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How Does a Firm's Focus on ESG Factors Affect its Cost of Debt?

Investigating Regional and Industry level ESG Materiality Factors and their Effect on Firm Cost of Debt.

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As ESG risk and ESG materiality concepts become increasingly important to firm and lender-level decision making, our paper aims to investigate the dynamic factors affecting industry and regional-level materiality. Our paper is the first to construct a materiality map on a regional level and contrasts this with the SASB sector-level materiality map. We use ESG incident frequency as a proxy for firm ESG performance and find evidence for industry-level materiality, which is largely consistent with findings by Khan et al. (2016). We also compare the effects of regional and industry material ESG incidents against overall ESG incidents, which include material and immaterial topics, and find that industry materiality related ESG incidents are the most important factor in increasing a firm's cost of debt. For MNE's developing ESG policies, we suggest a global versus local approach to ESG performance based on industry-level standards.

This thesis was written as a part of the Master of Science in Economics and Business Administration at NHH. Please note that neither the institution nor the examiners are responsible − through the approval of this thesis − for the theories and methods used, or results and conclusions drawn in this work.

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1. Introduction

Our thesis report investigates the dynamic factors of ESG materiality with respect to multinational enterprises (MNEs); specifically, how regional differences can affect the materiality of ESG factors and a parent firm's ability to reduce its cost of debt. Extant literature currently focuses on Sustainability Accounting Standards Board's (SASB) industry materiality with very little research into regional differences. Our paper is one of the first to investigate regional differences as a chief factor to ESG materiality, and the mechanisms of regional ESG materiality with respect to cost of debt. Furthermore, this paper contributes to existing financial sustainability research by being one of the first to map ESG materiality based on region. This will enable firms across industries to understand how regional differences impact the materiality of ESG factors, and thereby mitigate their risk levels.

A firm's ability to mitigate financial risk is a key determinant to firm value and success. Themes of Corporate Social Responsibility (CSR) and Environmental, Social, and Governance (ESG) factors are becoming critical to decision making at all levels of business operations (PWC, n.d.). ESG represents an all-encompassing term outlining the issues of sustainability and corporate social responsibility for bottom line strategy consideration in the corporate world (Maaloul et al., 2021). As the awareness for ESG issues and their integration to corporate strategy and responsible investment decisions has increased rapidly since the acronym first originated at the United Nations Global Compact's "Who Cares Wins" in 2004 (Maaloul et al., 2021), banks and other lending firms have become increasingly aware of the risk that is associated with ESG non-compliance. In addition to the usual default risk that is evaluated when determining the cost of debt financing for a borrowing firm, lending firms have started to evaluate reputational risk based on ESG factors (Eliwa et al., 2021).

We investigate ESG firm scores with respect to industry and regional materiality and compare how cost of debt differs between the relationships. We hypothesise that focusing on regionally material ESG factors will lower the cost of debt for a parent firm as there is a lower perceived risk by analysts. We define industry level ESG factors by the SASB materiality definition. By hand mapping SASB ESG factors with RepRisk ESG risk factors, we develop a way to measure regional materiality by the frequency and severity of ESG issue incidence. When contrasted with industry level materiality, we can measure publicly traded MNE's ESG scores on an industry and regional basis. For MNE's, we designate their headquarter location as their main region of operation. With respect to cost of debt, we the accounting ratio of a

firm's interest expense to average debt using data from Compustat to measure if, on average, firms incur higher cost of debt financing when they place a greater emphasis on industry materially significant ESG factors over regionally material factors.

Our findings show that, in general, overall ESG incidents and the moderating effect on industry materiality has a significant impact on firm cost of debt. This financial impact is notably large for firms with high long-term debt. For firms with poor ESG performance on material factors and with high long-term debt, the overall increase in cost of debt can be in the millions of dollars. Conversely, smaller firms with small operating budgets and lower long-term debt will not be impacted as greatly as larger firms. For firms, industry material ESG factors are more significant to lowering cost of debt when compared to regionally material ESG factors. We further find mixed and limited evidence for regional materiality. As RepRisk measures severity impact, stakeholder sentiments and values are harder to measure, and overall, we find no evidence to support that poor performance on regionally material ESG factors will have an overall impact on firm cost of debt.

We recommend future research to focus on regional differences on ESG performance to robustly develop a regional materiality matrix specifically based on data from shareholders and overall stakeholders on a country and regional basis. Current ESG frameworks currently collect data on an industry and firm basis and based on research may show to be significant as ESG topics become highly integrated within financial markets and decision-making processes.

Our research builds upon the literature written by Eliwa et al. (2021) and Khan et al. (2016) and our findings are largely consistent with their findings on cost of debt factors and industry materiality respectively. We want to thank Professor Jose A. Albuquerque de Sousa for his guidance throughout the thesis writing process and his course on Sustainable Finance as being the main motivator for our thesis. We would also like to acknowledge Ivanessa Staykova for her guidance in navigating 10-K forms and the NHH library in their guidance in navigating the available ESG and Financial related databases. Finally, we would like to thank our family for their continued support in our pursuit of higher education and the Ivey Business School at Western University for granting us the opportunity to complete the Master of Science in Management, International Business degree and dual degree program in Norway.

2.0 Literature Review

As businesses across industries grapple with the risk of a changing climate, it is critical to develop a framework and understanding of factors affecting financial risk to ensure the flow of funds to important ESG related work. The current scope of literature covers how corporate sustainability efforts and ESG factors can impact a wide range of industries' bottom line. Our literature covers this scope of literature in two major sections: the impact of ESG factors, materiality, and their determinants to firm value, and cost of debt, its determinants, and its relationship to ESG issues and risk management.

We link climate change to ESG factors as "ESG Risk". There is a body of research linking improved ESG management with lowered risk in asset pricing, lowered returns, and predicting future financial performance (Borgers, Derwall, Koedijk, & ter Horse, 2013; Giese, Lee, Melas, Nagy, & Nishikawa, 2019; Maiti, 2020). As a result, when discussing financial risk, we can equate financial risk with ESG risk. Thereby, businesses with poor ESG scores and management have inherently higher financial risk and will incur sub-market returns and higher interest rates. As a result, throughout our thesis, we investigate links to cost of debt with ESG factors on the basis that poor ESG management and performance affects a firm's cost of debt.

With respect to MNEs, our research aims to understand the links between global factors influencing MNE operation. As a result, our work takes an institutional-based view of internationalization, whereby MNE's success and failure and governed by external forces (Herold, 2018; Peng and Meyer, 2019). In this respect, theory states there are formal and informal forces in a firm's country of operations that can affect a firm's performance and also shape its operations (Peng and Meyer, 2019). Formal institutions such as the EU can mandate EU-based businesses to disclose their ESG impacts within their financial reporting (European Comission, 2021; Directive 2014/95/EU). Through this, perceptions of a non-EU compliant firm could affect its ability to finance debt from EU banks.

2.1 ESG Performance & Materiality

Through our focus on ESG incidents and ESG as a risk factor, we categorize ESG factors as material or immaterial. The SASB defines financial materiality based on financial reporting on topics that are "reasonably likely" to be critical to investors in their decision-making process (SASB, n.d.). We extend the SASB's definition of materiality to ESG factors, whereby a material ESG factor is critical to an investor in the decision-making process. Therefore, poor ESG performance in a *material* ESG factor will lead to a decision against investment, whereas an *immaterial* ESG factor is unlikely to be a critical decision-making factor for an investor. In general, we find a large body of research supporting the idea that good performance on CSR, ESG, and sustainability related issues will improve overall firm performance (Derrien et al., 2021; Giese, Lee, Melas, Nagy, & Nishikawa, 2019; Operean-Stan et al., 2020); however, the links to firm performance with respect to material versus immaterial ESG factors are unclear.

2.1.1 ESG Performance versus ESG Disclosure

ESG scores are commonly based on one or both of two measurements – ESG *performance* and ESG *disclosure*. ESG performance is "used to indicate an effective commitment to ESG strategies" while ESG disclosure "represents an effort to construct an image of commitment designed to positively influence stakeholders' perceptions" (Eliwa et al., 2021). Both stakeholders and lending firms often fail to distinguish between ESG performance and disclosure when evaluating the overall reputational risk of borrowing firms, which could have negative implications regarding cost of debt financing (Eliwa et al., 2021). It can be argued that there is a risk that ESG disclosure can be deceptive in overall evaluation of a firm's sustainability efforts, as many firms engage in a 'symbolic management approach' (Ashforth & Gibbs, 1990). Using this approach, firms commit to 'societal requirements' to appeal to stakeholders and improve perceived reputation, meaning that weak performers are inclined to increase their disclosure above their performance, in an act of 'greenwashing', to achieve lower debt financing costs (Ashforth & Gibbs, 1990). In our study, we will focus on ESG performance (based on the frequency of ESG issue incidents occurrence within a firm) over ESG disclosure to gain a true understanding of how a firm's material ESG action can affect firm value and avoid the risk of using self-reported statistics that could be subject to 'greenwashing'.

2.1.2 Industry Defined Materiality

Research by Khan et al. (2016) on materiality finds that businesses that focus on materially significant ESG factors to their industry outperform their peers in stock market performance and that a focus on immaterial factors does not predict future performance (Khan et al., 2016). Furthermore, businesses have positive return on sales (ROS), return on assets (ROA), and return on equity (ROE) performances with respect to industry-level material factors. In their research, Khan et al. (2016) link SASB defined material ESG factors across Health Care, Financials, Technology and Communication, Non-renewable Resources, Transportation, and Services industries. In this respect, they draw a clear connection between industry-defined material ESG scores with firm performance. Given that cost of debt is linked to firm assets and other performance related variables, it is reasonable to extend that a firm's cost of debt can be lowered if they focus on materially significant ESG factors.

With reference to global business and its moderating factors on materiality, we extend our discussion to franchising businesses. We find it pertinent to investigate the effects of material and immaterial sustainability performance with firms that span global boundaries; given that franchising is an internationalization strategy for MNEs. In this respect, evidence from Kim and Lee's (2020) research shows some notable findings. By investigating material sustainability engagement for franchising firms within the food industry, the study finds that materially classified ESG topics are not *more or less* likely to affect firm performance (Kim and Lee, 2020). Conversely, they find that franchising is a moderating factor between immaterial ESG factors and firm performance (Kim and Lee, 2020). While this study provides reasonings for its inconsistent findings with Khan et al.'s (2016) work – namely, the different scope and data analysis methodology – it has the following similarities: (1) Kim and Lee (2020) define the restaurant industry ESG materiality factors using the SASB's industry-specific map and (2) they measure net materiality and immateriality scores using a difference in ESG scores sourced from KLD, adopted from the Khan et al. (2016) study. However, Khan et al.'s (2016) study looks at a range of SASB defined US-based industries (finance, healthcare, non-renewable resource, services, technology, communication, and transportation), while Kim et al. (2020) focus on franchising restaurant brands whose degree of internationalization is higher than a typical MNE. In this respect, we believe, given the conflicting results between Kim et al. (2020) and Khan et al. (2016)'s research, global factors have a significant impact on ESG materiality and firm performance.

With respect to the positive moderating effect on franchising to immaterial ESG factors and firm performance, Kim and Lee (2020) suggest that as a firm's degree of internationalization increases, the impact of immaterial ESG factors becomes significant enough to positively influence firm performance due to the need to balance multiple stakeholder interests. As the study defines materiality and immateriality for the restaurant industry using the SASB, this suggests that the SASB's definition of industry-level material ESG factors cannot be applied across different regions. This lends to the necessity for understanding how internationalization and stakeholders can influence ESG behaviour, and by extension, how ESG factors can become regionally material.

Integrative stakeholder theory suggests that there cannot be a separation between sustainability management and firm value creation (Horisch et al., 2014). When applied to MNEs who typically have a diverse group of stakeholders and potential debtors, highly internationalized firms can have a greater degree of sustainability-versus-firm value conflicts (Horisch et al., 2014). Furthermore, conceptual frameworks mapping stakeholder interactions show that education and regulation are key factors to mutual sustainability interests (Horisch et al., 2014). Factors such as education and regulation are highly regionally specific (Christmann, 2004), despite global sustainability initiatives such as the UN SDGs and the GRI (Horisch et al., 2014). As MNEs must balance stakeholder sustainability interests through their ESG management, the concept of an industry-level material ESG factor may not be sufficient to manage an MNE's ESG practices; thereby, suggesting materiality is influenced not only on an industry-level, but also regionally.

2.1.3 Regional Materiality

To reconcile conflicts for MNE's with diverse stakeholders, SASB defined materiality, and Khan et al. (2016) and Kim and Lee's (2020) work, we introduce *Regional Materiality*. We define regional-level materiality as ESG factors that are critical decision-making factors for investment decisions of investors in a specific region. As a result, like the SASB industry-level material ESG factors, we suggest regional-level ESG materiality as a factor impacting an MNE's cost of debt.

Using the concept of *Dynamic Materiality*, Bala et al. (2020) tie in stakeholder responses to events and externalities in relation to companies and industries. As discussed, the diversity of stakeholders can have an impact on MNE operations and performance. As a result,

the concept of materiality is extended to industry, region, country, economic development, and company size (Bala et al., 2020). By extending the concept of materiality, Bala et al. (2020) find evidence for regional-level materiality and its effects on investor decision making. Using SASB ESG categories, ETF holdings as region benchmarks, and TruValue form scores, researchers were able to measure the *Levenshtein Distance* between country materiality signatures (Bala et al., 2020). Findings show that countries with similar resource-based economies are more likely to share environmentally related SASB ESG categories. Furthermore, developing economies facing corruption are more likely to find factors related to business ethics generally more material (Bala et al., 2020). Based on this, stakeholder responses are a key signifier to materially linked ESG issues; and further, regionally material ESG factors are important to consider for MNE performance. This is also corroborated by case-based data from Freiberg et al. (2020)'s study, which identified stakeholder response as a main mechanism to ESG issues becoming material. While Bala et al. (2020)'s paper finds empirical evidence for the regional differences as a determinant to materiality, the mechanisms that drive this phenomenon are relatively unclear and untested. While it is possible to point to specific incidents, such as strict data reporting in the EU through GPDR making data security a more material ESG factor within Europe than the rest of the world (Bala et al., 2020), it is not clear how policies, culture, and stakeholder behaviour affect ESG performance as a risk premium. As a result, it is not possible to conclude how industry-level ESG materiality influences a firms' cost of debt financing when compared to regional-level ESG materiality.

