# ESG practices and the cost of capital: Evidence from CA100+ companies

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## 1. Introduction

Since the 1990s, the social cost of carbon (Nordhaus, 2008) was integrated into macroeconomic models as previously external natural capital became a part of the Cobb Douglas equation of corporate output based on Human Capital, Energy Capital, and Technology. However, the relationship between ESG and microeconomic dynamics of the cost of capital with a portfolio of ESG-deficient and ESG-efficient assets has not been modeled in the same vein. Meta-studies of literature, such as Whelan, Atz, Holt, and Clark (2021) and Friede, Busch, and Bassen (2015), shed more light on the explanatory power of ESG criteria and financial performance. However, less attention was directed to the cost of capital that underlies a firm's investment decisions and financing decisions and, ultimately, the long-term consequences on corporate valuation.

Globally, sustainable investment grew to $35.3 trillion at the beginning of 2020, representing a two-year increase of 15 percent, or 35.9 percent of total assets under management in 2020 (Global sustainable investment alliance, 2020). For example, a survey of sustainability reporting by Richard Threlfall, Adrian King, Jennifer Shulman, Wim Bartels (2020) found a sustainability reporting rate of 96% for G250 companies — the world's largest 250 companies. Within the oil and gas sector, the disclosure rate of the sustainability report was 100% for these G250 companies. In the United States alone, one-third of the country's assets under management —$17.1 trillion—were managed according to sustainability metrics (US SIF: The Forum for Sustainable and Responsible Investment, 2020).

Over the decade leading up to 2020, exponential growth in ESG-labelled passive investing and activist impact investing has gained momentum, largely thanks to confirming evidence that company actions focused on material ESG risks are translatable to improved risk management and long-term returns; all else being equal. Indeed, Friede et al. (2015)'s study found that companies with high ESG scores experienced lower costs of capital, lower equity costs, and lower debt costs than companies with poor ESG scores, using the residuals obtained from the cross-sectional regression of industry adjusted ESG scores.

The global COVID-19 crisis sheds light on the broader impact of the ESG factor that underlies a confounding effect on governance quality, social footprints, and business model resilience. An emerging body of research tracing the window of time around the market crash is induced by the SAS2-CoV-2 outbreak. For example, Cheema-Fox, LaPerla, Serafeim, and Wang (2020) discovered that less negative investment return is correlated with positive ESG sentiment around a company's response to the COVID crisis. ESG is far more than mere window dressing; it is a strategic imperative for any going concern company.

In our research, we aim to pinpoint the direction of disaggregated Environmental, Social, or Governance dimension in specific equity or debt market. A cross-section of globally important firms enriches the cost-of-capital perspective, and the effect specific signs of ESG disclosure and ESG controversies management are also tested. Our underlying sample of two-thirds of the world's heaviest emitters signed up to the Climate Action 100+ (herewith referred to as CA100+). These 167 signatories emit 80 percent of the global industrial greenhouse gases, and their holdings represent a total of $52 trillion in signatory assets under management. In the 2021 progress update, ClimateAction100+ (2022), 52 percent of signatories have set a net-zero or equivalent target compared to five companies in 2018. To demonstrate the scale of impact, Bloomberg NEF (2021) estimated that these net-zero targets will reduce greenhouse gas emissions by 3.7 billion metric tons of carbon dioxide equivalent annually and 9.8 billion metric tons by 2050, which approaches the level of current emissions from China as it stood in 2021.

The results are applicable to a best-in-class screening or multi-sector selection of an ESG-oriented portfolio for profitable companies in all GICS industries save for the energy and materials industries, because our results are robust to the industry effect, the ROA effect, and the auto-correlation effect of Emissions as the key category in the Refinitiv ESG scoring. Nevertheless, the limitations of the CA100+ sample are that these 'focus companies' tend to be of large market capitalizations, situated in rather risky industries owing to their high emissions, and most of the reported emissions lie in Scope 3 emissions (CDP, 2021), which signaling the needs of appraising a broader supply-chain perspective from the ESG data collectors.

## 2. Background: ESG Practices

### 2.1 ESG disclosure: Global pledge, national legislation, company discretion

The rules for a global carbon market were created under the Article 6 of the Paris Agreement, signed in November 2021 following the 26th Conference of Parties (COP 26) in Glasgow.

At the national level, unification efforts have progressed to avoid the issue of additionalities that may leave loopholes in double-counted emission traded in between borders, partial sector-specific carbon taxes favored by each nation states and exempted products that are vulnerable to international trade competitions. The COP 26 addressed these international issues, notably by featuring common table format to determine the portion of 'sustainable' activities of a company, which is defined by how a company is aligned in relative percentage to sales turnover, capital expenditures and operating expenditures. In addition, Nationally Determined Contributions (NDCs) signed by the majority of the Paris Agreement signatories, including China and the United States, under the global pledge of the Net Zero Emissions. Because NDCs take into account a financial strategy detailing its national plans for domestic companies to reduce greenhouse gas emissions, these nations guide the shifts in different sectors by consistently rethinking needed sectoral carbon price as a function of how this economy and this society produces and consumes (United Nation, n.d.).

However, at the corporate level, the cost of ignoring ESG metrics leaves a significant financial impact. The World Bank claimed in 2022, even as revenues from carbon-pricing market surged by 60%, less than 4% of the absolute level of emissions are covered by these carbon-pricing systems (World Bank, 2022). Therefore, this essay bases its data from corporate-level disclosures to tackles the current heterogeneities in carbon prices across markets. More specifically, it targets the wider emissions data that may be regulated by both carbon taxes, exchange-traded system (ETS) and carbon credits trading as both voluntary and involuntary market-based instruments. Immediately after the COP 26 in Glasgow, the revenues from ETS crossed those from carbon tax for the first time. Pressures have also been mounting from providers' ESG frameworks. (Sakis Kotsantonis, 2016) highlighted that the number of listed firms who report ESG information has grown to 8500 in 2014 from fewer than 20 in the 1990s.

