG scores. The authors highlight that ESG is a hedging feature and that confident CEOs tend to underestimate firm risk and undertake less hedging.

One aspect that has received much attention in the literature is the linkage between ESG performance and CEO compensation. Traditional agency cost theory would argue that CEOs benefit from investing in ESG and do so at the expense of shareholder returns (Mitnick, 2011). If boards would reduce CEO pay correspondingly, investing in ESG-related activities can align with optimal contracting and not result in agency conflicts (Gillan et al., 2021). Multiple studies found that greater ESG performance is associated with lower salaries, which would point to ESG investments as salary substitutes and align with the above-explained reasoning. I.e., Jian & Lee (2015) found a negative linkage between CEO pay and ESG performance and that CEOs are rewarded for ESG investments in line with industry peers but penalized as soon as investment behavior deviates substantially from the competitive peer group. This effect is especially pronounced in companies characterized by strong corporate governance.

2.3.3 Ownership Characteristics and ESG Performance

A third research area provides publications on the relationship between ownership characteristics, especially institutional ownership – stock owned by pension funds or other large entities that manage funds on behalf of others – and ESG scores. In general, positive relationships between institutional ownership and ESG scores are reported.

Nofsinger et al. (2019) found that institutional ownership indeed shows selective preferences regarding ESG in a way that institutional holdings are negatively correlated to low ESG scores, most likely driven by economic invectives, in the sense that low ESG scores pose downturn risks to a stock that could result in bankruptcy or delisting. The findings hold especially true for longer-horizon investors. For high ESG scores, no such influence was found. While studying a firm’s environmental performance in conjunction with its cost of capital, Chava (2014) also found that firms with environmental concerns (hazardous chemicals, substantial emissions, and climate change concerns) are linked to lower institutional ownership. On a similar note, Hong & Kacperczyk (2009) found that norm-constraint institutional investors (i.e., pension funds) are less likely to hold sin stocks (companies involved in producing alcohol, tobacco, and gaming) when compared to hedge funds.

All in all, there are various external factors that determine the level of ESG scores, ranging from market characteristics, over firm leadership characteristics, to ownership characteristics. Building on the overarching NRBV theory framework, the research on the effects of ESG scores on corporate performance, and the determinants of ESG scores, the hypotheses are derived in the next section.

2.4 Hypotheses

As outlined above, Hart (1995) provided the theoretical model that concludes that companies executing proactive environmental strategies will yield competitive advantages. Competitive advantages in turn will ultimately be reflected in better corporate performance. As high ESG scores are generally associated with corporate performance benefits in terms of firm value, cost of capital, and risk levels (Ferrell et al., 2016; Gao & Zhang, 2015; Albuquerque et al., 2019; Goss & Roberts, 2011; Hong & Liskovich, 2015; Krüger, 2015; Ng & Rezaee, 2015; Stellner et al., 2015; Zerbib, 2019) in the absence of agency problems (Buchanan et al., 2018; Di Giuli & Kostovetsky, 2014), ESG scores are assumed to mediate between environmental strategies and corporate performance. This assumption is backed by Chan et al. (2022), who built a link between environmental strategy and corporate performance. Chan et al. (2022) found that a proactive environmental strategy is associated with improved corporate market performance, especially in highly competitive markets, and a reactive environmental strategy is associated with no negative outcomes in less competitive markets. In line with the findings of Chan et al. (2022), assuming that a proactive environmental strategy is pursued to gain corporate performance benefits through increased ESG scores, the first hypothesis states that proactive environmental strategies lead to better ESG performance.

Hypothesis 1: A proactive environmental strategy has a positive impact on ESG scores.

The environmental strategy modes outlined by Hart (1995) focus on the natural resources that a company affects. Therefore, environmental strategies are focused on the environment and do not account for socially responsible behavior in communities or best-in-class governance structures.

In addition to the reasoning leading to hypothesis one, empirical evidence on the connection between environmental strategies and environmental performance underlines the motivation to test an additional hypothesis focused on the environmental performance component of ESG scores only. Kim (2018) studies how reactive and proactive environmental strategies are linked to environmental performance and finds proof for the NRBV in the way that a proactive environmental strategy is associated with better environmental performance. Kim (2018) uses annual toxics releases reported in the Toxics Release Inventory (TRI) data by US Environmental Protection Agency. In accordance with the findings by Kim (2018), the second hypothesis states that a proactive environmental strategy leads to better expected environmental performance, measured by the Environmental (E) component of an ESG score.

Hypothesis 2: A proactive environmental strategy has a positive impact on environmental performance.

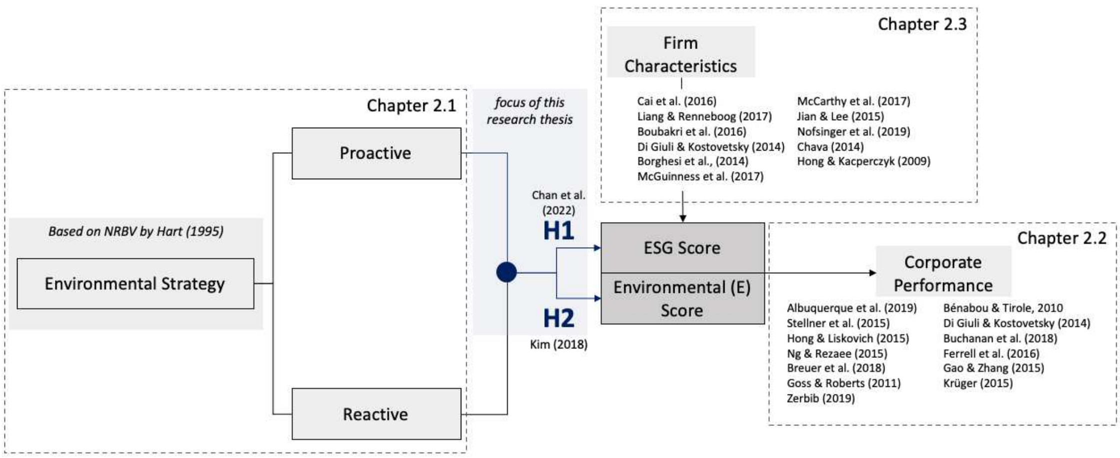

Figure 1 Discourse summary and model

Figure 1 summarizes the theoretical foundation and the hypotheses graphically. The theoretical underpinning for the model is the NRBV developed by Hart (1995). The NRBV leads to the differentiation between proactive and reactive environmental strategies. The influence of proactive environmental strategies on ESG scores is the focus of this thesis. As ESG scores are influenced by various variables (“firm characteristics”), these variables must be accounted for in the regression model. The comprehensive literature on the influence of ESG scores on corporate performance explains the relevance of studying the strategy determinant of ESG scores.

3 Methodology

The hypotheses stated are tested using linear regression models. Multiple factors explain why a quantitative research method is most adequate to answer the given research question and test the stated hypotheses.