2.1.4 Country Bias

When investigating MNE behaviour in host countries, evidence shows that firms headquartered in developed markets tend to take a local rather than global approach, leading to lower *Corporate Irresponsibility Scores* (CSI), and higher ESG incidence rates (Salsbery, 2021). Given these findings, and the tendency of MNE's to adopt local management practices, it would be expected that developed market (DM) headquartered MNEs would have improved CSI scores as they would attempt to manage stakeholders in their host countries. However, the effect of governance and cross-cutting of DM firms operating in other countries leads to poorer CSI norms abroad (Salsbery, 2021). From these results, it follows that, while an MNE may operate in conditions outside of their home country, they tend to adopt CSI qualities of their *host* market, rather than placing a strong focus on ESG issues materially significant to the *home* market. Salsbery (2020) suggests that the perception of ESG importance is a factor in

the way MNEs operate in host countries. If the perception is that a host-country has a higher CSI rate, it is more likely that MNE's operating in that host country. By extension, lenders can also have a country bias effecting the perceived ESG performance of an MNE when evaluating for cost of debt financing.

Zu and Zueme's (2021) paper investigating this country-bias effect (also known has 'home-bias') finds that firms with domestic and foreign incidents have more negative abnormal returns for domestic incidents. This phenomenon occurs due to two factors: (1) shareholder sensitivities and (2) ownership country of origin. In their analysis, Zu and Zueme (2021) find that any shareholder return bias is due to the percentage of shareholder ownership in the incident country. While it is most likely that most shareholders are found in a firm's home country, it follows that the incident country will have more negative returns. Furthermore, the mediating effect of home-incident country distance, language, and media coverage variables are negligible. Additional returns find that the UK, Germany, Korea, and China are more likely to react more strongly to foreign events (Zu and Zueme, 2021). These regional differences are due to shareholder sensitives, lending to the idea that ESG materiality changes on a regional basis, but more specifically due the types of shareholders in those regions. These results further confirm the concept of regional ESG materiality and that lenders perceive ESG risk as higher for domestic firms than foreign firms. When investigating ESG factors on a regional basis, ESG incidents will be an important signal for materiality.

2.2 Cost of Debt & Materiality

2.2.1 Cost of Debt

To understand how a firm's focus on ESG materiality can impact the firm, we look to measure overall value and financial performance based on a measurement of a firm's cost of debt. The Corporate Finance Institute defines the cost of debt as "the return that a company provides to its debtholders and creditors" (Corporate Finance Institute, n.d.). Accordingly, the cost of debt helps external stakeholders to understand the overall rate being paid by a company using debt financing (Stanišić et al., 2016). Capital providers must be compensated for risk exposures related to lending financing to firms, indicating that the higher the risk (in this case, risk derived from ESG issues), the higher the cost of debt (Corporate Finance Institute n.d.; Stanišić et al., 2016).

2.2.2 Cost of Debt determinants

When lending firms are considering loaning capital to a borrowing firm, there are multiple factors that are considered in the decision-making process to determine the cost of debt financing. Research by Stanišić et al. (2016) outlines an exhaustive list of the general determinants for the cost of corporate debt, including firm size, financial leverage, assets, interest, debt ratio, short-term and long-term debt, and the presence of capital. According to prior research, we have determined that there are four significant variables consistently found to have a significant relation to determining the rate of cost of debt financing and should therefore be controlled for specifically when looking to understand other relationships with the rate. These factors are firm size, financial leverage, return on assets (used as a proxy for firm performance/profitability), and interest rate coverage ratio (Eliwa et al., 2021; Maaloul et al., 2021; Raimo et al., 2021; Stanišić et al., 2016). In understanding the interplay between these factors and the associated financing rates, we can understand outlying relationships between the cost of debt and any other factors that may be accounted for in determining debt financing rates.

2.2.3 ESG compliance and Cost of Debt

Despite the increasing awareness of ESG issues in business and the associated risks and compliance versus non-compliance, it is still a relatively new topic in literature-particularly regarding the relationship between ESG issues and cost of debt financing. The majority of recent research exploring this relationship finds that there is negative association between ESG performance and disclosure and the cost of debt (Eliwa et al., 2021; Maaloul et al., 2021; Raimo et al., 2021). In other words, it has been found that firms with higher ESG performance and disclosure scores will be rewarded with a lower cost of debt from lending firms (Eliwa et al., 2021; Maaloul et al., 2021; Raimo et al., 2021).

Eliwa et al. (2021) have found that as ESG performance increases, the interest (i.e., cost of debt financing) that the lending firms are willing to set as risk collateral for borrowing firms decreases; meaning that ESG performance is *integrated* in risk evaluation in addition to default risk as a part of the lending decision model. Alternatively, Raimo et al. (2021) found that higher levels of ESG disclosure allows for higher levels of transparency for a firm, which leads to a reduction in debt financing costs. Specifically, this negative association was found in reference to different types of disclosure, including voluntary disclosure, financial

disclosure, and carbon emissions disclosure (Raimo et al., 2021). Findings by Maaloul et al. (2021) go further in saying that the negative relationship between the cost of debt and ESG performance and disclosure is not direct but indirectly mediated by corporate reputation. Studies show that strong management and transparency regarding ESG issues will enhance a firm's reputation, leading to reductions in cost of debt financing (Maaloul et al., 2021).

The reason for the negative relationship between ESG compliance and cost of debt found across literature ultimately comes down to risk – specifically, reputational risk. Banks have both financial and reputational reasons for focusing on firms' ESG performance and disclosure when evaluating for debt financing decisions (Houston & Shan, 2019). Firms that have poor ESG performance scores have a greater potential to have greater credit risk. This is because poor ESG performers are more likely to face backlash from stakeholders, which could lead to negative publicity, boycotts, and increased regulation or litigation – all of which would have costly consequences and, thus, have a great impact on a firm's ability to repay their debts (Houston & Shan, 2019). Through proven sustainability performance and higher levels of disclosure on ESG issues, borrowing firms can reduce risk to lending firms by increasing transparency and showing that they are not hiding any potentially adverse information that could negatively impact firm value through reputational damage (Eliwa et al., 2021; Houston & Shan; Raimo et al., 2021).

2.2.4 ESG compliance and information asymmetry

In further demonstration of the relationship between the cost of debt and ESG performance and disclosure, literature has numerous explanations to describe why the relationship exists. Greater transparency not only increases corporate reputation, but it is also linked to a lower levels of *information asymmetry* between borrowing and lending firms (Eliwa et al., 2021; Raimo et al., 2021). Information asymmetries, which are the result of one firm having more information over another in any sort of interaction or transaction (such as debt financing), increasingly consider non-financial aspects of corporate management (such as ESG issues). This is because non-financial factors like ESG issues can greatly impact reputational risk (Raimo et al., 2021). Accordingly, firms can mitigate agency conflicts and reduce overall risk to lending firms by lowering information asymmetry through greater transparency in their ESG reporting, making it an important consideration when investigating the relationship between ESG compliance and the cost of debt, and further the impact of industry versus regional materiality focus (Eliwa et al., 2021).

2.2.5 ESG compliance and relationship lending

Research by Houston & Shan (2019) explains how firms consider ESG profiles in their debt financing decisions, revealing that banks are more likely to grant loans to firms that have positive or similar ESG profiles to their own. This ultimately comes back to the relation of ESG compliance to risk management, as firms with greater ESG non-compliance are more likely to face greater credit risk (Houston & Shan, 2019). It can also be argued that banks are likely concerned with protecting their own reputation and social capital, indicating that they are more likely to engage in business with borrowing firms that exhibit strong ESG performance, or have ESG interest alignment (Houston & Shan, 2019). Relationship lending plays a critical role in cost of debt evaluation and will be an important consideration in our study when looking at how firms also consider industry and regional factors in forming lending relationships.

2.3 Hypothesis Development

Given the extant literature on firm, stakeholder, and lender behaviour with respect to ESG materiality, we propose the following hypotheses. In our discussion on firm lenders, we assume firm-lenders are from a firm's home-country, as studies show majority of firm lenders belong to firm's home-country (Zu and Zueme, 2021).

Hypothesis 1: As a firm's ESG incident frequency increases, its cost of debt will increase.

Through hypothesis 1, we want to establish a relationship between incident frequency and the cost of debt. In general, we expect that the cost of debt of a firm will increase if it is associated with a high number of incidents abroad. We expect that firm lenders associate a higher frequency of ESG related incidents with a higher reputational and operational risk. As this has a direct bearing on a firm's financial performance, lenders will expect a higher premium on loans.

H1: There is a positive relationship between the frequency of ESG incidents and the CoD.

In our tests of hypothesis 1, we expect the cost of debt to increase as the frequency of ESG incidents increases. The positive relationship between ESG incidents and the cost of debt would be driven primarily by reputation and risk. As we focus on incidents – primarily high to medium severity incidents and high reach incidents – we expect lenders to be aware of such

incidents and thus respond by increasing the cost of debt financing. If hypothesis 1 is proven, we can establish a relationship between the ESG incident frequency and the cost of debt, allowing further analysis of materiality in hypothesis 2.

If hypothesis 1 is not proven, this would indicate that there is not a significant relationship between the frequency of ESG incidents and the cost of debt. As discussed in our literature review, the home-bias effect could lead lenders in each company's home-country to neglect high to medium severity and high reach incidents to favour other metrics to determine firm cost of debt. Furthermore, since we do not distinguish between material and immaterial factors, this could be another factor resulting in an insignificant relationship.

Hypothesis 2: As a firm's ESG incident frequency in material factors increases, its cost of debt will increase.

In hypothesis 2, we introduce the concept of materiality on a regional and industry basis. We split hypothesis 2 into three parts. We first attempt to establish a relationship between regional materiality and the cost of debt. Then, we test the relationship between industry materiality and the cost of debt. To understand the effect of these different material factors, we attempt to test the comparative effects of regional and industry level materiality on the cost of debt.

H2a: There is a positive relationship between the frequency of regionally material ESG incidents and the CoD.

To prove the effect of materiality on the cost of debt for firms, we first test all firms with strong performance on regionally material ESG factors. We define strong performance by a low comparative frequency of incidents on regionally material ESG factors. A positive relationship between the frequency of a firm's regionally material ESG incidents and its cost of debt means that lenders are generally more sensitive to their regional ESG factors than other ESG factors. A higher lending premium is then given to firms with higher regionally material ESG factors. Firms with lower immaterial ESG incidents or firms with a high rate of ESG incidents are not tested.

H2b: There is a positive relationship between the frequency of industry material ESG incidents and the CoD.

To understand the relationship between industry level materiality and the cost of debt, we attempt to extend the research of Khan et al. (2016) which proves industry level materiality influences firm-stock performance. Our paper defines strong ESG performance by a low comparative frequency of incidents on industry level material ESG factors. A positive relationship between the frequency of a firm's industry material ESG incidents and its cost of debt means that lenders are generally more sensitive to sector-level ESG incidents and will assign higher lending premiums to firms that incur higher industry level ESG incidents when compared to their peer groups.

H2c: Firms with a lower occurrence of regionally material ESG incidents will have a lower CoD than firms with a lower occurrence of industry material ESG incidents.

To understand the mechanisms of regional and industry level materiality, H2c compares the cost of debt for firms that have lower frequencies of incidents. If H2c is proven, the effect of regional materiality is stronger than industry-level materiality; and, by extension, lenders are more sensitive to regional events than within sectors. Based on integrative stakeholder theory, we expect that ESG materiality will change based on region. Specifically, there will be a more significant positive relationship between ESG materiality on a regional basis and cost of debt than on an industry basis. Furthermore, information asymmetry will be lowered when firms exhibit a stronger performance on regional ESG factors, further lending to the idea that cost of debt will be lowered. However, relationship lending theory may negate this relationship as lenders would perceive a lower ESG risk on strong industry-level ESG performance.

3.0 Research Methodology

3.1 Variable measurement

3.1.1 Dependent variable: Cost of Debt (*CoD*)

The Cost of Debt (*CoD*) represents the dependent variable being measured in our study. As in the study by Eliwa et al. (2021), the cost of debt in this study is measured using the standard accounting formula, which is a calculated as a ratio of a firm's total interest expense to its average debt. The reasoning for this, as noted by Eliwa et al. (2021), is that studies have shown that ESG performance is more highly related to accounting-based measures than market-based measures.

3.1.2 Independent variables: ESG incident frequency (Total, Industry/Regionally Material)

ESG incident frequency represents the independent variable being measured against the dependent variable in our study. We look at ESG incident frequency on a basis of three levels of measurement – total incident frequency (*Total_Incdnt_Freq*), incident frequency of industry material ESG issues (*Industry_Incdnt_Freq*), and incident frequency of regionally material ESG issues (*Regional_Incdnt_Freq*).

For each level of ESG incident frequency, we look at frequency on a company level and ESG issue level, which allows us to make a distinction between material and immaterial ESG issues. The measure of ESG incident frequency in our study is used as a proxy for ESG performance, with a lower incident occurrence indicating stronger performance in ESG issues. Since ESG performance is used as a proxy for ESG incident frequency, this data is less biased and represents an objective measure of firm performance, in contrast to typical measure of ESG disclosure scores that are measured based on publicly available information available in firms' annual reports, ESG and sustainability reports, and websites (Eliwa et al., 2021).