Regarding the ESG disclosure landscape, eleven specified areas of disclosure are covered in the frameword set by the Taskforce for Climate-related Financial Reporting Directive (TCFD are accepted by government entities as mandatory reporting practices to be rendered transparent and this scope is still increasing in 2022 (Financial Conduct Authority, 2020),. Supra-national and national regulators worldwide are involved in harmonizing disclosures on sustainable finance-related financial or non-financial disclosures. By virtue of the inter-connectedness in economic value chains and financial markets, regulations such as the EU

Taxonomy and the Sustainable Finance Disclosures Regulation (SFDR) will have widespread implications as they mandate a holistic disclosure for both financial and non-financial entities. As for non-financial firms, the EU Taxonomy requires firms working in the European Unions to transparent the proportion of revenue that falls into its scope and the company-specific capital expenditure and relevant operating expenditures (EU Technical Expert Group on Sustainable Finance, 2020). As for manufacturers of financial products and financial advisors, the SFDR demands detailed disclosures regarding the integration of sustainability-related objectives in investment procedures and risk-management procedures for the adverse impacts of ESG controversies.

Though industry-specific guidelines differ, the Taskforce for Climate-related Financial Disclosure unites the framing methodologies of ESG disclosures in different industries by a scientific approach. The International Financial Reporting Standard also connects its financial reporting and sustainability reporting under the IFRS Sustainable Disclosures Standard by the framework of 'Integrated Reporting.' Similarly, more indicators are set up based on the ESG issues by the Sustainability Accounting Standard Board (SASB) to collaborate with other standards, namely the Global Reporting Initiative (GRI). The integration of ESG standards supports the corporate communications at a more detailed level, as well as targets a broader set of stakeholders because the GRI includes information is also relevant to government entities and non-governmental organizations, on top of the investor-focus and financial materiality criteria under the SASB (GRI and SASB, 2021).

Indeed, in what may be coined by Schwab and Vanham (2021) as a 'stakeholder capitalism,' firms must respond materially to a broad set of stakeholders, such as institutional investors, retail investors in the equity capital market, and the debt capital market, government, and regulatory bodies. For the lending institutions, a study by Yasser et al. (2019) demonstrated a reward for disclosures for ESG performance through a lowered cost of debt in fifteen EU countries. For equity investors, the integration of ESG factors into an equity investment in listed companies (active ownership assessment of qualitative and quantitative ESG factors, company engagement, voting) is the most widespread practice according to UN PRI.

## 2.2 International rating agencies: Common Methodologies, diverging results

The bifurcation of processed and measured ESG data at the rating agencies level presents significant roadblocks in three main dimensions to fully integrating ESG consideration at the firm level. Firstly, at the asset owner's level, the variance in ESG ratings complicates the investment appraisal from the perspective of ESG performance for funds administrators and portfolio managers, who are the primary clients of ESG raters. In sustainable investments, Billio, Costola, Hristova, Latino, and Pelizzon (2020) observed the rating heterogeneity from 1,049 companies listed in the MSCI World Index with available ESG ratings from MSCI ESG, Refinitiv, S&P's RobeccoSAM, and Sustainalytics. The finding of significant rating divergence received by the same company leads to an important implication for investors since ESG preferences may be dispersed when they are passed on to asset prices, to the point that even when there is an agreement between ratings, it has no impact on financial performances. Indeed, Halbritter and Dorfleitner (2015) found that despite the significant relationship between ESG variables and returns, as revealed by the Fama and MacBeth's cross-sectional regressions (MacBeth, 1973), investors are hardly able to find abnormal returns between companies with high ESG ratings and those with low ESG ratings.

Secondly, at a corporate level, the lack of conclusion from ESG ratings puts off incentives for companies under transition to improve their ESG performance so that improvement efforts are likely to be less rewarded. In turn, heterogenous signals prevent a clear perception for the companies of their expected actions ex-ante and expected market valuations ex-post. For instance, Badía, Gómez-Bezares, and Ferruz (2022) distinguished the impact on portfolio returns between investments in material ESG topics as opposed to immaterial, general ESG issues. Between 2008 and 2017, the identification of material ESG topics relevant to that sector differentiated best and worst performers on both ESG and financial dimensions, while investing solely on the grounds of general ESG topics was not found to distinguish top-percentile performance.

Thirdly, at a market level, ESG achievements are less probable to be priced correctly and precisely since ESG performance impacts prices through the subjective tastes of investors (Robert Heinkel, 2001). This phenomenon is due to the unique role of an ESG weighting agency is to furnish information to diverse investors compared to the company credit rating agency that weights specific or through a subjective view of the ESG rater that influences the measurement of defined categories (Florian, 2019).

In conclusion, among ESG rating agencies, MSCI, FTSE Russell, and Refinitiv include the same initial universe of metrics then refined based on industry, CDP, Sustainalytics, ESS-ESG, SAM CSA, and Vigeo Eiris customized at the level of the question asked. For example, rating providers can assess 'material ESG issues and their exposure scores' (Sustainalytics), identify key issues where each industry 'currently generate large environmental or social externalities' (MSCI) or define the most 'challenging' issues (ISS-ESG). They can also evaluate weight criteria based on the nature of stakeholders' right, interests, and expectation, the vulnerability of stakeholders by sector, and risk categories for the company' (Vigeo Eiris), SAM CSA merge the selection of 'industry-specific' ESG criteria with those that are 'financially material.'