First, this research thesis aims at testing hypotheses derived from findings in the current academic discourse. This testing is best done through a quantitative approach, allowing to assess the statistical significance of relationships between variables and contributing to the academic discourse by testing established knowledge. Second, quantitative methods are the primary methods used in ESG literature to understand performance implications (Zerbib, 2019), so using a linear regression model aligns with common standards in existing research. Third, all necessary measurement instruments are available, especially the framework by Walls et al. (2011) that builds a basis for an encoding process that ensures a high degree of replicability. Fourth, this research thesis aims to contribute to theory with rigorous and generalizable findings within the limitation of the study (Wooldridge, 2016).

Therefore, the research question will be answered using a quantitative approach, using secondary data collected from publicly available information in the form of annual reports, sustainability reports, and the like.

3.1 Sample Strategy and Research Design

Certain companies have, due to the nature of their business model, a greater impact on the environment than others. These companies, i.e., operating in the Oil & Gas industry or the Transportation sector, face increased stakeholder pressure to answer how they plan to reduce their environmental footprint (Kim, 2018). This is done, among others, through communicating strategies and commitments that are made publicly available. As companies that operate in industries with low environmental performance can differentiate themselves profoundly from competitors using ESG scores (Krüger, 2015), companies from high-emissions sectors are heavily incentivized to make comprehensive public communication available explaining their environmental strategies. Therefore, the sample is limited to companies from high-emission sectors, defined by the IEA (2021).

The sector that emits the most CO_2 emissions is the power generating sector, followed by the industry sector and the transport sector (IEA, 2021). In the power generating sector, most growth that led to a 25% increase in power consumption in the last ten years was met by renewable energies. Still, the power sector accounted for 12.3 Giga tons of carbon dioxide (Gt CO_2) emissions in 2020, making up 36% of all energy-related CO_2 emissions. The industry sector accounts for approx. 8.7 Gt CO_2, primarily from producing iron, steel, cement, and chemicals. The transport sectors emitted 7.1 Gt CO_2 emissions in 2020, mainly originating in passenger road transport, freight road transport, and aviation and shipping (IEA, 2021).

Using industry classifications provided by S&P Capital IQ, companies publicly listed on the NYSE and NASDAQ as the two largest stock exchanges in the world, over 250 companies in the beforementioned industries of power generation, industrial, and transport were identified. In the next step, MSCI's ESG ratings on the 250 companies were stored (see MSCI Inc., 2023 and appendix for exemplary data). As the publicly available MSCI database does not report on all publicly listed companies, data was only available for less than half (110) of the identified companies, which comprised the sample of this research. In addition to the ESG rating, a variable that comes closest to the Environmental (E) component – the so-called Implied Temperature Rise (ITR) – of the ESG score was collected (see appendix for exemplary data). The variable will be discussed in section 3.2.2.

To build the database for all 110 companies with complete information on the ESG score, publicly available data were collected through annual reports and sustainability reports to record the environmental strategy. For the purpose of recording the environmental strategy, multiple frameworks have been assessed. While Hart (1995) differentiates the three different strategy modes outlined in Chapter 2, other scholars in subsequent research have conceptualized environmental strategies along a spectrum of activity, differentiating between proactive and reactive strategies. Depending on the specific research subject, scholars have adapted the spectrum of activity according to their research purpose. Therefore, numerous nomenclatures have emerged, enabling robust results in niche research fields but limiting the transferability of the methods. Walls et al. (2011) developed a framework that guides researchers in measuring environmental strategy. Using 21 variables to describe a proactive environmental strategy, the authors define a transferable framework without defining fixed thresholds for classifying the spectrum of activity. The model gives researchers leeway to use the framework as a starting point and adjust it depending on the research subject. This research thesis uses the 21 variables that measure a proactive strategy as a base for analysis. Therefore, for each company, all 21 variables proposed by Walls et al. (2011) were categorized (details are described in section 3.2.3).

The hypotheses were tested using a linear regression model for multiple reasons. First, the research question aims to understand the relationship between environmental strategy and ESG scores. To study such a relationship, a linear regression model is well-suited, as linear regression models fit data best that exhibits a linear relationship between variables which is expected, based on findings by Chan et al. (2022). Second, the comparatively small sample size of 110 observations is unsuited for more complex estimation techniques (Wooldridge, 2016). In addition, linear regression models have also been used by a wide array of researchers studying ESG scores, following exemplary research from Borghesi et al. (2014), Kim (2018) and Krüger (2015).

3.2 Variables and Model

The dataset consists of two main dependent variables: the ESG score and the ITR metric. In addition, 21 binary independent variables that describe the environmental strategy of a company are used. Furthermore, three controlling variables are defined: country of origin, which is in line with the findings by Cai et al. (2016), firm size, in line with Borghesi et al. (2014) and industry, in line with findings by Hong & Kacperczyk (2009).

3.2.1 ESG Rating

The ESG ratings used in the sample are sourced from the publicly available MSCI ESG Ratings & Climate Search Tool (see MSCI Inc., 2023). The data provided by MSCI continues methodologies introduced by Kinder, Lydenberg, and Domini, whose data is widely used in academic research (Krüger, 2015). The MSCI ESG rating measures a company's resilience to financial material environmental, societal, and governance (ESG) risks. The rating can take values between CCC (lowest) and AAA (highest). CCC and B-rated companies are considered "Laggards" in the MSCI categorization as these companies show a high exposure and a lack of sufficient management of ESG risks compared to peers. BB, BBB, and A-rated companies are considered “Average” with a mixed track record of managing the most significant ESG risks and opportunities relative to industry peers. AA and AAA-rated companies are considered “ESG Leaders” and are at the forefront of managing the most significant ESG risks and opportunities. For the purpose of the analysis, the rating was transformed into numeric values and is treated as an ordinal variable. The rating is not an absolute measure but assesses how well companies manage risk compared to their peers within an industry, emulating a perfect normal distribution within an industry cluster. As MSCI does not report the group of companies belonging to an industry cluster, a perfect normal distribution could not be replicated. Though plotting the histograms for the ESG ratings, a close-to-normal distribution allows the variable to be included in the model without a transformation (Wooldridge, 2016). In the course of the analysis, the three-cluster differentiation between “Laggard”, “Average” and “Leader” will be used for the sake of simplicity during the results interpretation process.

CCC	B	BB	BBB	A	AA	AAA
ESG Laggard		Average			ESG Leader	

Table 1 ESG Ratings Classification

3.2.2 Implied Temperature Rise

The second variable that is used as a dependent variable and functions as a representation of the Environmental (E) component of the ESG score is the so-called ITR. The measure breaks down the global 2°C carbon budget based on IPCC reporting and assigns a carbon budget to every company assessed. The measure then extrapolates the global implied temperature rise (by 2100) as if the whole economy “overshot/undershot” its carbon budget the same way the given company overshoots/undershoots its’ carbon budget. A company's emissions are holistically measured, considering scope 1, scope 2, and scope 3 emissions. The difference between the allocated CO_2 budget and the company’s projected carbon emissions results in an over-/undershoot that can then be extrapolated to the whole economy. The Transient Climate Response to Cumulative Emissions (TCRE) provided by the IPCC is used to calculate the ITR. The TCRE provides a relationship between each additional unit of emissions beyond the 2°C carbon budget and the degrees of additional warming. MSCI uses the TCRE factor of 0.000545°C warming per Gt CO_2, calculated by the IPCC in 2020. Described differently, for every Gt CO_2 emissions beyond the global 2°C carbon budget, we can expect an added 0.000545°C warming over 2°C so that the ITR is calculated by:

Additional Warming = Relative company-level over/undershoot × Global 2°C Budget × TCRE Factor

MSCI calculates the ITR precisely for all companies with a temperature rise of less than 3.2°C. Until that threshold, the variable can be used as a continuous variable. For companies that operate in ways leading to theoretical temperature increases of above 3.2°C, MSCI only sometimes calculates a precise value but most often reports a category that is called “>3.2°C”. Therefore, upon this threshold, the variable turns into one that can only be used as an ordinal variable. Due to that limitation and in line with the international climate policy goal of limiting global warming to less than 2°C by 2100 compared to the pre-industrialization level defined in the Paris climate agreement, the ITR variable is transformed into a binary variable differentiating between “aligned” in line with the 2°C goal and “not aligned”. For the interpretation of the binary variable, a logit model will be used.