3.1.3 Control variables: Size, Leverage, Return on Assets, Interest Rate Coverage

When lending firms are considering loaning capital to a borrowing firm, there are multiple factors that are considered in the decision-making process to determine the cost of

debt financing. Research by Stanišić et al. (2016) outlines an exhaustive list of the general determinants for the cost of corporate debt, including firm size, financial leverage, assets, interest, debt ratio, short-term and long-term debt, and the presence of capital.

According to prior research, we have determined that there are four variables that are consistently found to have a significant relationship in determining cost of debt financing and should therefore be controlled for specifically when looking to understand other existing relationships. These factors, representing the control variables in our study, are firm size (*Size)*, financial leverage (*Lev)*, return on assets (used as a proxy for firm performance/profitability) (*ROA*), and interest rate coverage ratio (*Int_Cov)* (Eliwa et al., 2021; Maaloul et al., 2021; Raimo et al., 2021; Stanišić et al., 2016). In understanding the interplay between these factors and the associated financing rates, we can understand outlying relationships between the cost of debt and any other factors that may be accounted for in determining debt financing rates.

Based on previous research, the relationships between *CoD* and *Size*, *ROA,* and *Int_Cov* are expected to be negative (Eliwa et al., 2021). Larger firms generally have access to more resources, and thus are expected to be able to pay for external financing, explaining why as size increases, the cost of debt decreases (Eliwa et al., 2021). A strong ROA usually indicates a strong financial position, supporting a firm's ability to pay interest on financing, explaining why as ROA increases, cost of debt decreases. Since interest coverage is a measure of a firm's ability to pay interest costs, a higher interest coverage ratio likely indicates a firm's ability to pay cost of debt financing, explaining why as interest coverage increases, cost of debt decreases (Eliwa et al., 2021). The relationship between the cost of debt and leverge is expected to be positive (Eliwa et al., 2021).

3.2 Data and sample

3.2.1 Materiality Matrix Construction

3.2.1.1 Industry Materiality Matrix

To remain consistent with extant research on industry materiality (Khan et al., 2016), we determine industry materiality from the SASB Standards industry materiality matrix (SASB, 2021). The SASB (Sustainability Accounting Standards Board) is a non-profit organization aimed to assist businesses and investors to create a common language surrounding sustainable business operations and sustainable finance for long term value. The

SASB standards can be used as a tool to implement principles supported by the TCDF (Task Force for Climate-related Financial Disclosures) framework. The SASB aims to align accounting metrics for ESG related disclosure topics and currently works closely with the GRI (Global Reporting Initiative) and other entities to achieve this goal (SASB, 2021).

The SASB Financial Materiality standards are intended to represent ESG factors that are materially significant to short-, medium- and long-term enterprise value (SASB 2021). The SASB ESG dimensions are categorized by Environment, Social Capital, Human Capital, Business Model & Innovation, and Leadership & Governance topics. Based on the SASB Dimension and 26 General Issue Categories definitions and 73 RepRisk topic issue definitions, we develop a final topic-issue mapping of 26 ESG topics, seen in Appendix 1 Table 1. This topic-issue mapping is consistent for all our ESG incident data.

The SASB Industry Classification system groups industries based on common sustainability risks, allowing a more comprehensive comparison system of company ESG performance. In our research, we use the 2021 SASB industry materiality matrix. The SASB matrix defines industry materiality as the following:

> "1. Issues likely to be material for more than 50% of industries in a given sector.
>
> 2. Issues likely to be material for fewer than 50% of industries in a given sector.
>
> 3. Issues not likely to material for any of the indies in a given sector." (SASB, 2021).

In our analysis, we considered materiality only for issues likely to be material for over 50% of industries in a given sector. These are highlighted as dark grey by the SASB Materiality matrix, available in Appendix 1 Figure 1. We then mapped the RepRisk industries to the SASB Thematic sectors based on the SASB and RepRisk sector definitions, available in Appendix 1 Table 2. This sector mapping is consistent for all our ESG incident data.

Our final Industry Materiality matrix, adapted directly from the SASB Industry Materiality matrix is included in Appendix 1 Table 3. For all ESG topics likely to be material for over 50% of industries in a given sector, a numeric value of 1 is given. For all other ESG

topics likely to be material for less than 50% or ESG topics designated as *not likely to be material*, a numeric value of 0 is given.

3.2.1.2 Regional Materiality Matrix

The sample of regions we use to determine a measure of regionally material ESG issues consists of the geographic regions defined by the World Bank lending group classifications (World Bank, 2022). These regions are East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa, North America, South Asia, and Sub-Saharan Africa, abbreviated to EAP, ECA, LAC, MNA, NAM, SAS and SSA respectively, as based on the World Bank abbreviations (World Bank, 2022).

To create the regional materiality matrix, we merged the World Bank regions and RepRisk ESG incident location and frequency data with the SASB topic data. The RepRisk data base includes 20,000 publicly traded firms around the world (RepRisk, 2022). RepRisk's data sources include over 100,000 public sources in over 23 languages. These sources range from print and online media, governmental bodies, and other online sources. RepRisk further categorizes these sources on a regional, national, and local basis (RepRisk, 2022). RepRisk's strength as a database and its application to our paper is its focus on credit risk management. RepRisk excludes self-reported firm data, removing any firm bias from its analysis. Compared to other available ESG databases such as MSCI (formerly KLD), Bloomberg, and Sustainalytics, RepRisk's data is exclusively from news-sources; giving it the unique ability to directly link ESG risk with world-events that are categorized by ESG topic and location.

To collect the data used to determine regional materiality, we use the Wharton Research Data Services RepRisk- Standard Package – Public Companies with News- Topic Tag and Location Data queries. For a date range of 2007-2020, we downloaded the following variables for Topic Tag: ISIN (international securities identification number), reprisk_id (the internal RepRisk ID for a given company), date, topic_tag (the ESG topic associate with the incident), high_severity, medium_severity, and high_reach_source. Similarly, for the date range of 2007-2020, we downloaded the following variables for Location data: company name (name), ISIN, reprisk_id, date, country, high_severity, medium_severity, and high_reach_source. In our query, we filter for observations that include only high severity incidents, medium severity incidents, and incidents from high reach sources. We refine our search using the following where-clause: (high_severity > 0 OR medium_severity > 0 OR high_reach_source > 0).

Merging the above RepRisk topic tag and location data and the World Bank geographic regions with the SASB topic tags, we determined the frequency of incident occurrence under each topic tag in each region. A total incident frequency of N 31,049 was found across all SASB topic tags and World Bank geographic regions (Appendix 2, Table 1). Appendix 2 Table 2 displays the percentage frequency of incident occurrence in each region, showing the greatest frequency in NAM and EAP regions at 26.93% and 24.1% respectively. Through the analysis of incident frequency data under each SASB topic tag against each World Bank geographic region, we determined which topic tags are regionally material. We determined that in all instances, any SASB topic tag with a total incident frequency greater than 100 across all regions would be considered, except for "Business model resilience" and "Energy management", given their frequency in the SASB materiality matrix. Considering the incident count for each topic in each region, we calculated the average incident count for each topic tag. In each region, a topic is considered material if the incident frequency is greater than or equal to the average number of incidents. An exception is made when total incident frequency for the topic is above 100, where frequency greater than or equal to the average minus 10 are considered. An example of this can be seen in the case of the SASB topic tag "Employee health and safety" in Table 1 Appendix 2, where the frequency average is approximately 434 but was deemed material in EAP at an incident frequency of 431. Additionally, any incident frequency above 1000 is considered material. An example of this can be seen in the case of the SASB topic tag "Ecological impacts" in Table 1, where the frequency average is approximately 1135 but was deemed material in ECA at an incident frequency of 1013. A full list of SASB topics considered regionally material in at least one region can be found in Appendix 2, Table 3. All topics deemed to be regionally material were assigned a score of 1 in the regional materiality matrix, which can be seen in Appendix 2. Conversely, any topic is considered immaterial if the incident frequency is less than or equal to the average number of incidents, excluding those considered material through the stated exceptions. All topics deemed to be regionally immaterial were assigned a score of 0 in the regional materiality matrix (Appendix 2).

3.2.2 CoD Data, and control variables

To collect the data needed to calculate the dependent variable, *CoD*, and the associated control variables, we use the Wharton Research Data Services Compustat – Capital IQ database. S&P Global Market Intelligence, the provider of the Compustat – Capital IQ

database, is a leading provider of financial and industry data, research, news, and analytics data for investment professionals, government agencies, corporations, and universities (WRDS, 2022). Specifically, Compustat Fundamentals provides standardized North American and global financial statements and market data for over 80,000 active and inactive publicly traded companies (WRDS, 2022). S&P Compustat's strength as a database and its application to our paper is representation of global data. Our analysis depends on a comparison of both industry and regional level information, making access to globally diverse information an important factor. Additionally, compared to other databases, Compustat lists their global data by International Securities Identification Numbers (ISINs) and North American data by CUSIP ID codes (WRDS, 2022). This is an important distinction because the RepRisk database lists their data by ISIN (in additional to their internal RepRisk ID), allowing for the comparison of both cost of debt and ESG incident data. To use the North American Compustat data, we needed to convert the RepRisk ISINs to CUSIP ID codes. To do this, we converted the ISINs to CUSIP8, then used the WRDS CUSIP converter query to convert the resultant CUSIP8 data to CUSIP9 to match the Compustat data, which ultimately allowed us to append the Compustat and RepRisk North American data sets.

Data for the dependent *CoD* and control variables was collected through the execution two separate queries on WRDS: Compustat Global – Fundamentals Annual and Compustat Daily Updates – Fundamentals Annual (North American data). For a date range of 2007-2020, we downloaded the following variables for the Global query: company name (CONM), International Security ID (ISIN), Data Year – Fiscal (FYEAR), Debt in Current Liabilities – Total (DLC), Long-Term Debt – Total (DLTT), Assets – Total (AT), Net Income (Loss) – Consolidated (NICON), Operating Income Before Depreciation (OIBDP), Interest and Related Expense – Total (XINT), Income Taxes – Total (TXT), and Earnings Before Interest and Taxes (EBIT). Similarly for the Daily Updates (North American) query, for a date range of 2007-2020, we downloaded the following variables: company name (CONM), CUSIP (CUSIP), Data Year – Fiscal (FYEAR), Debt in Current Liabilities – Total (DLC), Long-Term Debt – Total (DLTT), Assets – Total (AT), Net Income (Loss) (NI), Operating Income Before Depreciation (OIBDP), Interest and Related Expense – Total (XINT), Income Taxes – Total (TXT), and Earnings Before Interest and Taxes (EBIT). A total of N 215,231 observations were collected from the queries. Table 1, Appendix 3 reports how the dependent variable *CoD* and each individual control variable was calculated using the data collected from the Compustat database.

3.2.3 ESG Data- RepRisk incidents

3.2.3.1 Hypothesis 1 Total Incidents Frequency

Appendix 4 Tables 1-4 show a summary of the final RepRisk ESG data set. A summary of the total number of world regions, incident topics, sectors, and years available in the final sample data set. Due to the availability of news resources and financial information our sample data set is comprised of primarily EAP, ECA, and NAM businesses, at 23 %, 29%, and 34% respectively.

With respect to SASB incident topic, the majority of incidents are environmental and social related factors with 25% attributed to "Ecological impacts", 26% to "Human rights and community relations", and 10% for "Labour practices". All other incidents are roughly between 1 to 10% with the exceptions of "Air quality", "Customer welfare", "Employee engagement diversity and inclusion", "Materials sourcing, and efficiency", "Selling practices and product labelling", and finally "Waste and hazardous materials" at roughly 0.01% of observations.

Year data is roughly uniform with from 7 to 10% of observations for each year between 2011 to 2020. Years 2007 to 2010 ESG incident counts are low. This can be attributed to multiple factors, low reporting on ESG factors as the concept of Environmental Social Governance would have been relatively novel before 2012. It is noted that 2016 makes up roughly 6% of observations, which is low for the years between 2011 and 2020. This trend is seen throughout our sample data sets.

With reference to the industries included in our data set, financial industries make up only 0.91% of all incident observations. Industrial and manufacturing-based industries such as "Extractive and minerals processing", "Infrastructure", and "Renewable resources and alternative energies" make up most observations at 31%, 14% and 13% respectively; with all remaining industries making up 1 to 10% of the sample data set.

With respect to the variables measured for our regression, we determine the frequency of ESG incidents by finding the total sum of High Severity, Medium Severity and High Reach topics per ESG topic, per company, and per year. This variable is named *Total_Incdnt_Freq*. This variable is log normalized within our analysis. Due to spread of the data, however, the total incident frequency has the least normal distribution out of all our dependant and control variables. The mean is 2.87 with a standard deviation of 1.58. Our dependant variable is the

cost of debt (*CoD)* with a mean of 1.38 and a standard deviation of 0.71. Our control variables are Size (*Size)*, Leverage (*Lev),* Return on Assets (*ROA*), and Interest Coverage Rate (*Int_Cov)*. The summary of our variable descriptive statistics is found in Appendix 4, Table 5.

3.2.3.2 Hypothesis 2

Out of the hypothesis 1 sample data set and our constructed regional and industry materiality matrices, we develop variables for hypothesis 2a and 2b. From the Hypothesis 1 data set, we calculated total frequencies of Medium Severity, High Severity and High Reach Count incidents per ESG topic. Appendix 5, Table 1 contains total incident frequencies per ESG topic. Any ESG topics with a frequency below 100 are excluded from our final analysis.