**Table 1 Comparisons of ESG Rating Providers**

| ESG Rating Provider | Key ESG Issues/ Topics Disclosed | Underlying Indicators Disclosed | Weightings Disclosed | Scoring Methodology Disclosed |
|---|---|---|---|---|
| Sustainalytics | | | | ✓ |
| CDP | ✓ | ✓ | ✓ | ✓ |
| ISS ESG | ✓ | | | |
| ISS Quality Score | ✓ | ✓ | | ✓ |
| Bloomberg ESG Disclosure score | | | | |
| SAM | ✓ | ✓ | ✓ | |
| MSCI | ✓ | | | ✓ |
| Vigeo Eiris | ✓ | | | ✓ |
| FTSE Russell | ✓ | | | |
| Refinitiv | ✓ | | ✓ | ✓ |
| RepRisk | | | | |

In terms of disclosure of industry-specific methodology, Bloomberg ESG and ISS QualityScore do not disclose which data apply to which industry, even if Bloomberg specifies additional industry-specific indicators. While MSCI adopted a quantified model based on industry averages of ESG ratings (MSCI ESG Research LLC, 2022), Refinitiv allows for different indicator weights across time based on the impact of ESG indicators from Refinitiv on an entity's opportunity cost of capital into the future. (Refinitiv, 2022)

Regarding adverse media, only Refinitiv (Refinitiv, 2022) and MSA CSA (S&P Global Corporate Sustainability Assessment - Media and Stakeholder Analysis, 2022) provides the calculation methodologies to quantify negative news or controversial allegations, while Sustainalytics (Sustainalytics, 2021), ISS-ESG (Institutional Shareholder Services Inc., 2021), MSCI (MSCI ESG Research LLC, 2022), and Moody's ESG (Vigeo Eiris, Moody's Corp., 2021) use adverse media exposure as a qualitative layering to the ESG rating. The process of ESG controversy scan is often updated more frequently than the final rating.

The divergence between high-level ESG ratings for a given company is thus essential, for any statistically significant conclusions on the cost of capital cannot be reached without expanding the sampling size across rating agencies. On the one hand, some categories are commonly considered by all six raters, such as Biodiversity, Employee Development, Energy, Health and Safety, Labor Practices, Product Safety, Remuneration, Supply Chain, and Water. On the other hand, all rating agencies do not cover many unmatched indicators. For example, Refinitiv has the most unclassified ESG indicators, mostly stemming from its economic dimension. The economic category contains accounting and finance indicators such as net income growth or capital expenditure, which are not considered by any rating agency.

As for the measurement by rating agencies within the three components of ESG - 'Environmental,' 'Social,' and 'Governance,' previous rating research points to a 'halo effect,' which is related to the rater's bias that was extensively studied in sociology, management, and psychology in performance evaluation of credit rating agencies (see, for example, Shrout's study (1971)). In our case, it has been concluded that the process of evaluating the aggregate ESG ratings seems prone to a rater's bias. Evaluating firm performance in the categories of Human Rights, Community, and Society, Labor Practices requires rating agencies to use a degree of judgment. When the assessment of a company is positive for one indicator, it is also likely to be positive for another indicator. We tackle the rater's bias by three means. First, in the primary analysis, we focused on a single ESG rating agency to benefit from the sectoral specification of the CA100+ worldwide organization and the industry-specific standard from harmonized standards and taxonomy. Indeed, according to Berg, Kölbel, Pavlova, and Rigobon (2021), adherence to a science-based taxonomy like the SASB mitigates the risk of misclassifying indicators into wrong categories from different rating agencies. Second, in additional analysis, we remove industry-specific average in sub-sample regressions to evaluate the marginal contribution of each pillar in a narrower span.

## 3. Literature Review

Recent years have witnessed blurred boundaries in ESG, where researchers from both academic disciplines and the asset management industry co-published papers on the functional relationship between ESG characteristics and financial profiles. However, the research interests lie predominantly in finding the linkages between ESG ratings and stock returns for the external capital market rather than for the internal cost of capital. For instance, Berg et al. (2021) detected higher expected stock returns for companies located in North America, Europe, and Japan using eight ESG score providers. In parallel, Bolton and Kacperczyk (2020) discovered a positive association between stock returns and carbon emissions in 77 countries in panel data of 14,400 companies across sectors. At its core, sustainable investing with the integration of ESG ratings might deliver better stock returns for financial market participants. Still, ESG ratings are not designed as a sufficient solution to solve the intended impact of environmental, social, and governance-related problems that are deeply ingrained within companies from the stage of capital financing. ESG integration has been permeating into both investing and financing policies of companies. Globally, ESG considerations offer additional data to the process of both risk management and new investments identification. The increasing realization is that an understanding of the opportunities and risks imposed on a broader set of stakeholders and surrounding environments is vital not only for asset managers with the investment thesis that client demand for ESG targets fosters ESG strategies but also for the individual firms in their financing decisions because capital will flow to the better ESG performers, which translates into a financing advantage.

In this research paper, the authors focus on determining the coefficient of ESG scores on the two partitions of the cost of capital. Regarding the sources of ESG rating, several meta-studies of research papers such as Lev, Demers, Hendrikse, and Joos (2021) using data from Refinitiv and MSCI, Fulton, Kahn, and Sharples (2012) all found inconclusive correlations between ESG performance and financial performance. However, most research papers that were studied by Whelan et al. (2021) found a positive correlation. For instance, McKinsey (2020) cites more than 2,000 academic studies to conclude that better ESG scores translate to about a 10% lower cost of capital across industries.