3.2.3 Environmental Strategy

To understand the degree of proactiveness a company executes for its’ environmental strategy, the classification by Walls (2011) is adopted in a slightly adjusted way, reducing the complexity of the data collection process, among others, to increase validity. Twenty-one binary variables were created to indicate whether a firm performs an activity or not. For each of the 110 companies included in the sample, content for classifying the adopted environmental strategies from publicly available reporting, including annual reports, sustainability reporting, ESG presentations, and press releases, was collected. All texts included in the analysis were published in 2021 or 2022. Table 2 summarizes all 21 variables. Column 1 defines clusters used by Walls (2011) to have the possibility to analyze the variables in clusters. Column 3 names the topic and variable name, and column 4 gives a generic example from Walls (2011) and an example from the actual dataset to provide an idea of what a phrase looks like that matches the variable. Column 5 reports the scale by Walls (2011), and column 6 is the scale used in this thesis.

Cluster	No	Topic **Variable Name**	General example signaling a proactive strategy *Example Phrase from Dataset*	Scale *Walls (2011)*	Measurement scale used
Historical orientation	1	History of implementing environmental program **history**	"our commitment to sustainability has a long history" "*For the past 15 years, we published a Sustainability Report [...].*"	0= no history 1= 1-10 years 2= 11-20 years 3= 21-30 years 4= >30 years	0 = no history 1 = > 10 years
Supply chain	2	Supplier policies **suppliers**	"suppliers must be committed to reducing the environmental impact of their designs and manufacturing processes" "*We encourage all our suppliers to reduce greenhouse gas emissions, improve energy efficiency and reduce waste [...].*"	binary	binary
	3	Buyer policies **customers**	"ISO certification to meet customer requirements" "*In an effort to reduce emissions from flying [...], Delta has signed agreements with 35 corporate customers [...] to fund SAF that will be applied towards GHG emissions from their business travel on Delta.*"	binary	binary
	4	Life cycle analysis or product stewardship **lca**	"product life cycle principles are being applied to acquired products and during the development of new products and during the design phase" "*Over the past year, Corteva has used LCA and its methodologies to: -Provide subject matter expertise and guidance for leadership -Understand the environmental footprint of select products, [...]*"	binary	binary
	5	Industrial symbiosis activities **symbiosis**	"facility recovers starch released during cutting operations, which is then sold to outside companies for further processing and use in products." "*A biorefinery that will process more than 75% waste and residue for a second life as biofuel*"	binary	binary
Other stakeholders	6	Government relationships **government**	"cooperate with federal, state and local government agencies in developing a cost-effective, performance-based environment, safety and health policy" " *[...] This project phase concerns the storage part of the Longship CCS project, which includes carbon capture facilities, transportation, and storage (full value chain) initiated by the Norwegian government*"	binary	binary
	7	NGO relationships **ngo**	"pipe was donated to three different wildlife refuges in California for use in watershed habitat maintenance" "*Collaborating with nongovernmental partners [...] reduce emissions [...], including: As a founding member of the ONE Future Coalition, working with a group of more than 40 companies[...]on reducing methane emissions.*"	binary	binary
	8	Business/industry associations **associations**	"participate in the Global Roundtable on Climate Change" "*Together with the Edison Electric Institute (EEI) and the American Gas Association (AGA), we helped develop the ESG Reporting Template to standardize ESG disclosures across our industry.*"	binary	binary
	9	Community programs **community**	"a statewide initiative to teach young people about renewable energy technologies" "*[...] we engaged local Indigenous community members from Conklin, Alberta to advise us on the specific qualities of the vegetative species and participate in the planting of seedlings for a constructed wetland in 2018.*"	binary	binary
	10	Employee programs **employee**	"more than 600 . . . environmental activities are being undertaken . . . by our employees" "*an early-career Boeing engineer, plants trees along the banks of the Snoqualmie River near Seattle in her free time. Sharma joined other Boeing volunteers working with Stewardship Partners, a nonprofit that creates people- based solutions to engage Puget Sound communities as caretakers of the land and water that sustain us.*"	binary	binary
	11	Socially responsible shareholders **shareholders**	"proudly listed in the Dow Jones Sustainability Index, Calvert Social Index and the Domini 400 Social Index" "*Dow Jones Sustainability Index (DJSI) included Halliburton in the S&P Global Sustainability Yearbook 2022, which highlights the top 10% most sustainable companies per industry.*"	binary	binary
	12	Volunteer programs **volunteerpro**	"entered into voluntary cleanup agreements ... with the Department of Environmental Conservation" "*CECONY has participated for several years in voluntary initiatives with the EPA to reduce its methane and sulfur hexafluoride emissions.*"	binary	binary
Endowments	13	ISO certification **isocert**	"half of our locations are ISO14001 certified" "*Our Lubricants business conforms to the ISO 14001:2004 Environmental Management System. Five of our lubricants facilities have certification to ISO 14001 and the ISO 9001:2015/IATF16949:2016 Quality Management System Standard.*"	0 = No ISO 1 = some sites have ISO 2 = all sites have ISO	0 = No ISO 1 = some sites are ISO certified