Hypothesis 2a Regional Materiality Incidents

To test hypothesis 2a that there is a positive relationship between the frequency of regionally material ESG incidents and the cost of debt, we transform the regional materiality matrix into a dummy variable called *RegionDummy*. The dummy variable ensures that we only include regionally material datapoints in our analysis, ultimately acting as a test variable for hypothesis 2. To create the test variable *Regional_Incdnt_Freq*, we then multiply the *RegionDummy* variable by total incident frequency log. Each firm with a value of one will have a resulting numeric value, while all firms assigned a value of zero will have a resulting value of zero. We then include the dummy variable in an interaction term with *CoD* in the main regression.

With respect to the variables measured for our regression, we determine the frequency of ESG incidents by calculating the total sum of High Severity, Medium Severity and High Reach topics per ESG topic, per company, and per year. This variable is named *Regional_Incdnt_Freq*. This variable is log normalized within our analysis. Due to spread of the data, however, the total regional materiality incident frequency has the least normal distribution out of all our dependant and control variables. The mean is 2.24 with a standard deviation of 1.82 indicating high spread in our data. Our dependant variable is the cost of debt (*CoD*) with a mean of 1.38 and a standard deviation of 0.71. Our control variables are Size (*Size)*, Leverage (*Lev),* Return on Assets (*ROA*), and Interest Coverage Rate (*Int_Cov).* The summary for hypothesis 2a variable descriptive statistics is found in Appendix 5, Table 2.

Hypothesis 2b Industry Materiality Incidents

To test hypothesis 2b that there is a positive relationship between the frequency of industry material ESG incidents and the cost of debt, we transform the industry materiality matrix into a dummy variable called *IndustryDummy.* As with the *RegionDummy* variable, this dummy variable ensures that we only include industry material datapoints in our analysis, ultimately acting as a test variable for hypothesis 2b. To create the test variable *Industry_Incdnt_Freq*, we then multiply the *IndustryDummy* variable by total incident frequency log. Each firm with a value of one will have a resulting numeric value, while all firms assigned a value of zero will have a resulting value of zero. We then include the dummy variable in an interaction term with *CoD* in the main regression.

With respect to the variables measured for our regression, we determine the frequency of ESG incidents by calculating the total sum of High Severity, Medium Severity and High Reach topics per ESG topic, per company, and per year. This variable is named *Industry_Incdnt_Freq*. This variable is log normalized within our analysis. Due to spread of the data, however, the total industry materiality incident frequency has the least normal distribution out of all our dependant and control variables. The mean is 0.77 with a standard deviation of 1.57 indicating high spread in our data. Our dependant variable is the cost of debt (*CoD*) with a mean of 1.38 and a standard deviation of 0.71. It is important to note that the data is not normally distributed and is highly right-skewed. Our control variables are Size (*Size)*, Leverage (*Lev),* Return on Assets (*ROA*), and Interest Coverage Rate (*Int_Cov)*. The summary of our variable descriptive statistics is found in Appendix 5, Table 3.

3.3 Main tests and results

To test the relationship between the cost of debt and ESG incidents across world regions and sectors, we develop a regression model that first tests the overall effect of ESG incidents on the *CoD*, then progressively add further terms through fixed effects and additional control variables to understand the mechanisms between the *CoD* and ESG performance. Due to the nature of the data set, regression tests will be a clustered standard error regression model. The data collected from RepRisk includes multiple repeated incidents within a given year as RepRisk updates its incident frequency on a monthly basis (RepRisk, 2022). Through our treatment of the data by merging the RepRisk and Compustat data, repeated data points are present for a given company, year, and incident type. As a result, a clustered analysis on the

firm level will lower standard errors and account for the overrepresentation of large corporations within the data set. Additionally, as a panel type data set, where data is stored by year, region and industry, fixed effects testing is conducted to test the robustness of the regression results to ensure any biases affecting the cost of debt are accounted for. Since our data contains multiple observations across years, regions, and industries, it is important to introduce fixed effects into our regression models that test for the statistical significance of variations across multiple observations (Farkas, 2005). Fixed effects use data of individuals that have multiple observations and estimates effects of variables that change across observations (Farkas, 2005). In our analysis, we use year, country, and industry fixed effects. All variables discussed in this section are further defined in Table 1, Appendix 6.

3.3.1 Hypothesis 1: Proving the relationship between cost of debt and ESG incident frequency

To understand the relationship between ESG incident frequencies and the cost of debt, we propose four regression tests. These tests first attempt to prove a strong and significant relationship between the cost of debt and ESG incident frequencies. Fixed effects by year, company country headquarters, and company industry are added to robustly test the causality of ESG incident frequency on the cost of debt. As a basis, these tests are important to understand how differences in countries and industries may affect the cost of debt. Control variables of size, leverage, return on assets, and interest coverage are all controlled for in all tests.

In model 1, we develop a basic OLS regression model to understand the basic relationship between Cost of Debt with the Total ESG Incident Frequency. Where i represents the firm.

$$CoD = \alpha + \beta_1 Total\ Incidents_i + \beta_2 Size_i + \beta_3 Lev_i + \beta_4 ROA_i + \beta_5 IntCov_i + \varepsilon_i \quad (1)$$

In model 2, we add year fixed effects τ, by year t.

$$CoD = \alpha + \beta_1 Total\ Incidents_{it} + \beta_2 Size_{it} + \beta_3 Lev_{it} + \beta_4 ROA_{it} + \beta_5 IntCov_{it} + \tau_t + \varepsilon_{it} \quad (2)$$

Model 3 further adds country fixed effects δ, by country c.

$$CoD = \alpha + \beta_1 Total\ Incidents_{itc} + \beta_2 Size_{itc} + \beta_3 Lev_{itc} + \beta_4 ROA_{itc} + \beta_5 IntCov_{itc} + \tau_t + \delta_c + \varepsilon_{it} \quad (3)$$

Finally, in model 4, industry (or sector) fixed effects θ, by sector s are added.

$$CoD = \alpha + \beta_1 TotalIncidents_{its} + \beta_2 Size_{its} + \beta_3 Lev_{its} + \beta_4 ROA_{its} + \beta_5 IntCov_{its} + \tau_t + \theta_s + \varepsilon_{its} \quad (4)$$

3.3.2 Hypothesis 2: The case of ESG materiality and its effects on cost of debt

Hypothesis 2a and 2b utilize dummy variables to represent materiality by region and industry. Hypothesis 2a tests regional materiality, by which countries are implicitly treated by the creation of the region-materiality incident frequency (*Regional_Incdnt_Freq*) test variable. As defined in section 3.2, ESG incidents that are not deemed regionally material are set to zero, and country data in the *Regional_Incdnt_Freq* variable is impacted. Therefore, a country-fixed effects test is not conducted. Furthermore, an additional variable, total incident frequency (*Total_Incdt_Freq*) is added as a control variable. Out of the regionally material incident frequencies, we want to control for firms that have an abnormal size of incidents as this can vary widely by region. Given that RepRisk uses news incidents, we anticipate countries with comprehensive news coverage to overreport ESG incidents despite their actual severity and frequency.

Model 5 first tests year fixed effects τ, by year t. This creates a basis to compare against the effect of industry in model 6.

$$CoD = \alpha + \beta_1 TotalIncidents_{it} + \beta_2 Size_{it} + \beta_3 Lev_{it} + \beta_4 ROA_{it} + \beta_5 IntCov_{it} + \beta_6 RegionDummy * TotalIncidents_{it} + \tau_t + \varepsilon_{it} \quad (5)$$

Model 6 has the additional industry (or sector) fixed effects term θ, by sector s.

$$CoD = \alpha + \beta_1 TotalIncidents_{its} + \beta_2 Size_{its} + \beta_3 Lev_{its} + \beta_4 ROA_{its} + \beta_5 IntCov_{its} + \beta_6 RegionDummy * TotalIncidents_{its} + \tau_t + \theta_s + \varepsilon_{its} \quad (6)$$

Similarly, for hypothesis 2b, we add total incident frequency as a control variable to control for variability in incident reporting as research shows firm characteristics can influence media coverage (Jonkman et al., 2020). In addition, industry-fixed effects testing is not conducted. Industry data in the industry material incident frequency (Industry_Incdnt_Freq) test variable is impacted due to the creation of the industry materiality dummy variable.

Like models 5 and 6, model 7 first tests a basis of year fixed effects τ, by year t to contrast against additional country fixed effects in model 8.

$$CoD = \alpha + \beta_1 TotalIncidents_{it} + \beta_2 Size_{it} + \beta_3 Lev_{it} + \beta_4 ROA_{it} + \beta_5 IntCov_{it} + \beta_6 IndustryDummy * TotalIncidents_{it} + \tau_t + \varepsilon_{it} \quad (7)$$

Model 8 adds country fixed effects δ, by country c.

$$CoD = \alpha + \beta_1 TotalIncidents_{itc} + \beta_2 Size_{itc} + \beta_3 Lev_{itc} + \beta_4 ROA_{itc} + \beta_5 IntCov_{itc} + \beta_6 IndustryDummy * TotalIncidents_{itc} + \tau_t + \delta_c + \varepsilon_{itc} \quad (8)$$

Finally, in hypothesis 2c, we combine all test variables to compare industry and region materiality moderating effects. A summary table of all tests is found in Appendix 6, Table 2.

Model 9 contains the year fixed effects τ, by year t. In this model, we can compare the Regional Materiality and Industry Materiality interaction terms with Total Incident frequencies to understand their overall effect on firm cost of debt.

$$CoD = \alpha + \beta_1 TotalIncidents_{it} + \beta_2 Size_{it} + \beta_3 Lev_{it} + \beta_4 ROA_{it} + \beta_5 IntCov_{it} + \beta_6 IndustryDummy * TotalIncidents_{it} + \beta_7 IndustryDummy * TotalIncidents_{it} + \tau_t + \varepsilon_{it} \quad (9)$$

3.4 Results

Table A (continued in Table B)

This table represents the results of regression tests conducted to explain the relationship between firm cost of debt and ESG incident frequencies. The first four tests attempt to create a basic relationship between ESG incident frequencies and the cost of debt while the remaining five test introduce regional and industry materiality by testing the relationship to cost of debt on material factors *only*. Standard errors are clustered by firm (or ISIN which is the variable for firms within the data set). The following *, **, *** indicate significance at the 90%, 95%, and 99% confidence levels. Table 1 in appendix 6 contains a summary of all variables used. T statistics are in parentheses and variable coefficients are listed above the T statistics.

	Cost of Debt			
	Hypothesis 1			
	1	2	3	4
Total_Incdnt_Freq	**0.020* (1.84)**	**0.019* (1.75)**	**0.010* (1.81)**	**0.0091 (1.03)**
Regional_Incdnt_Freq				
Industry_Incdnt_Freq				
Size	-0.037** *(-5.43)*	-0.037*** (-5.33)	-0.033*** (-4.91)	-0.035*** (-5.34)
Lev	-0.81*** (-36.22)	-0.80*** (-35.80)	-0.78*** (-30.86)	-0.80*** (-36.34)
ROA	0.24*** (14.2)	0.24*** (13.82)	0.19*** (11.67)	0.24*** (14.38)
Int_Cov	-0.75*** (-34.81)	-0.75*** (-34.79)	-0.70*** (-27.97)	-0.76*** (-35.73)
Constant	9.28*** (43.39)	9.33*** (43.54)	9.61*** (41.11)	9.46*** (43.34)
Observations	33,574	33,574	33,574	33,574
R-squared	0.7239	0.7268	0.7911	0.7411
Clustered SE (ISIN)	YES	YES	YES	YES
Year FE	NO	YES	YES	YES
Country FE	NO	NO	YES	NO
Industry FE	NO	NO	NO	YES

Table X continued below

As seen in table A, we find statistical *significanc*e of the effect of ESG incident frequency on a firm's cost of debt. In models 1 to 3, the R-squared values are moderately high showing good fit with correlations at 0.020, 0.019, and 0.010 respectively. As all variables in the models are log-normalized, we can interpret percent changes in our test to have a percentage change in our test variable, which is in line with conventional statistical research (Ford, 2018). These results show that for a 1% increase in a firm's ESG related incidents, its cost of debt is expected to increase by 0.020%, 0.019% and 0.010% respectively for models 1 to 3. We note that these results have a lower statistical confidence of 90% when contrasted with other test variables in other models. Generally, we find low to moderate T-statistics (magnitudes ranging from 1.75 to 43.54), which indicate some large standard errors and variance from the proposed models. Reviewing comparable literature by Eliwa et al. (2021), and Khan et al. (2016), we find these T-statistics acceptable.

Furthermore, we find the addition of year and country fixed effects are statistically significant. T-statistics and P-value ranges do not have any appreciable change, showing that standard errors and model fit does not significantly change with the addition of these fixed effects. Model 4 adds industry fixed effects which is statistically *insignificant*, indicating that the differences in firm industry type does not affect the overall relationship between ESG incident frequency and cost of debt. With respect to our models' control variable coefficients, we find that Size, Leverage, and Interest Coverage have a negative relationship with the cost of debt, while Return on Assets has a positive relationship. These results generally conform with extant literature investigating the cost of debt (Eliwa et al., 2021; Erragragui, 2018). Additionally, the coefficients of these control variables do not vary between models significantly, indicating a good fit and selection of these control variables and their effect on the cost of debt.