ESG ratings can affect the cost of capital as supported by three disciplinary theories. Firstly, from the fundamental theory, companies that publish positive ESG news get rewarded by the market, and companies with negative ESG news get punished (Pindyck, 1988). Secondly, Bekaert, Engstrom, and Xing (2009) found that companies that disclose more data reduce the information asymmetry, so they are rewarded by investors for increasing transparency and lower their cost of capital. On a conceptual basis, the authors elucidated a persistent uncertainty in dividend growth relevant to the theory of dividends-discount asset pricing, thereby affecting the market value. Thirdly, there may also be a behavioral bias behind the reverse causality, as investors who get more ESG data perceive a company as less risky. For example, market behaviors and valuation theories converge in that better ESG ratings lower the cost of capital, as Omoregie (2021) explained in his study. Humphrey, Kogan, Sagi, and Starks (2021) explained that a persistent and asymmetric effect on social preferences affects investment choices through belief formation, capital allocation, and learning decisions. Similar to the finding in ESG controversies, they noted that negative ESG social externalities have a greater impact than positive ESG externalities.

The coefficient between ESG ratings and the cost of capital has profound implications for responsible investors to be informed of sustainability-related aspects from rating providers. If coefficients are low, it implies that sustainability performance is less likely to be reflected at the investing stage through share price or bond prices and the financing stage since capital providers cannot identify sustainability outperformers or laggards (Guido Gese, 2019). However, despite a high correlation between ESG scores, recent research linking ESG performance and financial performance often fails to explain the intermediate economic mechanism that led to better ESG performance, typically focusing on historical data. A paper by Harvey, Liu, and Zhu (2015) highlighted that this type of purely data-focused research entails the risk of correlation mining, overfitting a financial model to a specific dataset to observe correlations that will not prevail when tested out of sample. The study quantified the lack of alignment between the underlying ESG data, and the measurement, scoping, and weighting methodologies was quantified in the study by Berg et al. (2019).

The cost of equity (CoE) was derived from the capital asset pricing model (CAPM), focusing on the equity's required rate of return (Timothy W. Ruefli, 1999). Consistent with the CAPM framework, where lower systematic risk (beta) implies lower cost of equity, Gese, Lee, Melas, Nagy, and Nishikawa (2019) showed that highly rated companies from the ESG viewpoint have been less exposed to systematic risks in the market beta versus companies with low ESG ratings. This generalization was built on the ground of conclusions from Eccles, Ioannou, Serafeim (2014), and Gregory, Tharyan, and Whittaker (2014) that a strong consensus on a company's ESG position is correlated with a higher valuation through a lower systematic risk. In the same paper, the authors argued that while the systematic risk is macroeconomic, the market beta for entities in different industries differs because regulatory changes, technological developments, and stranded assets differ. Besides having a lower systematic cost, high-ESG-scoring companies could also have benefited from lower company-specific risks. According to Gibson, Krueger, and Schmidt (2021), there was a time-varying disagreement on ESG ratings positively correlated with financial returns. By extension, a company with more disagreement on ESG ratings would experience a higher equity risk premium.

Focusing on the opportunity cost of debt (CoD), CoD considers the capability of an entity to raise both short- and long-term debt, which depends on both the yield curve of the region, prevailing market borrowing rates, and the creditworthiness of the company. Switzer, Tu, and Wang (2018) found that the average cost of debt of high-ESG-rated companies was lower than that of low-ESG-rated companies, implying that the Governance pillar of the ESG tends to mitigate the risk of default. In the corporate bond market, Polbennikov, Desclee, Dynkin, and Maitra (2016) concluded that higher ESG-rated corporate bonds had lower systematic risk and lower bond spreads; therefore, they enjoy higher valuation holding all other pricing factors constant.

To analyze whether the correlation observed between ESG ratings and cost of capital was more than a statistical accident, we can investigate the natural experiment published by Lodh (2020). The author from MSCI examined the shift in average cost of capital before and after rating upgrades. The conclusion seems to include an unexplainable 'catch-up effect,' namely that markets appeared to reward 'low-starters' companies with levels of initial ESG Ratings at the lower spectrum. A regional bias also appeared in place as markets tend to award companies in developed markets asymmetrically. Likewise, Auer and Schuhmacher (2016) analyzed the financial performances of ESG portfolios using data from Sustainalytics across the US, the European Union, and Asia from 2004 to 2012. The finding does not support the positive effect of sustainable and responsible investment on risk-adjusted returns but does find a regional bias in Europe. The portfolio screenings showed that European investors tend to pay the market price above the intrinsic value for a portfolio with the label of sustainable and responsible investments, thereby increasing the cost of capital and even resulting in underperformance of ESG portfolios compared to non-ESG portfolios, ceteris paribus.

However, it should be reiterated that so long as one does not encounter comprehensive studies that tackle the relationship between the ESG scores by one rating agency and its ESG characteristics, the relationship between the ESG characteristics and the cost of raising capital cannot be fully appreciated. In our study, we investigate the two relationships simultaneously. In addition, recent studies predominantly focused on a user's perspective by analyzing the effect of ESG ratings on returns on investment, even if a large body of academic research has demonstrated a divergence of ESG ratings and a weak correlation between scores from different ESG raters. Thus, only by basing the ESG rating output on the same ESG rater can we be reasonably assured of consistent conclusions being reached about the relationship between the ESG scores and the cost of equity, the cost of debt, and the cost of capital as a weighted average of both former.

Moreover, in most cases, previous research considers the impact on these costs of only selected aspects of the ESG elements without bringing the rating effect together or only studies ESG as a whole without breaking down the effects of the component pillar. For example, we have not encountered a study examining the impact of both the composite and the individual pillars of the ESG scores on the overall and the constituents of the cost of capital. Most previous literature only sheds light on the impact of a carbon footprint on the cost of debt.