	14	Environmental management system **ems**	"environmental management system being developed at facility by facility basis" "*The Zhaoqing plant has established a triple-layered management structure for safety and environmental protection. The three layers of the management system, i.e. decision-making, organization and implementation, each carries a unique responsibility and works together to advance environmental management.*"	binary	binary
	15	Environmental R&D **randd**	"investing US$1.5 billion over the next several years in environmental systems that will significantly reduce emissions of SO2 and NOx at our power plants" "*PPL is investing in clean energy technology R&D, and LG&E and KU are providing leadership in demonstrating several clean energy technologies at the E.W. Brown Generating Station discussed in more detail below.*"	0= $0-$399mil 1= $400-$1.6bn 2= > $1.6bn	0= no investment 1= some investment
Managerial vision	16	Long-term commitment to environment **longterm**	"new voluntary program to reduce carbon intensity by 2012" "*Our aim 2 is to be net zero on an absolute basis across the carbon in our upstream oil and gas production by 2050 or sooner.*"	0 = no statement 1 = statement 2=vision >5years	0 = no statement 1 = statement with > 10 years
	17	Global level of vision **global**	"three regional sustainability reports were published in Australia, Canada, Latin America" "*ERM CVS also assessed whether the 2021 data for the following metrics from ConocoPhillips global operations are fairly presented [...]: Total Scope 1, Total Scope 2, Total Scope 3 [...]*"	binary	binary
Top management team skills	18	Senior environmental executive **exec**	"the vice president of the department . . . reports to our group president . . . who reports directly to Chairman and CEO" "*In 2021, we announced the addition of a Chief Strategy and Sustainability Officer (CSSO) on our executive leadership team—reinforcing that sustainability is at the core of our corporate strategy.*"	binary	binary
	19	Reporting structure level **reporting**	"senior managers are part of the environmental management reporting structure" "*Board receives information and updates from management [...] with respect to management's execution of the corporate and business plans as well as progress on ESG priorities*"	0 = no reporting structure 1 = local/facility level 2 = senior management 3 = board/ external auditors	binary
Human resources	20	Environmental training programs **environmentaltraining**	"all facilities provide staffing and training initiatives to manage environmental protection" "*Dow [...] initiated the Environmental Literacy program to deliver comprehensive sustainability training [...]*"	binary	binary
	21	GRI or CERES reporting systems **gri**	"in developing this report, we relied on the guidelines issued by the [GRI]" "*Albemarle has reported the information cited in this GRI content index for the calendar year 2021, unless otherwise noted, with reference to the GRI Universal Standards 2021.*"	binary	binary

Table 2 Environmental strategy classification

All 21 variables are summed up, and the respective value is stored in the variable "total". The variable is close-to-normally distributed, and commonly used transformations (squaring, cubing, log transformation) do not bring it significantly closer to a normal distribution.

3.2.4 Control Variables

The model includes three control variables: firm size, country of origin, and industry.

First, firm size is accounted for by using the total asset base of a company, which is in line with previous research by Borghesi et al. (2014). As the total asset base metric is generally less volatile than revenues or market capitalization metrics and helps to compare companies across industries with varying revenue-generating models, it is best suited for the model and also in line with recommendations made by Dang et al. (2018). The data was sourced from Yahoo Inc. (2023) in USD and was randomly crossed-checked with annual report data by the companies, which confirmed that the collected data values from Yahoo Inc. (2023) were valid.

When plotting the histogram of the asset values, a long tail towards the upper end of the asset value spectrum emerges. As this distribution is not close to a normal distribution, a variable transformation is conducted using the logarithmic transformation, which is adopted in the model. All observations had z-scores of less than 5, so no outliers were removed based on assets (Wooldridge, 2016).

Second, the country of origin is included to account for the location effect, in line with findings from Cai et al. (2016). As there is a great variety of countries represented that are not from the US, testing has shown that a dummy variable that differentiates whether a company is from the US or not adds the most value to the model. The data was sourced from the MSCI website, includes the country of origin for each company, and was randomly cross-checked with data from the companies' websites, confirming the soundness of the source.

Third, the industry is accounted for using four industry dummies: (1) Power Generation, (2) Industry (representing companies from the industrial sector), (3) Transportation, and (4) Oil & Gas.

As laid out in the literature review, additional control variables impact ESG scores, for example, the law system a company is operating in, the political affiliation of the management, leadership characteristics like gender, age, and top management compensation, or the level of institutional ownership. As the sample used in this thesis only has 110 observations, adding more variables would cause the degrees of freedom to decrease and thus increase the risk of overfitting the model, reducing the ability to generalize the findings (Wooldridge, 2016). In the process of deciding on the most relevant control variables, firm size was identified as the most important one, being mentioned by a vast array of authors as the most relevant control metric, including Borghesi et al. (2014), Boubakri et al. (2016), Gao & Zhang (2015), Krüger (2015).

Country of origin with underlying country characteristics is of great importance as well, as it captures a great amount of underlying information, and is an integral part of most studies using an international sample, including Cai et al. (2016) and Liang & Renneboog (2017).

3.3 Model Specification

Using the specifications laid out in Chapter 3, the final model for testing hypothesis 1 is specified as follows:

$$ESGscore_i = a_1 + a_2 total_i + a_3 \log\_assets_i + a_4 usa1_i + Industry\ Dummies + \varepsilon_i$$

Using the specifications laid out in Chapter 3, the final model for testing the Environmental (E) component is specified as follows:

$$align_i = a_1 + a_2 total_i + a_3 \log\_assets_i + a_4 usa1_i + Industry\ Dummies + \varepsilon_i$$

Next, the findings will be reported, including the descriptive statistics as well as the results from the linear regression analysis. The findings will be connected to the academic discourse.

4 Findings

4.1 Descriptive Statistics of Dependent Variables

For the ESG rating, the mean lies at 4.8, which is closer to an A than to the scale middle rating of BBB, also because no CCC-rated company is present in the sample. The standard deviation of 1.3 indicates a moderate level of dispersion, with around 70% of values lying between 3.5 (between BB and BBB) and 6 (AA).

The median implied temperature rise is at 2.8°C with a standard deviation of 0.6°C, indicating that 70 % of all observations are between 2.2°C and 3.4°C. The minimum value aligns with a 1.5°C scenario, while the maximum value is on a 4°C trajectory. Close to 16% of the companies align with the 2°C goal, with a great dispersion indicated by the standard deviation of around 0.4.

No	Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
1	*esgratingindex*	110	4.791	1.264	2	4	6	7
2	*impliedtemprise*	110	28.564	6.252	15	23.2	32	40
3	*aligned*	110	0.155	0.363	0	0	0	1

Table 3 Summary statistics of ESG rating and ITR variables

4.2 Descriptive Statistics of Independent Variables

History

Only a minority of close to 12% of companies report a history of implementing environmental programs longer than 10 years ago. Especially measurements of greenhouse gas emissions have only been systematically implemented in companies' own operations within recent years. The measurement of downstream and upstream activities in the value chain often has even shorter measurement periods, if reported at all.

Supply Chain

For the cluster “Supply Chain”, 56% of companies have programs in place that demand suppliers to adhere to environmental standards beyond legislation. This is driven especially by companies from Auto Manufacturing and Chemicals. Supplier requirements play a very low importance in the Power Generation industry. Half of the companies have an environmental strategy element in place that is tailored toward customers' goals of reducing their environmental footprint. Around 42% of companies execute Life-Cycle Assessments (LCA) when steering activities like product development. Industrial symbiosis activities are uncommon, with the third lowest value among all 21 variables.