Table B

	Cost of Debt				
	Hypothesis 2a		Hypothesis 2b		Hypothesis 2c
	5	6	7	8	9
Total_Incdnt_Freq	**0.025*** (2.66)**	**0.018** (2.19)**	**0.01 (0.94)**	**0.0093 (1.61)**	**0.022** (2.36)**
Regional_Incdnt_Freq	**-0.0085 (-1.04)**	**-0.013* (-1.68)**			**-0.017* (-1.80)**
Industry_Incdnt_Freq			**0.026*** (3.14)**	**0.044 (0.83)**	**0.030*** (3.2)**
Size	-0.037*** (-5.31)	-0.035*** (-5.32)	-0.037*** (-5.39)	-0.033*** (-5.01)	-0.037*** (-5.36)
Lev	-0.80*** (-35.86)	-0.80*** (-36.28)	-0.80*** (-35.77)	-0.78*** (-30.79)	-0.80*** (-35.71)
ROA	0.24*** (13.82)	0.24*** (14.46)	0.24*** (14.11)	0.19*** (11.74)	0.24*** (14.18)
Int_Cov	-0.75*** (-34.48)	-0.75*** (-35.51)	-0.75*** (-35.59)	-0.70*** (-28.08)	-0.75*** (-35.30)
Constant	9.33*** (43.33)	9.45*** (43.18)	9.36*** (44.09)	9.61*** (41.22)	9.34*** (43.86)
Observations	33,574	33,574	33,574	33,574	33,574
R-squared	0.7271	0.7416	0.7296	0.7912	0.7306
Clustered SE (ISIN)	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	YES	NO
Industry FE	NO	YES	NO	NO	NO

Table B contains the results of the tests conducted for hypothesis 2a, 2b, and 2c. For hypothesis 2a, which tests regional materiality using the regionally material ESG incidents as a test variable, we find significance for only model 6. This model uses both year and industry fixed effects, indicating that within regional materiality, the difference in industries is statistically *significant.* Otherwise, the fixed effects model using Year only is statistically *insignificant*. Additionally, T-values, P-values, and coefficients are consistent with extant

literature (Eliwa et al., 2021; Khan et al., 2016; Erragragui, 2018). In model 6, we find that for a 1% increase in regionally material ESG incidents, a firm's cost of debt is expected to increase by 0.013%, and for a unit increase in *any* ESG incident will increase a firms cost of debt by 0.018%.

Conversely, hypothesis 2b, which tests year then year and country fixed effects, finds statistical *significance* for industry material ESG effects for the year fixed effects model *only*. For a 1% increase in industry material ESG incidents a firm can expect a 0.026% increase in its cost of debt. It is important to note that total ESG incidents (which does not differentiate between material or immaterial industry ESG incidents) is *not* found to be statistically significant. As such, only industry ESG incidents are found to be statistically significant, and when comparing between material and immaterial ESG factors, only industry material incidents are likely to increase a firm's overall cost of debt. Additionally, as will all the models above, control variables of Size, Leverage, Return on Assets, and Interest coverage statistics remain consistent.

Finally, with respect to hypothesis 2c, which compares regional and industry materiality with overall ESG incident frequencies, we find that the year fixed effects model is *significant* for all three variables. Based on the regression coefficients for these variables all else equal, a 0.022% and 0.033% increase in cost of debt is expected for a 1% increase in total ESG incidents and industry material ESG incidents respectively. A 0.017% *decrease* in a firm's cost of debt is expected for a 1% increase in regionally material ESG incidents. We also note this statistic has the lowest statistical confidence at 90%. All other control variables within the regression model are found to have consistent statistics.

4.0 Discussion

4.1 Analysis of results

4.1.1 Hypothesis 1

In hypothesis 1, we predict that there is a positive relationship between the frequency of ESG incidents and the cost of debt. Through a series of four regression tests, we look to prove, alongside other studies, the existence and strength of this relationship. In model 1, we performed a clustered standard error regression. In the results, we found that with a 1% increase in total ESG incident frequency, there was a 0.020% increase in the cost of debt, which is found to be significant at a 90% confidence level. This both confirms our hypothesis and supports prior research by Eliwa, et al. (2021) and others on the relationship between the cost of debt and ESG performance and disclosure. More specifically, research by Eliwa, et al. (2021) states that that there is a negative relationship between ESG performance and disclosure (i.e., strong performance and higher disclosure) and the cost of debt, conversely indicating that there would be a positive relationship between the frequency of ESG incidents (which indicates lower performance) and the cost of debt.

In model 2, we performed a clustered standard error regression with year fixed effects. We introduce year fixed effects into this model to account for the fact that our data contains multiple observations across different years and want to understand how this may impact our findings. In the results, we found that with a 1% increase in total ESG incident frequency, there is a 0.019% increase in the cost of debt, which is found to be significant at a 90% confidence level. The results indicate that while controlling for year fixed effects is statistically significant, it only marginally changes the relationship coefficient of total ESG incident frequency and the cost of debt. From this, we can draw that conclusion that it is important to control for year fixed effects. These results further confirm our hypothesis and support prior research by Eliwa et al. (2021) and others about the negative relationship between ESG performance and the cost of debt (and conversely, the positive relationship between ESG incident frequency and cost of debt).

In model 3, we performed a clustered standard error regression with year and country fixed effects. Similar to model 2, we introduce both year and country fixed effects into this model to account for the fact that our data contains multiple observations across different years

and regions (or specifically, countries). In the results, we found that with a 1% increase in total ESG incident frequency, there is a 0.010% increase in the cost of debt, which is found to be significant at a 90% confidence level. The results indicate that the addition of country fixed effects is statistically significant and has a notable impact on the relationship coefficient, reducing the coefficient of model 1 by half (0.020 to 0.010). The reduction in the coefficient can be explained by the relationship between the cost of debt and regional materiality. Overall, there is a positive relationship between ESG incident frequency and the cost of debt, but this relationship is greatly reduced when looking at each country on an individual basis. This shows that there are great variations in the attention given to ESG incidents across countries and that country differences weakens the relationship between ESG incident frequency and the cost of debt.

To provide an understanding of the magnitude of the positive relationship between ESG incident frequency and the cost of debt, we apply the significant findings from models 1 to 3 to sample data from Apple corporation. With an effective interest of 2.15% and total debt of $118B, Apple currently has a cost of debt of approximately $2.5 billion (Apple Inc, 2021). With the cost of debt increase of 0.020%, 0.019%, and 0.010% in models 1, 2, and 3, Apple would experience an increase of $9.25, $8.80, and $4.62 million respectively; given an overall 20% increase in overall ESG incidents. A sample calculation can be reference in Appendix 7. While there are variations in these numbers, there is a sizeable impact on the cost of debt across all models. From this, we can draw a conclusion that it is important for all firms, especially larger firms with greater amounts of debt financing, to pay attention to their ESG performance and compliance to minimize their cost of debt financing.

To frame the results of models 1 through 3, we attempt to understand how ESG incident frequency impacts overall perceived risk. In our research, we found that the interest rates lending firms set will decrease as risk collateral decreases and ESG performance improves (Eliwa et al., 2021). Since ESG performance has become more highly integrated into risk assessment for lending firms, the perceived risk of firms experiencing a greater number of ESG incidents across categories is likely to increase, thus causing interest on debt financing to rise. Maaloul et al. (2021) attributes this to an indirect relationship mediated by corporate reputation, indicating that a firm's non-compliance with ESG issues damages their reputation and thus lowers their overall value with investors, making them a greater risk to lending firms. The positive relationship between ESG incident frequency and the cost of debt found in our

results is likely caused by damage to a firm's corporate reputation, which we can further attribute to the concept of relationship lending.

Relationship lending states that banks are more likely to grant cost of debt financing to firms that have a positive ESG profile or one like their own, which ultimately comes down to ESG compliance, risk management, and firm reputation (Houston & Shan, 2019). As firms that have poorer ESG performance (i.e., a greater number of ESG incidents) are more likely to face greater credit risks, banks are less likely to grant financing or more likely to increase interest on debt financing for firms experiencing a higher frequency of ESG incidents, further explaining the positive relationship found in our results. Banks are likely also concerned with protecting their own reputation and social capital, meaning they are more likely to engage with firms experiencing a lower frequency of ESG incidents or, conversely, increase the interest rate on debt financing of firms that are experiencing a higher frequency of ESG incidents. Reasoning for this is likely because many banks are moving towards a greater sustainability focus, meaning that association with poor ESG performers could indirectly harm their own reputation, thus pushing them to increase the cost of debt financing when firms are experiencing a higher rate of ESG incidents.

In model 4, we performed a clustered standard error regression with year and industry fixed effects. Similar to models 2 and 3, we introduce both year and industry fixed effects into this model to account for the fact that our data contains multiple observations across different years and industries. In the results, we found that with a 1% increase in total ESG incident frequency, there is a 0.0091% increase in total ESG incident frequency. This, however, was not found to be significant, indicating that industry fixed effects *do not* have a statistically significant impact on the relationship between ESG incident frequency and the cost of debt.

4.1.2 Hypothesis 2

The case for regional materiality

In hypothesis 2a, we test for the moderating effect of regional materiality and its effect on the cost of debt. Model 5 contains year fixed effects while model 6 contains year and industry fixed effects. We find that regionally material ESG incident frequencies in model 5 have no statistical impact on a firm's cost of debt. Model 5 also corroborates findings in models 1 to 3 where the total incident frequency increases a firm's cost of debt. We find that

for every 1% in total ESG incidents, a firm's cost of debt will increase by 0.025%, which is similar to other significant results in models 1 to 4.

The case of regional materiality is mixed, as only the addition of industry fixed effects in model 6 finds statistical evidence for the moderating effect on regional materiality on firm cost of debt. We find that for every 1% increase in a firm's regionally material ESG incidents, a firm cost of debt will *decrease* by 0.013%. Additionally, for each 1% increase in total firm ESG incidents, the cost of debt will *increase* by 0.018%. These results are not consistent with our expectations or literature for the effect of regional materiality. Eliwa et al. (2021) explore the moderating effect of countries to firm ESG performance and cost of debt. They prove their hypothesis and find that improved ESG performance and disclosure can decrease a firm's cost of debt. They argue that lowered informational asymmetry is a key determinant to the cost of debt. When firms have improved ESG disclosure and performance, they are able to lower perceived ESG risk to creditors and lenders and enjoy lowered borrowing premiums (Eliwa et al., 2021). However, our findings show an inverse relationship between the moderating effects on regions and the cost of debt. Our results suggest that *worse* ESG performance (higher ESG incidents in regionally material ESG factors) can lower the cost of debt; while *improved* overall ESG performance (in total ESG incidents) can lower the cost of debt.

While research by Bala et al. (2020) find evidence for country and region-level materiality and their ability to lower perceived ESG risk, our research differs in in two important aspects. Firstly, we measure regional materiality by the frequency of certain ESG incident topics. If an ESG incident has a particularly high frequency in a specific region, we deem it material. Bala et al. (2020) constructs their regional materiality scoring differently. They gather data on *stakeholder* responses to ESG incidents and region-based financial benchmarks. Their methodology is more robust and focuses on stakeholders rather than overall incident reporting. In our research, we covered integrative stakeholder theory (Horisch et al., 2014) and home bias effect (Zu and Zueme, 2021), whereby shareholders view home-country related ESG incidents far more negatively. In this case, we would expect a positive coefficient for the moderating effect on regional materiality to the cost of debt in model 6. However, based on the way RepRisk collects data; whereby severity is not measured on a regional basis, but by consequences and impact range (RepRisk, 2022); we may not be able to capture *true stakeholder response* by region, and may explain the mixed results found in models 5 and 6.

Furthermore, our final regional materiality matrix neglects regions such as South Asia and the Middle East and North Africa due to their lower ESG incident reporting, while North America is overrepresented showing that all ESG topics defined by the SASB are deemed regionally material. As a result, any findings related to regional materiality are limited to country and region based ESG reporting and may not necessarily reflect true ESG firm performance or stakeholder sentiments in those regions.

Model 6 specifically finds significance for the moderating effect of regional materiality ESG incidents on cost of debt using industry fixed effects. We interpret this as differences in firm industry and sector classification are statistically significant to the cost of debt. We further consider industry materiality in hypothesis 2b using models 7 and 8.

The case for industry materiality

In hypothesis 2b, we test for the moderating effect of industry materiality and its effect on cost of debt. Model 7 which contains year fixed effects finds that for a 1% increase in industry material ESG incidents a firm will incur a 0.026% in its cost of debt. As an illustrative example, Apple (AAPL) had over $188B in long term debt, and an average effective interest rate of 2.15% (Apple Inc, 2021). For a 20% increase in industry related ESG incidents, Apple could incur an $12 M in interest paid annually to creditors. A sample calculation can be found in Appendix 7. For firms with similar financial profiles, these results show that additional ESG incidents in materially significant topics can have a significant effect on their bottom line. However, for firms with orders of magnitude lower long-term debt, additional material ESG incidents may have negligible effects on their finances.

Model 7 supports our hypothesis 2b and further corroborates research by Khan et al. (2016) which tests the significance of industry materiality on firm performance. Specifically, within our results, only the interaction term of industry materiality is found to be significant, while total ESG incidents has no significant effect on firm cost of debt. We interpret this as despite the frequency of a firm's ESG incidents in immaterial factors, *only* industry material incidents are likely to cause an increase in cost of debt. Conversely, we can draw the conclusion that immaterial industry related ESG incidents have *no* effect on firm cost of debt.

To frame these results, we attempt to understand how lenders and creditors view firms. When analysing a firm, capital providers must assess firm risk. In this case, when discussing ESG incident frequency, risk is manifested as reputational and operational (Derrien et al.,

2021; Giese, Lee, Melas, Nagy, & Nishikawa, 2019; Operean-Stan et al., 2020). As a result, firms with a high degree of ESG related incidents are assigned higher risk premiums, and thereby higher interest rates leading to increased cost of debt (Corporate Finance Institute n.d.; Stanišić et al., 2016). When analysing industry materiality as a moderating factor to cost of debt, research points to mainly information asymmetry and relationship lending concepts. We suggest that lenders focus on industry material concepts to assess ESG risk when compared to overall ESG performance. As lenders have a strong understanding of industry related standards through monitoring agencies and ESG and accounting frameworks such as the SASB; which have robust standard setting processes with data available to creditors and firms (SASB, 2022). As a result, there is an arguably lower informational asymmetry between lenders and firms, especially with respect to expected firm performance by industry and sector. Literature references informational asymmetry as an important factor to cost of debt (Derrien et al, 2016; Eliwa et al, 2021), and as informational asymmetry increases, perceived risk is greater, and a firm's cost of debt increases. With respect to ESG risk, lenders can more accurately measure risk on an industry basis, leading to industry related ESG incidents being more material to creditors, when compared to any other type of ESG related incident.