Previous literature also alludes to two general families of endogeneities in the sampling process for ESG data: regional bias and participation bias. Regarding regional bias, ESG is under the influence of the institutional systems and local cultures, which may set barriers in comparing global ESG ratings. As for the institutional system effect, Ortas, Gallego-Álvarez, and Álvarez (2018) collected data from 4,751 companies in understudied economies in Asia, Africa, and Eastern Europe, the Middle East, and Latin America to highlight the nested nature of firms' ESG performance within higher-level institutional contexts. As for the cross-cultural differences, Stahl (2017) explored the cultural dynamics and proposed a positive link between diversity and financial outcomes for global firms. Regarding the participation bias, there can be two underlying factors: company size and corporate. Also, it is contended by LaBella, Sullivan, Russell, and Novikov (2019) that the size bias chiefly stems from the resources that companies with larger capitalization must prepare for sustainability-related information. As an alternative measure of the size bias, Garz and Volk (2018) analyzed 4,000 Sustainalytics ESG ratings to conclude a 16 percent differential between big companies with capitalization above

200 billion dollars and small companies with a 50-300 million dollars range of market capitalization.

In addition, what should be noted when studying the results of research published in the cited scientific articles is the issue of insufficient sample size. Many firms studied can often derive from only a few dozen industries in a particular country or usually from a homogeneous industry. We decided to fill this gap with our research by looking at Climate Action 100+ companies, which covers industries spanning almost the whole GICS taxonomy, covering 166 of the world's largest corporate greenhouse gas emitters across 33 countries and representing over half of all global assets under management.

Building on the literature review, we progress to develop our hypothesis.

## 4. Hypothesis Development

### 4.1. The impact of ESG practices on the cost of capital

Evidence is emerging that a better ESG score translates to about a ten percent lower cost of capital as the risks that affect the business, in terms of its license to operate, is reduced if the companies have a strong ESG proposition (Mckinsey, 2020).

In terms of environmental performance, Sharfman and Fernand (2008) set out from a sample of 267 listed U.S. firms on the relationship between a firm's environmental performance and the cost of debt and equity capital. The conclusion resembled a reverse causality to our hypothesis that a better environmental performance lowers the cost of capital. Instead, the empirical results showed that firms improve their environmental risk management by reducing the cost of equity, shifting from equity to debt financing, and higher tax-deductibility of debt shield. These findings help build a better theory to uphold the counter-acting nature of the forces underlying the inconclusive sign of the coefficient of the Environment pillar score. In similar logic, Gianfrate (2020) arrived at nuanced results for the cost of debt and equity. The authors used the Bloomberg database to estimate the cost of debt and the Capital Asset Pricing Model (CAPM) to estimate the cost of equity. The results revealed a statistically significant positive relationship between the cost of debt and environmental risk management. Still, they pointed to a statistically significant negative relationship between environmental risk management and both the cost of equity and the weighted average cost of capital.

The benefit of breaking down the ESG score as a composite number into individual 'Environmental,' 'Social,' and 'Governance' pillars is that it can arguably raise the coefficient between ESG performance and financial performance. For example, a positive relationship between the governance (GOV) dimension and financial performance was found by Sehrawat, Singh, and Kumar (2020); more specifically, a positive link between managerial ownership and return on assets (ROA) and a positive correlation between the size of the board as well as managerial ownership and the Tobin's Q after examining a sample of 2,552 Indian non-financial firms. Similarly, regarding the environmental dimension (ENV), Semenova and Hassel (2008) studied a sample of U.S. firms. They found a positive correlation between market value and environmental preparedness and operational benefits to financial performance from environmental performance. As a counter-balancing force to environmental preparedness and performance, the authors also specified that in high-polluting and high-risk industries, environmental management could be so costly as to reduce corporate performance.

Industry-specific characteristics are important to be controlled for when assessing the ESG impacts. For example, Hong and Kacperczyk (2009) evidenced the effects of social norms on "sin" stocks in producing alcohol, tobacco, and gaming, as manifested in smaller holdings of norm-constrained institutions like pension plans and receive less analyst coverage than otherwise comparable firms. Time-varying aspects may also produce noises that detract from the actual impact of ESG scores on the cost of capital from the coefficients. For instance, during the each of the beginning quarter and the whole-year period's implosion across COVID years, Demers, Hendrikse, Joos, and Lev (2021) discovered that there is an exogenous positive relationship between capital expenditures in intangible assets and financial, even when ESG performance does not register statistically significant relationship on financial performance.

ESG disclosures and media controversies are also significant ESG-related factors that will significantly impact the cost of capital. Regarding ESG Disclosure, most empirical studies have focused on the relationship between non-financial information and the cost of capital. Some previous studies concluded that the reporting of CSR/ESG practices translates into lowering the cost of capital. For instance, Gruning (2011) probed on the relationship between disclosures, market liquidity, and cost of capital for German firms listed on the Deutsche Börse. A negative correlation was found between disclosure and cost of financing, which provides evidence for a cost-reduction effect of disclosures.

Regarding media controversies, ESG-related bad news by themselves has cost the companies a lot. Regarding the content of the controversies, sentiment research (Cui, 2020) highlighted the over-emphasis from investors on ESG considerations leading to markets volatilities when companies are the subject of negative ESG news. Market overreaction is much more pronounced for bad ESG news than good news. This is because investors tend to overweight the possibility that controversy may happen again, or the impact of controversy could be prolonged.

However, the maximization of ESG disclosures and the minimization of ESG controversies have been proven to enhance transparency and absorb corporate resources simultaneously; hence the directionality of the coefficient between ESG disclosures and cost capital from past research has not been uniform. In favor of the transparency's effect of ESG disclosure on the cost of capital, Garcia-Sanchez (2017) gained support from the practice of the integrated report while analyzing both financial and ESG information. On the side of the resource-utilization drag on the cost of capital when coping with ESG disclosures and management of controversies, Dorfleitner, Kreuzer, and Sparrer (2020) studied 2,500 companies in the European, the U.S., and global markets between 2002 and 2018. To significant positive coefficient for worst ESG portfolios and best controversies strategies is observed, which indicated that the controversies' impact on portfolio performance are driven by low-rated 'small-and-sins' companies, on the one hand, and green-rated, 'silent giants' on the other hand. Moreover, it is noteworthy to beware of a confounding effect between ESG disclosures and ESG controversies, as confirmed by Li (2017) in the regional study in China.