Other Stakeholders

For the cluster "Other Stakeholders", approximately 43% of companies work together with government agencies on projects to reduce environmental footprints. Such projects often entail the development of technologies like carbon capturing and storage technologies in the Oil & Gas industry. Only 28% of companies actively involve NGOs in their environmental strategy. While many companies include NGOs in communication processes like understanding community needs, the active cooperation between companies and NGOs to work on projects reducing the environmental footprint of a company is less common. More than 50% of the companies take an active role in industry associations to work on environmental matters, like reducing the environmental footprint of the industry. Associations are often used for defining environmental standards and reporting guidelines in environmental reporting. Sometimes, associations are also utilized to enable scientific research in the field of low-carbon or carbon-free technologies. Community programs (found in 32% of the companies in the sample) and employee programs (22%) aimed at reducing a company's environmental footprint are not widely spread. Although almost all companies report programs working with local communities (i.e., providing scholarships for students to attend colleges) and programs for employees (i.e., extended health care benefits), programs related to an environmental strategy are less common. Employee programs are often centered around career development or creating a diverse workforce. Programs designed around a platform for employees to work on environmental matters are less common. 34% of the companies are represented in a sustainability index like the Dow Jones Sustainability Index. Programs that are designed for voluntary commitments towards, i.e., targets to reduce greenhouse gas emissions are only reported by 16% of the companies. While many companies used frameworks by institutions like the Carbon Disclosure Project (CDP) to measure emissions, commitments towards emission reductions or minimum amounts of recycled input materials were often set by the companies without third-party involvement.

Endowments

Regarding the “Endowments” cluster, around 53% of the companies have parts or all of their operations certified by ISO certification ISO 14001, which defines globally recognized requirements for an environmental management system, including life cycle assessments and environmental performance evaluations. Following, 91% of companies report using an environmental management system, either due to their ISO 14001 certification or to a different system. 38% of companies in the sample conduct R&D activities related to clean technologies. In the case of the Oil & Gas industry, those R&D activities most often include carbon capture and storage technologies, and for the Chemicals industry, research in the field of green hydrogen is common.

Managerial Vision

For the “Managerial Vision” cluster, most companies (87%) have a long-term perspective embedded in their environmental strategy, exhibiting plans at least until 2030 and, in most cases, until 2050. While 2030 targets are often very detailed in reduction goals towards absolute emissions or emission intensity, perspectives for 2050 usually stay vaguer, stating plans to become net zero without detailed pathways. Close to 55% of companies use a global perspective in their reporting. In general, companies that have significant global business tend to report a global perspective, while companies with only domestic operations report on their regional footprint.

Top Management Team Skills

For the “Top Management Team Skills” cluster, most companies (74%) have senior executives in charge of sustainability activities at their respective firms. Most often, the responsibilities linked to environmental performance are added to an existing role. The Auto Manufacturing and the Oil & Gas industry drive the high value for anchoring sustainability at the executive level. About 38% of the companies state that multiple management levels are involved in the reporting process.

Human Resources

For the “Human Resources” cluster, only 5% of companies reported some form of an environmental training program that was used to educate employees on topics, such as environmental protection or sustainable design. Lastly, most companies (91%) use the reporting standard GRI for measuring and reporting on their emissions, independent of the company's size.

No	Statistic	N	Mean	St. Dev.	No	Statistic	N	Mean	St. Dev.
1	*history*	110	0.118	0.324	**12**	*volunteerpro*	110	0.164	0.372
2	*suppliers*	110	0.564	0.498	**13**	*isocert*	110	0.527	0.502
3	*customers*	110	0.500	0.502	**14**	*ems*	110	0.909	0.289
4	*lca*	110	0.418	0.496	**15**	*randd*	110	0.382	0.488
5	*symbiosis*	110	0.136	0.345	**16**	*longterm*	110	0.873	0.335
6	*government*	110	0.427	0.497	**17**	*global*	110	0.545	0.500
7	*ngo*	110	0.282	0.452	**18**	*exec*	110	0.736	0.443
8	*associations*	110	0.545	0.500	**19**	*reporting*	110	0.382	0.488
9	*community*	110	0.318	0.468	**20**	*environmentaltraining*	110	0.055	0.228
10	*employee*	110	0.218	0.415	**21**	*gri*	110	0.909	0.289
11	*shareholders*	110	0.336	0.475	**22**	*total*	110	9.345	3.957

Table 4 Summary statistics of 21 environmental strategy variables

The mean asset value is at 61bn USD, with a great dispersion indicated by the standard deviation of 86bn USD. The company with the smallest asset value reports only 193mn USD, while the largest company has an asset base of 564bn USD.

No	Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
1	*assets*	110	61,147,705	86,841,611	193,976	15,655,332	68,510,805	564,704,168
2	*log_assets*	110	17	1	12	17	18	20

Table 5 Summary statistics of the firm size variable

4.3 Testing Linear Regression Model Assumptions

Linear regression models come with several underlying assumptions to be met for the results to be valid and reliable. In the following, a summary of the testing results will be presented. All in all, linearity for the environmental strategy variable is only partly given, but all other tests yield satisfactory results.

4.3.1 Linearity

As all 21 strategy variables are binary, linearity cannot be assessed in the same way as for continuous independent variables. T-tests are conducted looking for statistically significant differences in mean value between the binary strategy variables and the ESG rating variable (*esgratingindex*). Only the *shareholder* variable had a statistically significant difference in the mean value for the ESG rating. When plotting the sum of the 21 strategy variables (variable *total*) against the ESG rating, a positive slope of 0.021 and a correlation coefficient of 0.07 shows little evidence supporting the assumption of a linear relationship between the strategy and the ESG rating. This indicates that when using the linear regression model to fit the data, a variable transformation to ensure a linear relationship is needed, or the generalizability of the results will be limited.

For the relationship between the ESG rating and the log assets, a residual plot was used that resulted in a random scatterplot around an almost horizontal line with only very little curvature. Therefore, a linear relationship is assumed.

4.3.2 Independence

To test for the independence of the observations, the residuals – the differences between the observed values and the predicted values – of the model are examined. If the assumption of independence holds and the residuals do not exhibit any patterns or systematic trends, unbiased parameter estimates with minimum variance and reliable confidence intervals can be expected (Wooldridge, 2016). In a simple model using only the *total* variable, representing the environmental strategy as the independent variable, the scatter plot for the ESG rating displayed no patterns. This observation was cross-checked using the Durbin-Watson test, with a DW value of 1.9 (p-value of 0.25) for the ESG rating (while a value of 2 is aimed for). For the relationship between the ESG rating and the log assets, the Durbin-Watson test yielded a DW value of 1.8 (p-value of 0.29). Therefore, based on the tests for the independence of the residuals, unbiased parameter estimates that are needed for valid hypothesis testing are assumed.

4.3.3 Homoscedasticity

Testing for homoscedasticity, the assumption in linear regression models that the variability of the residuals is constant across all levels of the independent variables, the Breusch-Pagan Test is conducted. As the residual plots from earlier tests already showed no patterns but rather a random scatter with roughly constant spreads, no heteroscedasticity is to be expected. This is confirmed by the results of the Breusch-Pagan tests: For the environmental strategy measured by total, we obtain a p-value of the Breusch-Pagan test of 0.44. Since the p-value is greater than the commonly used significance level of 0.05, we do not have enough evidence to reject the null hypothesis of homoscedasticity. This suggests that there is no strong indication of heteroscedasticity in the regression model. The same goes for the log assets, as we obtain a p-value of 0.21 in the Breusch-Pagan test.