Relationship lending can also explain the positive relationship found between industry material ESG incidents and cost of debt. ESG profiles tend to align by industry (SASB, 2022), and literature points to creditors being more likely to grant loans with firms that have similar ESG profiles. For firms with abnormal ESG profiles in their industry group due to high ESG incidents can lead to higher ESG risk. As research by Houston & Shan (2019) illustrates, non-compliant ESG firms tend to face higher credit risk and will more likely be assigned higher lending premiums. As creditors are concerned with protecting their reputational risk, they will be more averse to lending to firms with high or extreme ESG incidents, especially if they are material in their industry group.

Model 8 specifically tests for the impact on country differences with respect to industry materiality and firm cost of debt using country fixed effects. Regression results find that there is no significance to country fixed effects, thereby country differences have *no* impact on a firm's cost of debt with respect to its industry material ESG incidents. As argued above, major ESG disclosure, reporting, and evaluation frameworks such as the SASB collect data on the sector level with no granularity on the country level. As a result, higher informational asymmetry (Derrien et al, 2016) exists between lenders and firms on a country basis. As current ESG guidelines do not account for in- and out of country differences, lenders are less

likely to assess firms' performance on a regional basis. Despite these results, we expected country fixed effects to have a statistical significance on model 8's results as model 3 country-fixed effects were found to be significant. However, a key difference between model 8 and model 3 is the inclusion of industry materiality. Based on this, we find that the effect of the industry materiality interaction term to overall ESG incident frequency to be powerful; and as with model 7, to be the *only* significant factor in influencing cost of debt decisions for lenders when comparing total to industry material ESG topics.

ESG corporate focus, Industry or Region?

In hypothesis 2c, we predict that firms with a lower frequency of regionally material ESG issue incidents will have a lower cost of debt than firms with a lower frequency of industry material ESG issue incidents. Through our final regression test, we look to compare the effect of regional and industry materiality frequencies on the cost of debt and look to prove that the effect of regional materiality is stronger than industry materiality. In model 9, we performed a clustered standard error regression with year fixed effects. In the results, we found that with a 1% increase in the total incident frequency, there is a 0.022% increase in the cost of debt at a 95% confidence level, with a 1% increase in the regional incident frequency, there is a 0.017% *decrease* in the cost of debt at a 90% confidence level, and with a 1% increase in the industry incident frequency, there is a 0.030% increase in the cost of debt, which is found to be significant at a 99% confidence level.

Overall, we still see that there is a positive relationship between total ESG incident frequency and the cost of debt, meaning that this model is consistent with the other test models. This, however, is not the result of lower regional materiality incidence, as we predicted in our hypothesis. Further, can see that there is *a highly significant positive relationship between industry material ESG incidents and the cost of debt*, meaning that as firms have a higher frequency of industry material ESG incidents, their cost of debt goes up. In contrast to these findings about industry materiality, we see that there is a weak negative relationship between regionally material ESG incidents and the cost of debt, meaning that as firms have a higher frequency of regionally material ESG incidents, their cost of debt goes down, despite what we predicted. These findings refute our hypothesis, proving that firms with a lower frequency of industry material ESG issue incidents will have a lower cost of debt when compared to regionally material ESG issue incidents.

To frame these results, we attempt to understand why strong performance on industry material ESG issues lowers cost of debt, while strong regional material performance increases cost of debt, looking at relationship lending and overall reputational risk. As the results in model 9 are consistent with findings of model 7 of hypothesis 2b, we can draw similar connections to relationship lending and corporate reputation to explain the relationship. Lending firms are most likely to evaluate likeness to industry profile when evaluating the ESG profiles of firms, while firms with abnormal ESG profiles compared to industry groups are likely to present higher ESG risk. Because of this, it is most likely that banks evaluate industry material ESG performance to avoid ESG and resultant reputational risk.

While our findings about regional materiality are not consistent with our expectations or literature regarding the effect of regional materiality, they are consistent with the mixed results found in models 5 and 6. As discussed for hypothesis 2a, this could be the result of our lack of focus on stakeholder opinions of region-based financial benchmarks in the development of our regional materiality matrix. Based on stakeholder theory (Horisch et al., 2014) and home bias effect (Zu and Zueme, 2021), stakeholders view home based ESG incidents more negatively than industry related incidents, which would support a positive relationship between regionally material ESG incident frequency and the cost of debt. Due to a lack this robustness in our regional materiality matrix, it is unlikely that we can capture stakeholder response in our regional materiality scoring, which could have led to the inverse relationship results. Additionally, as research and tracking of ESG performance is relatively new, there may just be a lack of complete data about regional ESG incidents, leading to potentially inconclusive results.

5.0 Conclusion

5.1 Main takeaways and implications

With the growing importance of sustainability and ESG in business, there is a pressing importance in integrating ESG issues to financial strategy and investment decisions. Our thesis report investigates the ESG materiality on a regional and industry basis, analyzing the relationship between materiality in ESG issue incident frequency and a firm's cost of debt financing. Existing literature focuses largely on SASB industry materiality and ESG performance based on ESG incident frequency. Our paper is unique in how we frame our research by ESG materiality, looking at incident occurrence to minimize bias. Overall, our research looks to explore the effect of regional factors on ESG materiality and the differing effects of industry and regional materiality focus on a firm's cost of debt.

We have found three main takeaways from our findings:

1. ESG performance through ESG related incidents has a *positive* relationship with a firm's cost of debt,
2. Regionally material ESG related incidents *do not* have a strong relationship with a firm's cost of debt and
3. Industry material ESG related incidents have a *positiv*e relationship with the cost of debt.

Based on these main takeaways, we can conclude that, overall, it is important to maximize positive ESG performance (and minimize ESG issue incidents) to maintain lower cost of debt financing. Through a combined comparison of overall ESG related incidents (including both material and immaterial topics) with material regional factors and industry related factors, we have found that poor performance on industry material factors lead to a *higher* cost of debt when compared to other types of ESG related incidents. Based on these findings, we make the implication that MNEs should take a global rather than a local approach to ESG management. In doing this, firms can lower their cost of debt by managing ESG issues and performance related directly to their industry. In general, firms can lower their cost of debt through the effective management of ESG performance, particularly when emphasizing industry standards and material issues.

Through our findings, we have also found that the financial impact of unit increases in ESG incidents to the cost of debt was higher for firms with larger operating budgets and long-term debt. The main implication of this is while a focus on material ESG issues (or specifically industry material issues) is important across businesses and industries, it is *particularly* important for larger firms with greater amounts of capital and financing to perform well on material ESG issues to ensure they minimize their interest and cost of debt financing.

5.2 Future research and next steps

Based on promising research related to home bias effect and stakeholder theory (Zu and Zueme, 2021; Horisch et al., 2014), we find that regional stakeholder reactions to ESG related incidents should be valued and codified through ESG management frameworks. While current extant literature on ESG materiality is limited to industry-level materiality, we find that future research should continue focusing on country differences and regional-level values of creditors with respect to ESG risk management.

Furthermore, our research is limited to the relationship between ESG incidents as a proxy for ESG performance. Our data from RepRisk is based on actual firm-level performance and does not account for perceived performance through ESG disclosure or from third-party ESG rating providers. Within the realm of ESG literature, future research should cover ESG related disclosure and its effects when contrasted against ESG related performance on regional and industry level materiality factors. As ESG becomes an increasingly important topic within firm operations, financial decisions and policy making; more robust analysis of the dynamic factors impacting firm performance and ESG related topics should be undertaken. Through our thesis work, we find that ESG as a topic is becoming increasingly dynamic and material to firm performance and find this research is timely and relevant for firms hoping to improve their overall operations.

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7.0 Appendices

7.1 Appendix 1: SASB & RepRisk Topic & Industry Mapping

Table 1
RepRisk Topic Tags to SASB General Issue Categories mapping

RepRisk Topic Tags	SASB General Issue Categories
Abusive/Illegal fishing	Ecological impact
Abusive/Illegal fishing	Human rights and community relations
Abusive/Illegal fishing	Materials, sourcing, and efficiency
Access to products and services	Human rights and community relations
Agricultural commodity speculation	Human rights and community relations
Agricultural commodity speculation	Physical impact of climate change
Agricultural commodity speculation	Access and affordability
Agricultural commodity speculation	Materials, sourcing, and efficiency
Airborne pollutants	GHG emissions
Airborne pollutants	Air quality
Alcohol	Selling practices and product labelling
Alcohol	Management of legal and regulatory environment
Alcohol	Customer welfare
Animal transportation	Critical risk management
Arctic drilling	Ecological impacts
Arctic drilling	Physical impact of climate change
Arctic drilling	Business model resilience
Asbestos	Critical risk management
Asbestos	Employee health and safety
Automatic and semi-automatic weapons	Critical risk management
Automatic and semi-automatic weapons	Supply chain management
Biological weapons	Supply chain management
Biological weapons	Ecological impacts
Biological weapons	Waste and hazardous materials management
Biological weapons	Critical risk management
Biological weapons	Management of legal and regulatory environment
Chemical weapons	Supply chain management
Chemical weapons	Ecological impacts
Chemical weapons	Waste and hazardous materials management
Chemical weapons	Critical risk management
Chemical weapons	Management of legal and regulatory environment
Coal-fired power plants	GHG emissions
Coal-fired power plants	Air quality
Coal-fired power plants	Ecological impacts
Coal-fired power plants	Business model resilience
Conflict minerals	Human rights and community relations

Coral reefs	Ecological impacts
Cyberattack	Human rights and community relations
Cyberattack	Data security
Cyberattack	Management of legal and regulatory environment
Deep sea drilling	Ecological impacts
Depleted uranium munitions	Waste and hazardous materials management
Depleted uranium munitions	Supply chain management
Diamonds	Human rights and community relations
Drones	Human rights and community relations
Drones	Supply chain management
Economic impact	Human rights and community relations
Endangered species	Ecological impacts
Energy management	Energy management
Epidemics/Pandemics	Business ethics
Epidemics/Pandemics	Human rights and community relations
Epidemics/Pandemics	Product quality and safety
Epidemics/Pandemics	Employee health and safety
Epidemics/Pandemics	Labour practices
Forest burning	Ecological impacts
Fracking	Ecological impacts
Fur and exotic animal skins	Critical risk management
Gambling	Selling practices and product labelling
Gambling	Management of legal and regulatory environment
Gender inequality	Employee engagement, diversity, and inclusion
Gender inequality	Human rights and community relations
Gender inequality	Labour practices
Genetically modified organisms (GMOs)	Systemic risk management
Genetically modified organisms (GMOs)	Selling practices and product labelling
Genetically modified organisms (GMOs)	Competitive behaviour
Genetically modified organisms (GMOs)	Access and affordability
Genocide/Ethnic cleansing	Human rights and community relations
Greenhouse gas (GHG) emissions	GHG emissions
Health impact	Employee health and safety
High conservation value forests	Ecological impacts
Human trafficking	Human rights and community relations
Human trafficking	Labour practices
Hydropower (dams)	Human rights and community relations
Hydropower (dams)	Ecological impacts
Hydropower (dams)	Physical impact of climate change
Illegal logging	Ecological impacts
Indigenous people	Human rights and community relations
Involuntary resettlement	Human rights and community relations
Land ecosystems	Ecological impacts
Land grabbing	Human rights and community relations
Land mines	Human rights and community relations

Land mines	Supply chain management
Lobbying	Business ethics
Lobbying	Competitive behaviour
Marijuana / Cannabis	Selling practices and product labelling
Marijuana / Cannabis	Management of legal and regulatory environment
Marijuana / Cannabis	Customer welfare
Marine/Coastal ecosystems	Ecological impacts
Migrant labor	Labour practices
Monocultures	Ecological impacts
Mountaintop removal mining	Ecological impacts
Negligence	Business ethics
Negligence	Management of legal and regulatory environment
Nuclear power	Critical risk management
Nuclear power	Supply chain management
Nuclear power	Business model resilience
Nuclear weapons	Critical risk management
Nuclear weapons	Supply chain management
Nuclear weapons	Ecological impacts
Nuclear weapons	Air quality
Nuclear weapons	Management of legal and regulatory environment
Offshore drilling	Ecological impacts
Offshore drilling	Water and waste water management
Oil sands	Ecological impacts
Oil sands	GHG emissions
Oil sands	Waste and hazardous materials management
Oil sands	Water and waste water management
Oil sands	Business model resilience
Opioids	Business ethics
Opioids	Selling practices and product labelling
Opioids	Human rights and community relations
Palm oil	Ecological impacts
Palm oil	Human rights and community relations
Palm oil	Materials, sourcing, and efficiency
Plastics	Ecological impacts
Plastics	Waste and hazardous materials management
Plastics	Product design and life cycle management
Plastics	Human rights and community relations
Plastics	Business model resilience
Pornography	Labour practices
Pornography	Management of legal and regulatory environment
Predatory lending	Business ethics
Predatory lending	Customer welfare
Privacy violations	Customer privacy
Privacy violations	Human rights and community relations
Protected areas	Human rights and community relations