Based on the above discussion, the study came up with the following hypothesis:

**H1a. There is a negative relationship between the companies' ESG performances and the cost of capital.**

**H1b. There is a negative relationship between the companies' ESG disclosures and the cost of capital.**

**H1c. There is a negative relationship between the companies' ESG controversies and the cost of equity.**

### 4.2. The impact of ESG practices on the cost of debt

The growing attention paid to ESG issues has led to an increase in lending institutions' awareness of reputational risk imposed by borrowing firms and default risk. The reputational risk represents incentives for lending institutions to integrate ESG information into their creditworthiness evaluation process. Society can perceive lending institutions as facilitators of positive ESG practices of borrowing firms.

Prior research covered an abundance of reviews with respect to ESG performances and the cost of debt. For example, Schneider (2010) studied 48 American companies active in the pulp and paper and chemical industries from 1994 to 2004 and identified a highly statistically significant negative relationship between environmental performance and spreads in bond yields. In the bank loans market, Goss, and Roberts (2011) studied a broader sample covering 1,265 U.S. companies between 1991 and 2006 and found those poor performers in respect of the corporate social responsibility (CSR) paid between 7 and 18 basis points more than their more responsible peers, but higher CSR performance is not rewarded. The effect is stronger for bank loans that were issued without security but become insignificant for secured loans.

Regarding the cost of debt and ESG disclosure, Raimo, Caragnano, Zito, Vitolla, and Mariani (2021) registered a negative correlation between ESG disclosure and the cost of debt for 919 firms from 2010 to 2019, implying access to third-party financing at better conditions if the transparency on ESG aspects is enhanced. Additionally, Eliwa, Aboud, and Saleh (2019) examined a sample of companies operating in 15 European countries and concluded that the impact of ESG disclosures has a negative relationship with the cost of debt. As for Chinese companies, Fonseka, Rajapakse, and Richardson (2018) studied a sample of companies in the energy sector and found a negative relationship between environmental information and the cost of debt. These results can be interpreted as a sign that as ESG disclosures expand in scope and coverage, the interest rate that lenders are willing to confer for debt for such firms will decrease. This also means that lending institutions do integrate information about ESG disclosure of borrowing firms when evaluating their risk profile in their lending decision model.

The literature review shows that most previous studies analyzed the impact of ESG disclosures and performances on the cost of debt. However, less attention was paid to the effect of ESG controversies on the cost of debt. Therefore, the study came up with the following two additional hypotheses to complement the measures for the ESG performance.

**H2a. There is a negative relationship between the companies' ESG performances and the cost of debt.**

**H2b. There is a negative relationship between the companies' ESG disclosures and the cost of debt.**

**H2c. There is a negative relationship between the companies' ESG controversies and the cost of debt.**

### 4.3. The impact of ESG practices on the cost of equity

Increasingly, a strand of research popular among researchers' regression measured the impact of the cost of equity on sustainability and other control variables. The first study of such kind was conducted before the financial crisis by El Ghoul, Guedhami, Kwok, Chuck, and Mishra (2011), unveiled a positive relationship between ESG (employee relations, environmental policies, and product strategies) and cost of equity for a broad sample of U.S. firms. Further research exhibits inconclusive relationships. For example, a negative relationship between the cost of equity and ESG was documented for firms in controversial industries: the nuclear power industry and the tobacco industry. Salama, Anderson. and Toms (2011) also recorded a negative relationship between a company's environmental and community performance and its systematic financial risk in panel data before the financial crisis in the U.K. More recently, both general and industry specific ESG criteria in the same country before measuring sustainability performance. He found no evidence of a significant difference in the risk-adjusted performance of high-ESG and low-ESG firms independent of which ESG measure was employed. Similarly, in Australia, Li, Eddie, and Liu (2014) noted that no statistically significant positive relationship between emissions intensity and cost of equity was uncovered.

Therefore, empirical results on the cost of equity and ESG practices relationship are inconclusive, though in favor of a negative relationship in some regional studies. Some studies indicated a statistically significant negative relationship between the cost of equity and ESG performance and ESG disclosures. For example, Salzmann and Matthiessen (2017) suggested that the relationship between the cost of equity and ESG is more negative for higher levels of humane orientation, assertiveness, and institutional collectivism. By contrast, others found no or only marginal statistical significance between the variables of interest or a statistically significant but economically negligible relationship. Regarding ESG controversies, there are even fewer research articles that shed light on the relationship between the cost of equity and ESG controversies.

For the cost of equity, we posit the negative-relationship hypothesis on three ESG dimensions:

**H3a. There is a negative relationship between the companies' ESG performances and the cost of equity.**

**H3b. There is a negative relationship between the companies' ESG disclosures and the cost of equity.**

**H3c. There is a negative relationship between the companies' ESG controversies and the cost of equity.**

# 5. Research Design

## 5.1 Variable Measurement

### *5.1.1 Cost of Capital (COC), Cost of Debt (CoD) and Cost of Equity (CoE)*

The research analyzes the effect of ESG practices on the cost of debt, cost of equity, and cost of capital. To measure the cost of debt, we use the accounting measure, calculated as the ratio of a firm's interest expense to its average debt. Cost of Equity is measured as the return a firm theoretically pays its equity investors. It is calculated by multiplying the equity risk premium of the market with the beta of the stock plus an inflation-adjusted risk-free rate. The equity risk premium is the expected market return minus the inflation-adjusted risk-free rate. Cost of Capital is measured as in which each category of capital is proportionately weighted. All sources of capital, including equity stock, preferred stock, and debt, are included in the calculation.