4.3.4 Normality

The number of continuous variables that need to follow a normal distribution in the linear regression is limited in this model, as only the ESG score, the total variable for the environmental strategy, and the total assets as a proxy for firm size are continuous variables (Wooldridge, 2016). The ESG score metric is close-to-normal distributed with no transformation needed. The total metric sums up all 21 binary strategy variables and is close-to-normal distributed. The assets variable will be transformed using the natural logarithm to be normally distributed.

4.3.5 No Multicollinearity

The two continuous independent variables were checked for multicollinearity. The correlation of 0.25 already indicated that no multicollinearity can be expected, which was confirmed by the Variance Inflation Factor (VIF) values of close to 1.

4.4 Testing Hypothesis 1

To test the hypothesis that companies executing a proactive environmental strategy have higher ESG scores, the equation outlined in the model specification section was tested.

All 21 variables that describe the dimensions of the environmental strategy were included as dummy variables. The usa1 variable is also a dummy variable, controlling whether a company is US-based or not. indstry_broad controls for four different industries, and log_assets takes the logarithmic function of the assets. All estimated coefficients and a summary of the results are displayed in Table 6.

The adjusted R-squared value is 0.102, which means that the model is not a good fit for the data, and only 10.2% of the variation in the dependent variable can be explained by the independent variables after adjusting for the number of independent variables in the model.

Statistically significant coefficients are only reported for the variables symbiosis, community, shareholders, and log_assets.

Companies conducting industrial symbiosis activities, such as recovering and selling materials for further processing and use, have, on average and ceteris paribus, a 0.921 higher ESG score than companies not engaged in such activities. Translating the ESG score back to its original nomenclature, it can be derived that companies engaged in industrial symbiosis activities almost score "one letter" higher (i.e., A instead of BBB) than companies not engaged in those activities. The finding is statistically significant at the 5% level.

Companies engaged in community programs aimed at reducing the environmental footprint of a company tend to have, on average and ceteris paribus, an ESG score of 0.5 units less compared to companies not engaged in community programs. The finding is statistically significant at the 5% level. Although this finding is counterintuitive at first, certain activities seem to be implemented by companies as "low-hanging-fruits" to progress on the ESG score front, but these companies often do not complement their actions in one field with a holistic approach, resulting in certain variables like community programs to be negatively linked with ESG scores (Albertini, 2014).

For companies that are listed in sustainability indexes, like the Dow Jones Sustainability Index, the ESG score is about 0.7 points, on average and ceteris paribus, higher than for companies not listed in a sustainability index. The finding is statistically significant at the 5% level. For a company to be listed in a sustainability index or fund often requires a certain level of activity on various sustainability dimensions defined by the given index agency. Although the indexes often have different requirements for a company to get listed, all companies must reach certain ESG thresholds throughout different rating agencies for the listing to be legitimate and relevant (Albuquerque et al., 2019).

Lastly, the firm size measured by asset value reports a statistically significant coefficient. Every 1% increase in asset value results, on average and ceteris paribus, in an increase in the ESG score of a company by 0.00213. This result confirms prior findings by Borghesi et al. (2014), and supports the finding that larger companies can use more resources on ESG activities (Gillan et al., 2021).

		Dependent variable: esgratingindex			**Dependent variable: esgratingindex**
1	*history*	0.089 (0.389)	**14**	*ems*	-0.570 (0.456)
2	*suppliers*	-0.419 (0.308)	**15**	*randd*	0.035 (0.344)
3	*customers*	0.024 (0.307)	**16**	*longterm*	-0.195 (0.390)
4	*lca*	0.341 (0.348)	**17**	*global*	-0.090 (0.308)
5	*symbiosis*	0.921** (0.383)	**18**	*exec*	0.387 (0.314)
6	*government*	-0.077 (0.279)	**19**	*reporting*	-0.295 (0.307)
7	*ngo*	-0.300 (0.332)	**20**	*environmentaltraining*	0.041 (0.587)
8	*associations*	0.210 (0.284)	**21**	*gri*	0.304 (0.486)
9	*community*	-0.489* (0.289)	**22**	*usa1USA*	0.043 (0.310)
10	*employee*	0.134 (0.331)	**23**	*industry_broadOilGas*	0.253 (0.363)
11	*shareholders*	0.714** (0.271)	**24**	*industry_broadPowerGeneration*	0.675 (0.419)
12	*volunteerpro*	0.440 (0.385)	**25**	*industry_broadTransportation*	-0.498 (0.415)
13	*isocert*	0.046 (0.318)	**26**	*log_assets*	0.213* (0.111)
			27	Constant	0.904 (1.932)
Observations: 110					
R2: 0.316					
Adjusted R2: 0.102					
Residual Std. Error: 1.198 (df = 83)					
F Statistic: 1.474* (df = 26; 83)					
Note: *p<0.1; **p<0.05; ***p<0.01					

Table 6 Output regression analysis from testing of hypothesis 1

4.5 Hypothesis 2

To test the hypothesis that the more proactive a company's environmental strategy is, the better the environmental performance, measured by a lower expected environmental footprint measured through the ITR, the equation outlined in the model specification chapter was tested.

As the dependent variable, ITR, is a binary variable, a logit model is used for the regression analysis.

The fitting model results conclude that, by holding everything else constant at fixed values, a one-unit increase in the "total" variable is associated with approximately a 2.493-fold (exp(0.9141)) increase in the odds of a company aligning with 2°C goal. This means that for a company scoring on 8 proactivity metrics (out of 21), the probability for that company to align with the 2°C goal is 75% (probability = 1 / (1 + exp(-(-6.1992+0.9141*8)).

	Coefficients	Estimate	Std. Error	z value	Pr(>|z|)	
1	*(Intercept)*	-6.1992	6.3036	**-0.983**	*0.325*	
2	*total*	0.9141	0.2259	**4.047**	5.2e-05	***
3	*industry_broadOilGas*	-1.2042	1.4354	**-0.839**	0.402	
4	*industry_broadPowerGeneration*	-0.5441	1.2451	**-0.437**	0.662	
5	*industry_broadTransportation*	-0.7554	1.2855	**-0.588**	0.557	
6	*log_assets*	-0.3745	0.3899	**-0.961**	0.337	

Signif. codes: 0 ‘*’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1**					
Deviance Residuals:	**Min**	**1Q**	**Median**	**3Q**	**Max**
	-2.16542	**-0.12977**	**-0.05855**	**-0.01313**	**2.67508**

Table 7 Output logit model from testing hypothesis 2

5 Discussion

5.1 Contributions to Theory

This thesis contributes to the theory in four relevant ways. First, with the finding that there is no evidence for a statistically significant link between the degree of proactiveness in an environmental strategy and an ESG score, the research gap highlighted by Chan et al. (2022) is partially closed. Second, the statistically significant linkage of proactive environmental strategies and lower estimated environmental footprints (measured by the ITR) underscores the effectiveness of environmental strategy on the greenhouse gas emissions front. Third, this study also contributes to the contemporary academic discourse by being the first comprehensive application of the environmental strategy framework that Walls (2011) defined for high-emission industries. While other authors have used the Walls (2011) framework in parts, like Alipour et al. (2019) in studying whether board independence mediates the found linkage between environmental disclosure quality and performance or Tatoglu et al. (2020) study on environmental management practices of emerging market firms, this research thesis takes the framework holistically and applies it to a so-far unstudied industries classification. Finally, the research presented here involved the creation of a comprehensive database of 110 companies from high-emission industries with over 25 variables. The database provides a valuable source for future researchers to further explore the topics herein studied or other related purposes.