Protected areas	Ecological impacts
Racism/Racial inequality	Employee engagement, diversity, and inclusion
Racism/Racial inequality	Labour practices
Racism/Racial inequality	Human rights and community relations
Rare earths	Human rights and community relations
Rare earths	Waste and hazardous materials management
Rare earths	Ecological impacts
Salaries and benefits	Labour practices
Sand mining and dredging	Ecological impacts
Seabed mining	Ecological impacts
Security services	Human rights and community relations
Security services	Employee health and safety
Security services	Management of legal and regulatory environment
Ship breaking and scrapping	Ecological impacts
Ship breaking and scrapping	Waste and hazardous materials management
Ship breaking and scrapping	Labour practices
Ship breaking and scrapping	Employee health and safety
Soy	GHG emissions
Soy	Physical impact of climate change
Soy	Ecological impacts
Soy	Product quality and safety
Soy	Materials, sourcing, and efficiency
Tax havens	Business ethics
Tax havens	Management of legal and regulatory environment
Tobacco	Selling practices and product labelling
Tobacco	Management of legal and regulatory environment
Tobacco	Customer welfare
Wastewater management	Water and waste water management
Water management	Water and waste water management
Water scarcity	Water and waste water management
Water scarcity	Human rights and community relations
Water scarcity	Ecological impacts
Water scarcity	Physical impact of climate change

Figure 1
2021 SASB Materiality Matrix (SASB, 2021)

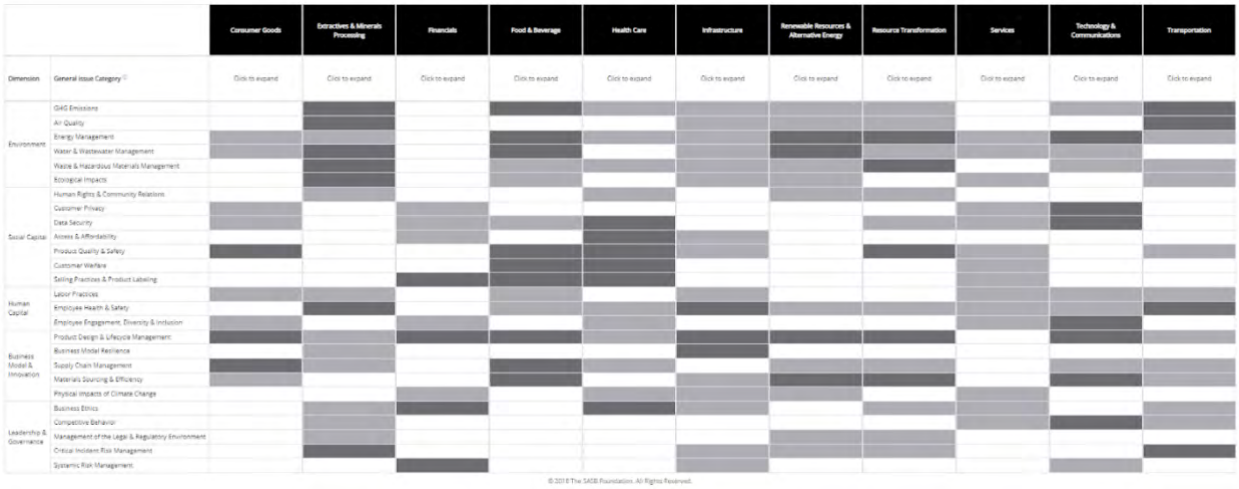

Table 2
SASB Thematic Sector Mapping to RepRisk Sector Mapping

SASB Thematic Sectors	**RepRisk Sectors**
Consumer goods	Personal and Household Goods
Consumer goods	Retail
Extractive and minerals processing	Construction and materials
Extractive and minerals processing	Industrial Metals
Extractive and minerals processing	Mining
Extractive and minerals processing	Oil and Gas
Financials	Banks
Financials	Development banks, central banks, and export credit agencies
Financials	Financial Services
Financials	Insurance
Food and beverage	Food and Beverage
Food and beverage	Tobacco
Healthcare	Health Care Equipment and Services
Healthcare	Pharmaceuticals and Biotechnology
Infrastructure	Industrial Engineering
Infrastructure	Utilities
Renewable resources and alternative energy	Alternative Energy
Renewable resources and alternative energy	Forestry
Renewable resources and alternative energy	Paper
Resource transformation	Aerospace and Defense
Resource transformation	Chemicals
Resource transformation	Electronic and Electrical Equipment
Resource transformation	General Industrials
Services	Gambling

Services	Media
Services	Support Services (Industrial Goods and Services)
Technology and communications	Software and Computer Services
Technology and communications	Technology Hardware and Equipment
Technology and communications	Telecommunications
Transportation	Airlines
Transportation	Automobiles and Parts
Transportation	Industrial Transportation
Transportation	Travel and Leisure
Unspecified*	Unspecified

**Any unspecified industries were excluded from our analysis*

Table 3
Industry Materiality Designations, 0- Immaterial, 1-Material

	SASB Thematic Sectors	
SASB Topic Tags	**Consumer Goods**	**Extractive and minerals processing**
GHG emissions	0	1
Air quality	0	1
Energy management	0	0
Water and waste-water management	0	1
Waste and hazardous materials management	0	1
Ecological impacts	0	1
Human rights and community relations	0	0
Customer privacy	0	0
Data security	0	0
Access and affordability	0	0
Product quality and safety	1	0
Customer welfare	0	0
Selling practices and product labelling	0	0
Labour practices	0	0
Employee health and safety	0	1
Employee engagement, diversity, and inclusion	0	0
Product design and life cycle management	1	0
Business model resilience	0	0
Supply chain management	1	0
Materials, sourcing, and efficiency	0	0
Physical impact of climate change	0	0
Business ethics	0	0
Competitive behaviour	0	0
Management of legal and regulatory environment	0	0
Critical risk management	0	1

Systemic risk management	0	0

Table 3 (continued)
Industry Materiality Designations, 0- Immaterial, 1-Material

	SASB Thematic Sectors	
SASB Topic Tags	**Financials**	**Food and beverage**
GHG emissions	0	1
Air quality	0	0
Energy management	0	1
Water and waste-water management	0	1
Waste and hazardous materials management	0	0
Ecological impacts	0	0
Human rights and community relations	0	0
Customer privacy	0	0
Data security	0	0
Access and affordability	0	0
Product quality and safety	0	1
Customer welfare	0	1
Selling practices and product labelling	1	1
Labour practices	0	0
Employee health and safety	0	0
Employee engagement, diversity, and inclusion	0	0
Product design and life cycle management	1	1
Business model resilience	0	0
Supply chain management	0	1
Materials, sourcing, and efficiency	0	1
Physical impact of climate change	0	0
Business ethics	1	0
Competitive behaviour	0	0
Management of legal and regulatory environment	0	0
Critical risk management	0	0
Systemic risk management	1	0

Table 3 (continued)
Industry Materiality Designations, 0- Immaterial, 1-Material

	SASB Thematic Sectors	
SASB Topic Tags	**Healthcare**	**Infrastructure**
GHG emissions	0	0
Air quality	0	0
Energy management	0	0
Water and waste-water management	0	0
Waste and hazardous materials management	0	0
Ecological impacts	0	0
Human rights and community relations	0	0
Customer privacy	0	0
Data security	1	0
Access and affordability	1	0
Product quality and safety	1	0
Customer welfare	1	0
Selling practices and product labelling	1	0
Labour practices	0	0
Employee health and safety	0	1
Employee engagement, diversity, and inclusion	0	0
Product design and life cycle management	0	1
Business model resilience	0	1
Supply chain management	0	0
Materials, sourcing, and efficiency	0	0
Physical impact of climate change	0	0
Business ethics	1	0
Competitive behaviour	0	0
Management of legal and regulatory environment	0	0
Critical risk management	0	0
Systemic risk management	0	0

Table 3 (continued)
Industry Materiality Designations, 0- Immaterial, 1-Material

	SASB Thematic Sectors	
SASB Topic Tags	**Renewable resources and alternative energy**	**Resource transformation**
GHG emissions	0	0
Air quality	0	0
Energy management	1	1
Water and waste-water management	1	0
Waste and hazardous materials management	0	1
Ecological impacts	0	0
Human rights and community relations	0	0
Customer privacy	0	0
Data security	0	0
Access and affordability	0	0
Product quality and safety	0	1
Customer welfare	0	0
Selling practices and product labelling	0	0
Labour practices	0	0
Employee health and safety	0	0
Employee engagement, diversity, and inclusion	0	0
Product design and life cycle management	1	1
Business model resilience	0	0
Supply chain management	0	0
Materials, sourcing, and efficiency	1	1
Physical impact of climate change	0	0
Business ethics	0	0
Competitive behaviour	0	0
Management of legal and regulatory environment	0	0
Critical risk management	0	0
Systemic risk management	0	0

Table 3 (continued)
Industry Materiality Designations, 0- Immaterial, 1-Material

	SASB Thematic Sectors	
SASB Topic Tags	**Services**	**Technology and communications**
GHG emissions	0	0
Air quality	0	0
Energy management	0	1
Water and waste-water management	0	0
Waste and hazardous materials management	0	0
Ecological impacts	0	0
Human rights and community relations	0	0
Customer privacy	0	1
Data security	0	1
Access and affordability	0	0
Product quality and safety	0	0
Customer welfare	0	0
Selling practices and product labelling	0	0
Labour practices	0	0
Employee health and safety	0	0
Employee engagement, diversity, and inclusion	0	1
Product design and life cycle management	0	1
Business model resilience	0	0
Supply chain management	0	0
Materials, sourcing, and efficiency	0	1
Physical impact of climate change	0	0
Business ethics	0	0
Competitive behaviour	0	1
Management of legal and regulatory environment	0	0
Critical risk management	0	0
Systemic risk management	0	0

Table 3 (final)
Industry Materiality Designations, 0- Immaterial, 1-Material

	SASB Thematic Sectors
SASB Topic Tags	**Transportation**
GHG emissions	1
Air quality	1
Energy management	0
Water and waste-water management	0
Waste and hazardous materials management	0
Ecological impacts	0
Human rights and community relations	0
Customer privacy	0
Data security	0
Access and affordability	0
Product quality and safety	0
Customer welfare	0
Selling practices and product labelling	0
Labour practices	0
Employee health and safety	1
Employee engagement, diversity, and inclusion	0
Product design and life cycle management	0
Business model resilience	0
Supply chain management	0
Materials, sourcing, and efficiency	0
Physical impact of climate change	0
Business ethics	0
Competitive behaviour	0
Management of legal and regulatory environment	0
Critical risk management	1
Systemic risk management	0

7.2 Appendix 2: Regional Materiality Mapping

Table 1
Regional Materiality Mapping

World Region	Access and affordability	Air quality	Business ethics	Business model resilience
East Asia & Pacific	1	0	1	17
Europe & Central Asia	0	0	1	21
Latin America & Caribbean	1	0	0	7
Middle East & North Africa	0	1	0	1
North America	0	1	2	124
South Asia	0	0	1	0
Sub-Saharan Africa	0	1	1	9
Total	2	3	6	179
Average	0.285714286	0.428571429	0.857142857	25.57142857

Table 1 (continued)
Regional Materiality Mapping

World Region	Competitive behaviour	Critical risk management	Customer privacy	Customer welfare
East Asia & Pacific	57	28	0	20
Europe & Central Asia	54	25	1	19
Latin America & Caribbean	74	6	0	2
Middle East & North Africa	10	9	0	0
North America	170	25	0	79
South Asia	17	0	0	4
Sub-Saharan Africa	20	7	0	0
Total	402	100	1	124
Average	57.42857143	14.28571429	0.142857143	17.71428571

Table 1 (continued)
Regional Materiality Mapping

World Region	Data security	Ecological impacts	Employee engagement, diversity, and inclusion	Employee health and safety
East Asia & Pacific	0	2357	49	431
Europe & Central Asia	1	1013	48	501
Latin America & Caribbean	0	1699	15	519
Middle East & North Africa	0	68	4	32
North America	0	1773	308	1147
South Asia	0	414	14	157
Sub-Saharan Africa	0	619	24	253
Total	1	7943	462	3040
Average	0.142857143	1134.714286	66	434.2857143

Table 1 (continued)
Regional Materiality Mapping

World Region	Energy management	GHG emissions	Human rights and community relations	Labour practices
East Asia & Pacific	12	446	1725	1253
Europe & Central Asia	3	551	894	432
Latin America & Caribbean	7	205	1743	375
Middle East & North Africa	1	20	267	150
North America	6	1015	1111	722
South Asia	2	116	449	397
Sub-Saharan Africa	0	130	1386	213
Total	31	2483	7575	3542
Average	4.428571429	354.7142857	1082.142857	506

Table 1 (continued)
Regional Materiality Mapping

World Region	Management of legal and regulatory environment	Materials, sourcing, and efficiency	Physical impact of climate change	Product design and life cycle management
East Asia & Pacific	684	0	0	1
Europe & Central Asia	821	1	1	0
Latin America & Caribbean	264	0	3	0
Middle East & North Africa	36	0	0	0
North America	1221	1	0	0
South Asia	124	0	0	0
Sub-Saharan Africa	85	0	0	0
Total	3235	2	4	1
Average	462.1428571	0.285714286	0.571428571	0.142857143

Table 1 (continued)
Regional Materiality Mapping

World Region	Product quality and safety	Selling practices and product labelling	Supply chain management	Systemic risk management
East Asia & Pacific	51	32	149	0
Europe & Central Asia	64	44	211	1
Latin America & Caribbean	43	3	16	0
Middle East & North Africa	2	1	32	0
North America	106	255	156	0
South Asia	11	2	11	0
Sub-Saharan Africa	19	1	4	0
Total	296	338	579	1
Average	42.28571429	48.28571429	82.71428571	0.142857143

Table 1 (final)
Regional Materiality Mapping

World Region	Waste and hazardous materials management	Water and waste water management	Total
East Asia & Pacific	8	161	7483
Europe & Central Asia	1	97	4805
Latin America & Caribbean	1	164	5148
Middle East & North Africa	6	17	657
North America	2	139	8363
South Asia	1	58	1778
Sub-Saharan Africa	0	43	2815
Total	19	679	31049
Average	2.714285714	97	