### *5.1.2 Control Variables*

According to our literature review, five control variables consistently show a significant relationship related to the cost of debt, cost of equity, and cost of capital. These variables include return on asset (ROA), leverage (LEV), interest coverage ratio (INTCOV), firm size (SIZE), and Beta. A detailed definition of variables taken for the study can be found in Table 2. ROA is defined as the net income before discontinued operations before extraordinary items, divided by average total assets. A negative association is expected between ROA and the cost of debt, as companies with higher ROA are in a better financial position and often acquire loans with lower interest rates. LEV is the ratio of total debt to total equity. A positive association between the LEV and the cost of capital and debt is expected as the companies with a lower level of leverage are expected to have better solvency and a lower interest rate than firms with a higher leverage ratio. INTCOV is a measure of a company's ability to pay off its interest expense, calculated as the total operating income divided by the total interest expense. It is likely firms with a higher interest coverage ratio will have a lower cost of debt. Size is calculated as the natural logarithm of the total asset in the year t. We expect to find a negative relationship between size and the cost of capital, cost of debt, and cost of equity. Companies with large sizes are expected to have more resources for external finance at a lower cost than those smaller sizes. Lastly, the beta is also considered a control variable. According to previous research, Beta is included to control systematic risk and is estimated using annual stock returns and market returns during the fiscal year. A positive association between Beta and cost of equity is expected.

Regarding industry-specific and time-varying aspects, variations within the ten GIC industries and the five-time periods are controlled by adding two fixed effects: Time (T) and Industry (IND). By taking an industry-by-industry lens underpinning the Refinitiv methodology, deeper and richer industry-specific viewpoints emerge.

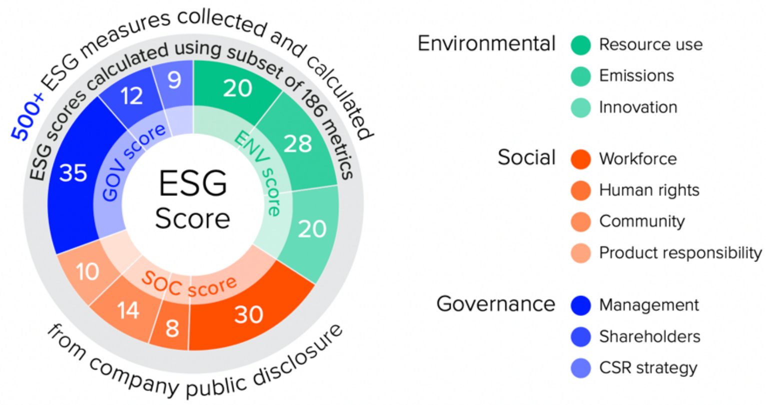
### *5.1.3 ESG Variables*

The study looks at the impact of ESG performances, disclosure, and controversies on the cost of capital, focusing on the cost of debt and the cost of equity. Proxies of ESG practices are available on the Refinitiv database. Refinitiv ESG scores reflect the underlying ESG data framework. They are a transparent, data-driven assessment of companies' relative ESG performance and capacity, integrating and accounting for industry materiality and company size biases (Refinitiv, 2021). We choose Refinitiv as a case study of rating providers as it provides not only disclosure of ESG issues and weightings for each, but also the scoring methodologies. Companies in the CA100+ samples start with a natural selection by market capitalizations, sensitivity to public economies from their listing venues, and their relative strategic positioning as industry heavyweights in the cement, steel, oil and gas and their distribution sectors, with ten sectoral coverages by the Global Industry Classification System (GICS).

#### 5.1.3.1 ESG Composite (ESG) and Pillar Score (ENV, SOC & GOV)

For this study, we extract a pooled data that include the three pillar scores (environmental, social, and governance) corresponding to the aggregate ESG composite. The ESG composite score weights are normalized to percentages ranging between 0 and 100, where 100 stands for the best-in-class practice and 0 for the worst-in-class.

**Graph 1 - Refinitiv ESG Measures calculation process**




| Pillars | Catagories | Themes | Data points | Weight method |
|---|---|---|---|---|
| Environmental | Emmission | Emissions | TR.AnalyticCO2 | Quant industry median |
| | | Waste | TR.AnalyticTotalWaste | Quant industry median |
| | | Biodiversity* | | |
| | | Environmental management systems* | | |
| | Innovation | Product innovation | TR.EnvProducts | Transparency weights |
| | | Green revenues, research and development (R&D) and capital expenditures (CapEx) | TR.AnalyticEnvRD | Quant industry median |
| | Resource use | Water | TR.AnalyticWaterUse | Quant industry median |
| | | Energy | TR.AnalyticEnergyUse | Quant industry median |
| | | Sustainable packaging* | | |
| | | Environmental supply chain* | | |
| Social | Community | Equally important to all industry groups, hence a median weight of five is assigned to all | | Equally important to all industry groups |
| | Human rights | Human rights | TR.PolicyHumanRights | Transparency weights |
| | Product responsibility | Responsible marketing | TR.PolicyResponsibleMarketing | Transparency weights |
| | | Product quality | TR.ProductQualityMonitoring | Transparency weights |
| | | Data privacy | TR.PolicyDataPrivacy | Transparency weights |
| | Workforce | Diversity and inclusion | TR.WomenEmployees | Quant industry median |
| | | Career development and training | TR.AvgTrainingHours | Transparency weights |
| | | Working conditions | TR.TradeUnionRep | Quant industry median |
| | | Health and safety | TR.AnalyticLostDays | Transparency weights |
| Governance | CSR strategy | CSR strategy | Data points in governance category and governance pillar | Count of data points in each governance category/all data points in governance pillar |
| | | ESG reporting and transparency | | |
| | Management | Structure (independence, diversity, committees) | Data points in governance category and governance pillar | Count of data points in each governance category/all data points in governance pillar |
| | | Compensation | | |
| | Shareholders | Shareholder rights | Data points in governance category and governance pillar | Count of data points in each governance category/all data points in governance pillar |
| | | Takeover defenses | | |

*No data points available that may be used as a proxy for ESG magnitude/materiality

These three pillar scores are subsequently grouped into ten categories that reformulate the three pillars to accrue to the final ESG composite score, which reflects the ESG performance, commitment, and effectiveness based on publicly reported information. In terms of mathematical formulas, the ESG pillar scores are a weighted sum of the relative categories, which vary by industry for the environmental and social pillars. For the governance pillar, the weights remain uniform across industries. The underlying indicators, or 'themes' are a subset of the 186 of the most comparable and material ESG measures per industry, and these ESG measures underpin the overall company scoring process (Refinitiv, 2021).