5.2 Contributions to Practice

This study may assist companies that are considering investing resources into proactive strategies. The finding that there is no evidence for a statistically significant link between the degree of proactiveness in an environmental strategy and an ESG score may indicate that companies assigning many resources towards their environmental strategies need to be aware of their alignment with ESG criteria. Higher ESG scores come with various benefits that corporations aim for, but tailored programs are needed to generate high ESG scores. Proactive environmental strategies are potentially insufficient, although they can function as a centrepiece of legitimizing a company's operations.

5.3 Limitations and Future Work

There are some noteworthy limitations present in this thesis. First, the sample was not randomly collected as it depended on whether data for a given company was provided by the MSCI ESG rating & climate search tool. The database did not report the complete industry clusters, but the industry classification was sourced from S&P Capital IQ, so companies, especially those with low ESG ratings, were left out. Assuming an aimed confidence level of 95%, a margin of error of 5%, and a population size of roughly 250, the sample would need to be composed of 152 representative observations to attain generalizable results. As the sample only holds 110 observations, the generalizability of the results is limited. Second, despite efforts to be as rigorous as possible in interpreting the text to populate the database, one should acknowledge the fact that subjectivity is inherent to the process, which potentially limits the reliability of the process. Third, the low adjusted R2 in the linear regression model for testing hypothesis 1 and the small number of significant variables limit the ability to generalize the findings. The strong estimates of the logit model indicate that the model with only 110 observations might be overfitted.

Concerning future avenues for research, the finding that companies executing proactive environmental strategies need to have an ESG agenda complementing their environmental strategy leads to the question of how environmental strategies and ESG strategies can be efficiently merged. In addition, the findings in this thesis aim to provide a basis for questioning the compositions of ESG ratings.

6 Conclusion

This research thesis aims to contribute to the literature on corporate sustainability by studying the relationship between environmental strategies and ESG scores. Many publications investigate the (most often positive) effects that ESG metrics have on various performance metrics, like firm value. However, studying the linkage of strategic decisions towards ESG metrics is not as prominent in extant literature. This linkage, though, is relevant to understand, on the one hand, for scholars developing theories of gaining competitive advantages through environmental strategies and, on the other hand, for managers to understand how to best steer their respective environmental strategies to profit from the benefits associated with high ESG scores. A unique sample of 110 observations was built using a prominent methodology to measure the proactiveness of environmental strategies by assessing 21 different strategy variables. Commonly used MSCI data on ESG scores were adopted for the model to align with the current standard in ESG data analysis in academics.

This thesis contributes to the discourse of strategic decisions influencing ESG scores by studying the linkage between environmental strategies and ESG scores. No evidence for a no positive (nor negative) linkage between a proactive environmental strategy and ESG scores has been found. However, using a logit model, evidence is found that proactive environmental strategies are positively linked to the Implied Temperature Rise variable, which is a proxy for the Environmental (E) fraction of the ESG equation. This finding is relevant as it proves that capital markets recognize proactive environmental strategies through rating agencies.

This research offers relevant insights into the relationship between environmental strategies and ESG scores and aims to inspire additional research in the field of environmental strategies, for example by asking how environmental strategy configurations and investments in ESG activities can be best complemented.

Reference List

Albertini, E. (2014). A Descriptive Analysis of Environmental Disclosure: A Longitudinal Study of French Companies. *Journal of Business Ethics*, *121*(2), 233–254. https://doi.org/10.1007/s10551-013-1698-y

Albuquerque, R., Koskinen, Y., & Zhang, C. (2019). Corporate Social Responsibility and Firm Risk: Theory and Empirical Evidence. *Management Science*, *65*(10), 4451–4469. https://doi.org/10.1287/mnsc.2018.3043

Alipour, M., Ghanbari, M., Jamshidinavid, B., & Taherabadi, A. (2019). Does board independence moderate the relationship between environmental disclosure quality and performance? Evidence from static and dynamic panel data. *Corporate Governance: The International Journal of Business in Society*, *19*(3), 580–610. https://doi.org/10.1108/CG-06-2018-0196

Bénabou, R., & Tirole, J. (2010). Individual and Corporate Social Responsibility. *Economica*, *77*(305), 1–19. https://doi.org/10.1111/j.1468-0335.2009.00843.x

Borghesi, R., Houston, J. F., & Naranjo, A. (2014). Corporate socially responsible investments: CEO altruism, reputation, and shareholder interests. *Journal of Corporate Finance*, *26*, 164–181. https://doi.org/10.1016/j.jcorpfin.2014.03.008

Boubakri, N., El Ghoul, S., Wang, H., Guedhami, O., & Kwok, C. C. Y. (2016). Cross-listing and corporate social responsibility. *Journal of Corporate Finance*, *41*, 123–138. https://doi.org/10.1016/j.jcorpfin.2016.08.008

Breuer, W., Müller, T., Rosenbach, D., & Salzmann, A. (2018). Corporate social responsibility, investor protection, and cost of equity: A cross-country comparison. *Journal of Banking & Finance*, *96*, 34–55. https://doi.org/10.1016/j.jbankfin.2018.07.018

Buchanan, B., Cao, C. X., & Chen, C. (2018). Corporate social responsibility, firm value, and influential institutional ownership. *Journal of Corporate Finance*, *52*, 73–95. https://doi.org/10.1016/j.jcorpfin.2018.07.004

Cai, Y., Pan, C. H., & Statman, M. (2016). Why do countries matter so much in corporate social performance? *Journal of Corporate Finance*, *41*, 591–609. https://doi.org/10.1016/j.jcorpfin.2016.09.004

Chan, R. Y. K., Lai, J. W. M., & Kim, N. (2022). Strategic motives and performance implications of proactive versus reactive environmental strategies in corporate sustainable development. *Business Strategy and the Environment*, *31*(5), 2127–2142.

https://doi.org/10.1002/bse.3011

Chava, S. (2014). Environmental Externalities and Cost of Capital. *Management Science*, *60*(9), 2223–2247. https://doi.org/10.1287/mnsc.2013.1863

Dang, C., (Frank) Li, Z., & Yang, C. (2018). Measuring firm size in empirical corporate finance. *Journal of Banking & Finance*, *86*, 159–176. https://doi.org/10.1016/j.jbankfin.2017.09.006

Di Giuli, A., & Kostovetsky, L. (2014). Are red or blue companies more likely to go green? Politics and corporate social responsibility. *Journal of Financial Economics*, *111*(1), 158–180. https://doi.org/10.1016/j.jfineco.2013.10.002

Ferrell, A., Liang, H., & Renneboog, L. (2016). Socially responsible firms. *Journal of Financial Economics*, *122*(3), 585–606. https://doi.org/10.1016/j.jfineco.2015.12.003

Friedman, M. (1970). The Social Responsibility Of Business Is to Increase Its Profits. *The New York Times Magazine*, 122–126.