Table 2
ESG Region Frequencies

World Region	Freq.	Percent
East Asia & Pacific	7,483	24.1
Europe & Central Asia	4,805	15.48
Latin America & Caribbean	5,148	16.58
Middle East & North Africa	657	2.12
North America	8,363	26.93
South Asia	1,778	5.73
Sub-Saharan Africa	2,815	9.07
Total	31,049	100

Table 3
Regional Materiality Matrix

	World Bank Regions	
SASB Topic Tags	**East Asia & Pacific**	**Europe & Central Asia**
Competitive behaviour	1	0
Critical risk management	1	1
Customer welfare	1	1
Ecological impacts	1	1
Employee engagement, diversity, and inclusion	0	0
Employee health and safety	1	1
Energy management	1	0
GHG emissions	1	1
Human rights and community relations	1	0

Labour practices	1	0
Management of legal and regulatory environment	1	1
Product quality and safety	1	1
Selling practices and product labelling	0	1
Supply chain management	1	1
Water and waste water management	1	1

Table 3 (continued)
Regional Materiality Matrix

	World Bank Regions	
SASB Topic Tags	**Latin America & Caribbean**	**Middle East & North Africa***
Competitive behaviour	1	0
Critical risk management	0	0
Customer welfare	0	0
Ecological impacts	1	0
Employee engagement, diversity, and inclusion	0	0
Employee health and safety	1	0
Energy management	1	0
GHG emissions	0	0
Human rights and community relations	1	0
Labour practices	0	0
Management of legal and regulatory environment	0	0
Product quality and safety	1	0
Selling practices and product labelling	0	0
Supply chain management	0	0
Water and waste water management	1	0

**No ESG Topics deemed materially significant for the Middle East & North Africa Region*

Table 3 (continued)
Regional Materiality Matrix

	World Bank Regions	
SASB Topic Tags	**North America**	**South Asia***
Competitive behaviour	1	0
Critical risk management	1	0
Customer welfare	1	0
Ecological impacts	1	0
Employee engagement, diversity, and inclusion	1	0
Employee health and safety	1	0
Energy management	1	0
GHG emissions	1	0
Human rights and community relations	1	0
Labour practices	1	0
Management of legal and regulatory environment	1	0
Product quality and safety	1	0
Selling practices and product labelling	1	0
Supply chain management	1	0
Water and waste water management	1	0

**No ESG Topics deemed materially significant for the South Asia region*

Table 3 (final)
Regional Materiality Matrix

	World Bank Regions
SASB Topic Tags	**Sub-Saharan Africa**
Competitive behaviour	0
Critical risk management	0
Customer welfare	0
Ecological impacts	0
Employee engagement, diversity, and inclusion	0
Employee health and safety	0
Energy management	0
GHG emissions	0
Human rights and community relations	1
Labour practices	0
Management of legal and regulatory environment	0
Product quality and safety	0
Selling practices and product labelling	0
Supply chain management	0
Water and waste water management	0

7.3 Appendix 3: Cost of Debt Data and Control Variables

Table 1
CoD and Control Variable Calculations and associated Compustat data

Variable	Equation	Compustat variables used
CoD – dependent	Total Interest Expense / Total Average Debt	Interest and Related Expense – Total (XINT) Debt in Current Liabilities – Total (DLC) Long-Term Debt – Total (DLTT)
Firm size (*Size)* – control	Ln (Total Assets) (*natural log of total assets)*	Assets – Total (AT)
Financial leverage *(LEV)* – control	(Total Debt / Total Assets) *100	Debt in Current Liabilities – Total (DLC) Long-Term Debt – Total (DLTT) Assets – Total (AT)
Return on Assets *(ROA)* – control	(Net Income / Average Total Assets) *100	Net Income (Loss) – Consolidated (NICON) (global) OR Net Income (Loss) (NI) (North America) Assets – Total (AT)
Interest Rate Coverage *(INT_COV)* – control	(Total Operating Income/Total Interest Expense) *100	Operating Income Before Depreciation (OIBDP) Interest and Related Expense – Total (XINT)

* *The resultant value of each variable was Log normalized to reduce skewness of data*

7.4 Appendix 4: Hypothesis 1 Data Summaries

Table 1
ESG Incident Occurrence Frequency by World Region

World Region	Percent
East Asia & Pacific	23.44
Europe & Central Asia	29.69
Latin America & Caribbean	5.5
Middle East & North Africa	0.52
North America	34.75
South Asia	4.83
Sub-Saharan Africa	1.27
Total	100

Table 2
ESG Incident Occurrence Frequency Data by SASB Thematic Sectors

SASB Topic Tags	Percent
Access and affordability	0.56
Air quality*	0
Business ethics	0.29
Business model resilience *	0
Competitive behaviour	0.55
Critical risk management	1.67
Customer privacy	2.39
Customer welfare*	0.01
Data security	0.57
Ecological impacts	25.39
Employee engagement, diversity, and inclusion *	0.01
Employee health and safety	9.92
Energy management	0.15
GHG emissions	10.34
Human rights and community relations	26.06
Labour practices	10.47
Management of legal and regulatory environment	6.78
Materials, sourcing, and efficiency*	0.01
Physical impact of climate change	0.43
Selling practices and product labelling*	0.01
Supply chain management	0.15
Waste and hazardous materials management *	0.01
Water and waste-water management	4.24
Total	100

**These ESG Topics are excluded from our final analysis.*

Table 3

ESG Incident Occurrence Frequency Data by Year

Year	Percent
2007	1.41
2008	3.87
2009	3.66
2010	6.25
2011	7.22
2012	6.62
2013	7.47
2014	10.94
2015	7.98
2016	6.46
2017	9.49
2018	10.4
2019	9.73
2020	8.49
Total	100

Table 4

ESG Incident Occurrence Frequency Data by Industry Sector

SASB Thematic Sectors	Percent
Consumer goods	9.36
Extractive and minerals processing	31.95
Financials	0.91
Food and beverage	14.73
Healthcare	2.43
Infrastructure	14.51
Renewable resources and alternative energy	1.27
Resource transformation	13.18
Services	3.26
Technology and communications	3.27

Table 5

Hypothesis 1 Descriptive Statistics

Variable	Mean	Std. dev.	0.25	Median	0.75
Total_Incdnt_Freq	2.86584	1.57953	1.609438	2.995732	4.158883
Cost of Debt (CoD)	1.37632	0.70814	1.043136	1.446118	1.749619
Size	11.3193	2.42867	9.919697	11.0201	12.33733
Lev	3.10663	0.90897	2.884957	3.268037	3.626965
ROA	1.39434	1.00444	0.9176199	1.54354	2.095828
Int_Cov	7.145	1.167	6.36382	7.016955	7.693611
Tax_Rate	3.05715	0.78718	2.807994	3.147794	3.438494

7.5 Appendix 5: Hypothesis 2 Data Summaries

Table 1

Incident Frequencies per ESG Topic Tag

SASB ESG Topic Tags	Total Incidents Per ESG Topic
Access and affordability	676
Air quality*	5
Business ethics	535
Business model resilience*	7
Competitive behaviour	447
Critical risk management	1421
Customer privacy	2561
Customer welfare*	4
Data security	566
Ecological impacts	25224
Employee engagement, diversity, and inclusion*	6
Employee health and safety	9650
Energy management	109
GHG emissions	10082
Human rights and community relations	25488
Labour practices	7713
Management of legal and regulatory environment	6539
Materials, sourcing, and efficiency *	21
Physical impact of climate change	425
Product design and life cycle management*	1
Product quality and safety*	3
Selling practices and product labelling*	11
Supply chain management	128
Systemic risk management*	1
Waste and hazardous materials management*	8
Water and waste-water management	3547

Table 2

Hypothesis 2a Descriptive Statistics

Variable	Mean	Std. dev.	0.25	Median	0.75
Regional_Incdnt_Freq	2.24458	1.81942	0	2.30259	3.7612
Cost of Debt (CoD)	1.37632	0.70814	1.043136	1.446118	1.749619
Size	11.3193	2.42867	9.919697	11.0201	12.33733
Lev	3.10663	0.90897	2.884957	3.268037	3.626965
ROA	1.39434	1.00444	0.9176199	1.54354	2.095828
Int_Cov	7.145	1.167	6.36382	7.016955	7.693611

Table 3

Hypothesis 2b Descriptive Statistics

Variable	Mean	Std. dev.	0.25	Median	0.75
Industry_Incdnt_Freq	0.767025	1.56858	0	0	0
Cost of Debt (CoD)	1.37632	0.70814	1.043136	1.446118	1.749619
Size	11.3193	2.42867	9.919697	11.0201	12.33733
Lev	3.10663	0.90897	2.884957	3.268037	3.626965
ROA	1.39434	1.00444	0.9176199	1.54354	2.095828
Int_Cov	7.145	1.167	6.36382	7.016955	7.693611

7.6 Appendix 6: Variable Definitions & Model Formation

Table 1
Descriptive summary of all variables referenced in models

Variable Name	Description
Total_Incdnt_Freq	Total Incident Frequency, sorted by firm, year, and incident type. This variable is log normalized.
Regional_Incdnt_Freq	Regional Incident Frequency, sorted by firm, year, and incident type. Derived from the Total Incident Frequency variable using dummy variables assigning 1 for a regionally material incident, and 0 for an immaterial regional incident. This variable is log normalized
Industry_Incdnt_Freq	Industry Incident Frequency, sorted by firm, year, and incident type. Derived from the Total Incident Frequency variable using dummy variables assigning 1 for a industry-material incident, and 0 for an immaterial industry-incident. This variable is log normalized
Size	The natural logarithm of a firm's total assets.
Lev	A ratio of a firm's total debts and total assets. This variable log normalized
ROA	A ratio of a firm's net income and average total assets. This variable is log normalized
Int_Cov	A ratio of a firm's total operating income and total interest expense. This variable is log normalized
Constant	The constant term within a linear regression model.
Observations	The total number of observations within the test data set.
R-squared	The coefficient of determination.
Clustered SE (ISIN)	A clustered standard error test, clustered by a firm's ISIN which a unique identifier for a firm within the test data set.
Year FE	Year fixed effects.
Country FE	Country fixed effects. Country refers to a firm's country headquarters.
Industry FE	Industry fixed effects. Industry refers to a firm's primary industry, mapped to the SASB thematic sectors.

Table 2
This table contains a summary of all tests which can be referenced in their equation model form in section 3.3.1 and 3.3.2. This table indicates, for a given regression model, the variables tested, the constant variables, if fixed effects models are used and if clustered standard error testing is used.

	Main Regression Tests								
	1	2	3	4	5	6	7	8	9
Total_Incdnt_Freq	Tested	Tested	Tested	Tested	Tested	Tested	Tested	Tested	Tested
Regional_Incdnt_Freq	Not Tested	Not Tested	Not Tested	Not Tested	Tested	Tested	Not Tested	Not Tested	Tested
Industry_Incdnt_Freq	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Not Tested	Tested	Tested	Tested
Size	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable
Lev	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable
ROA	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable
Int_Cov	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable	Constant Variable
Clustered Standard Error (by ISIN)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country Fixed Effects	No	No	Yes	No	No	No	No	Yes	No
Industry Fixed Effects	No	No	No	Yes	No	Yes	No	No	No

7.7 Appendix 7: Sample Calculations using Apple (AAPL) as an illustrative example

We first begin by finding Apple's effective cost of debt. In this example we only use long term debt as creditors can adjust future interest rates based on current Apple performance. As such, a future increase in ESG related incidents would be reflected in the effective rates for future long-term debt.

$$D, Total\ Long\ Term\ Debt\ = \$118\ B$$

$$I, Effective\ Interest\ Rate\ for\ long\ term\ debt = 2.15\%^{*}$$

**We find the average effective interest rate for the long-term debt listed by taking the mean of the effective interest rates listed for long term debt.*

$$CoD, Cost\ of\ Debt = D \times I$$

$$CoD = \$118\ B \times 0.0215$$

$$CoD = \$\ 2.53\ B$$

Therefore, the average cost of debt for Apple is approximately 2.53B annually.

Given a 20% increase in ESG related incidents, we then calculate the overall percentage increase in cost of debt.

In our results for Model 1, we find that for a 1% increase in ESG incidents, overall cost of debt will increase by 0.020%. We then find the overall cost of debt increase for a 20% increase in ESG incidents

$$\Delta ESG, Change\ in\ ESG\ incidents = 20\%$$

$$\Delta CoD_{unit}, 1\%\ ESG\ incident\ Cost\ of\ Debt\ change\ (Model\ 1) = 0.020\%$$

$$\Delta CoD_{total}, \%Overall\ CoD\ Increase = (1 + \Delta ESG)^{\Delta CoD_{unit}} - 1$$

$$\Delta CoD_{total}, \%Overall\ CoD\ Increase = (1 + 0.20)^{0.020} - 1$$

$$\Delta CoD_{total}, \%Overall\ CoD\ Increase = 0.476\%$$

Therefore, if Apple's overall ESG incident frequency increases by 20%, the overall cost of debt will increase by 0.476%

Now, we use this to calculate the overall annual increase in cost of debt paid to creditors.

$$Cost\ of\ Debt\ Increase = CoD\ \times \Delta CoD_{total}$$

$$Cost\ of\ Debt\ Increase = \$2.53\ B\ \times 0.00476$$

$$Cost\ of\ Debt\ Increase = \$\ 9.25\ M$$

Therefore, for a 20% increase in overall ESG related incidents (as tested in model 1), Apple can expect an overall $9.25 million dollars in excess annual cost of debt payments.

These results are only used as an *illustrative* model to explain the financial impact of a cost of debt increase to a large and well-known business. While we acknowledge that there are more complex mechanisms to effective interest rate increases, and this assumes a 20% increase in ESG related incidents, these numbers are limited to the scope of this study only.