Gao, L., & Zhang, J. H. (2015). Firms' earnings smoothing, corporate social responsibility, and valuation. *Journal of Corporate Finance*, *32*, 108–127. https://doi.org/10.1016/j.jcorpfin.2015.03.004

Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, *66*, 101889. https://doi.org/10.1016/j.jcorpfin.2021.101889

Goss, A., & Roberts, G. S. (2011). The impact of corporate social responsibility on the cost of bank loans. *Journal of Banking & Finance*, *35*(7), 1794–1810. https://doi.org/10.1016/j.jbankfin.2010.12.002

Governance & Accountability Institute, Inc. (2022). *2022 Sustainability Reporting in Focus*. http://www.ga-institute.com/fileadmin/ga_institute/images/FlashReports/2022/G_A-2022-Sustainability_Trends_Report.pdf?vgo_ee=RYoi091TpKG%2FbetTANWqpJkpb34Zu00PGA32mwk3uA%3D%3D%3AwuCQ4HBA1BkYl8GKOZXkOvobHuXbSct%2B

Hart, S. L. (1995). A Natural-Resource-Based View of the Firm. *The Academy of Management Review*, *20*(4), 986. https://doi.org/10.2307/258963

Hart, S. L., & Dowell, G. (2011). Invited Editorial: A Natural-Resource-Based View of the Firm: Fifteen Years After. *Journal of Management*, *37*(5), 1464–1479. https://doi.org/10.1177/0149206310390219

Hong, H., & Kacperczyk, M. (2009). The price of sin: The effects of social norms on markets.

Journal of Financial Economics, *93*(1), 15–36. https://doi.org/10.1016/j.jfineco.2008.09.001

Hong, H., & Liskovich, Ii. (2015). *Crime, Punishment and the Halo Effect of Corporate Social Responsibility (National Bureau of Economic Research working paper)*. https://www.nber.org/system/files/working_papers/w21215/w21215.pdf

IEA. (2021). *World Energy Outlook 2021*.

IPCC. (2023). *IPCC AR6 SYR*.

Jian, M., & Lee, K.-W. (2015). CEO compensation and corporate social responsibility. *Journal of Multinational Financial Management*, *29*, 46–65. https://doi.org/10.1016/j.mulfin.2014.11.004

Kim, K. (2018). Proactive versus Reactive Corporate Environmental Practices and Environmental Performance. *Sustainability*, *10*(2), 97. https://doi.org/10.3390/su10010097

Krüger, P. (2015). Corporate goodness and shareholder wealth. *Journal of Financial Economics*, *115*(2), 304–329. https://doi.org/10.1016/j.jfineco.2014.09.008

Liang, H., & Renneboog, L. (2017). On the Foundations of Corporate Social Responsibility: On the Foundations of Corporate Social Responsibility. *The Journal of Finance*, *72*(2), 853–910. https://doi.org/10.1111/jofi.12487

McCarthy, S., Oliver, B., & Song, S. (2017). Corporate social responsibility and CEO confidence. *Journal of Banking & Finance*, *75*, 280–291. https://doi.org/10.1016/j.jbankfin.2016.11.024

Mitnick, B. M. (2011). Origin of the Theory of Agency: An Account By One of the Theory's Originators. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1020378

Morningstar. (2023). *Global Sustainable Fund Flows: Q1 2023 in Review*. https://assets.contentstack.io/v3/assets/blt4eb669caa7dc65b2/blt9a7d6263f20a8c7a/6446d8887fbb1e0c982fcc69/Global_Sustainable_Fund_Flows_Q1_2023_in_Review.pdf

MSCI Inc. (2023). *ESG Ratings & Climate Search Tool*. https://www.msci.com/our-solutions/esg-investing/esg-ratings-climate-search-tool

Ng, A. C., & Rezaee, Z. (2015). Business sustainability performance and cost of equity capital. *Journal of Corporate Finance*, *34*, 128–149. https://doi.org/10.1016/j.jcorpfin.2015.08.003

Nofsinger, J. R., Sulaeman, J., & Varma, A. (2019). Institutional investors and corporate social responsibility. *Journal of Corporate Finance*, *58*, 700–725.

https://doi.org/10.1016/j.jcorpfin.2019.07.012

Porter, M. & Van der Linde, C. (1995). Green and competitive: Ending the stalemate. In *The Dynamics of the eco-efficient economy: Environmental regulation and competitive advantage* (Vol. 33, pp. 120–134).

Potrich, L., Cortimiglia, M. N., & de Medeiros, J. F. (2019). A systematic literature review on firm-level proactive environmental management. *Journal of Environmental Management*, *243*, 273–286. https://doi.org/10.1016/j.jenvman.2019.04.110

Stellner, C., Klein, C., & Zwergel, B. (2015). Corporate social responsibility and Eurozone corporate bonds: The moderating role of country sustainability. *Journal of Banking & Finance*, *59*, 538–549. https://doi.org/10.1016/j.jbankfin.2015.04.032

Tatoglu, E., Frynas, J. G., Bayraktar, E., Demirbag, M., Sahadev, S., Doh, J., & Koh, S. C. L. (2020). Why do Emerging Market Firms Engage in Voluntary Environmental Management Practices? A Strategic Choice Perspective. *British Journal of Management*, *31*(1), 80–100. https://doi.org/10.1111/1467-8551.12351

Walls, J. L., Phan, P. H., & Berrone, P. (2011). Measuring Environmental Strategy: Construct Development, Reliability, and Validity. *Business & Society*, *50*(1), 71–115. https://doi.org/10.1177/0007650310394427

Wooldridge, J. M. (2016). *Introductory econometrics: A modern approach* (Sixth edition, student edition). Cengage Learning.

Yahoo Inc. (2023). *Financial data*. https://de.finance.yahoo.com

Zerbib, O. D. (2019). The effect of pro-environmental preferences on bond prices: Evidence from green bonds. *Journal of Banking & Finance*, *98*, 39–60. https://doi.org/10.1016/j.jbankfin.2018.10.012

Appendix

Figure 2 MSCI ESG Rating

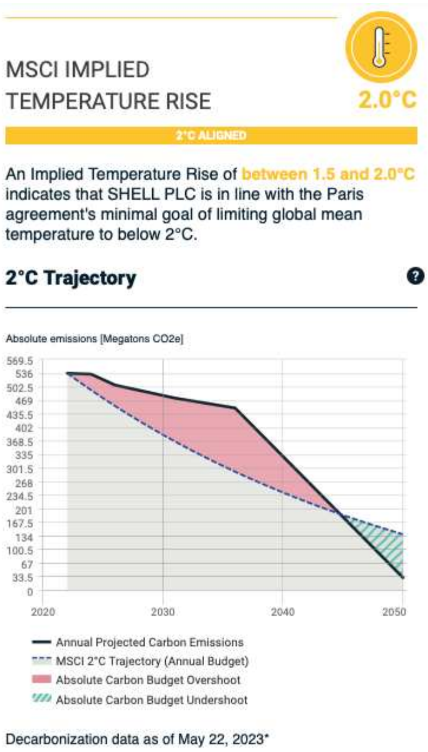

Figure 3 MSCI Implied Temperature Rise metric