Focusing on the individual measurement areas by the Refinitiv ('Categories'), it is noteworthy that some categories adopt a myriad of themes measured by multi-dimensional data points, while some rely on a uniform or even homogenized data points owing to the subjective nature. For example, the social pillar employs quantitative data points for themes like workforce and qualitative data points for the theme of product responsibility as measured by subjective data such as data privacy or quality of a product. In contrast, the theme of community is allocated identically across industries. The most consistent measurements tend to lie in the 'Environmental' categories, as issues like Green House Gas emissions (all Scope 1, 2, 3) and energy efficiency prevail, albeit in varying units. The message is clear: ESG risks may lead to a significant reallocation of capital.

#### 5.1.3.2 ESG Controversies Score (MEDIA)

The study also includes the ESG controversies score, which captures the exposure to ESG controversies and negative events reflected in the global media news. The ESG controversies score is calculated based on 23 ESG controversy topics, including anti-competition, business ethics, intellectual property, tax fraud privacy, environmental issues, diversity & opportunity, etc. During the year, if a scandal occurs, the company involved is penalized, affecting their ESG controversies score and grading. The event's impact may still be seen in the following year if there are new developments related to the negative event, such as lawsuits, ongoing legislation disputes, or fines. The default value of all controversy measures is 0, meaning companies with no controversy will get a score of 100% (Refinitiv, 2021).

Refinitiv's calculation methodology of ESG controversy scores addresses the market-capitalization bias from which large-cap companies suffer from more media attention being attracted to them as compared to smaller-capitalization companies. This is because the 'severity' weights are applied in the quantification with regards to both current and historical periods.

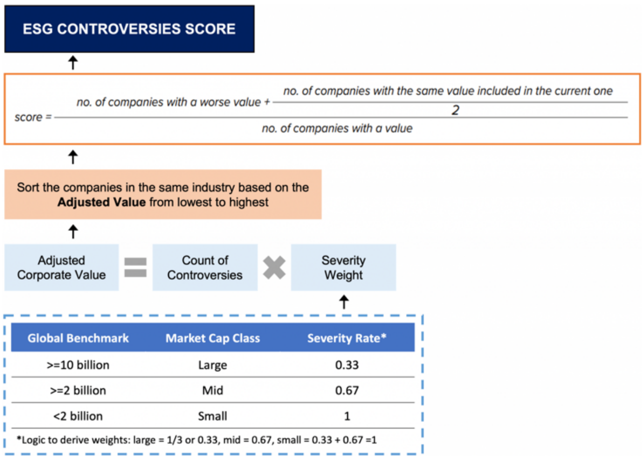
Details of calculating methodology to derive the ESG controversies score are as follows:

- Default value of all controversy measures is 0
- Extract values pertaining to controversies for all companies of the last closing fiscal year and there is no double-counting
- Based on the class of market capitalizations, multiply the count of controversies by a 'Severity Rate'
- Sort the companies from lowest to highest (lowest being better).

- Apply the percentile-rank formula to derive the ESG controversies scores. Controversies are benchmarked on the industry group
- Companies with no controversies will get a score of 100

Hence, the higher the controversies scores, the better the firm is in managing its ESG-related adverse media interactions. We therefore expect a negative correlation between controversies and the cost of capital.

**Graph 2 - Refintiv ESG Controversies Score Calculation Process**




### 5.1.3.3 ESG Reporting scope (DISL)

ESG reporting scope variable measures the percentage of activities covered in the environmental and social reporting. If extra-financial reporting covers both environmental and governance, the scope score would be 100.

### 5.1.3.4 ESG Emission Score (EMIS)

Additionally, the study also considers emissions measures as all the companies in the climate action 100+ are associated with a high level of emission in their regular daily operation. The emission score is defined as the commitment and effectiveness towards reducing emissions in the company's production and operational process.

**Table 2 -Variable Table**

| VARIABLE NAME | VARIABLE SYMBOL | DEFINITION OF THE VARIABLE NAME | SOURCE |
|---|---|---|---|
| **Dependent Variables** | | | |
| Cost of Capital (%) | COC | Ratio of a firm's total financial cost to its average total fund | 2017/12/31 – 2021/12/31 Refinitiv |
| Cost of Debt (%) | COD | Ratio of a firm's interest expense to its average debt | 2017/12/31 – 2021/12/31 Refinitiv |
| Cost of Equity (%) | COE | Implied cost of equity according to the Capital Asset Pricing Model (CAPM), which is a weighted sum of systematic risk-free rate and idiosyncratic equity risk premium multiplied by the beta with respect to market | 2017/12/31 – 2021/12/31 Refinitiv |
| **Control Variables** | | | |
| Leverage Ratio | LEV | Ratio of total debt to total equity | Debt/EQ 2017/12/31 – 2021/12/31 Refinitiv |
| Firm Size | SIZE | The natural logarithm of total assets | Total Assets – Actual 2017/12/31 – 2021/12/31 Refinitiv |
| Return on Average Total Asset | ROA | Net income before Discontinued Operations before Extraordinary Items, divided by Average Total Assets. | 2017/12/31 – 2021/12/31 Refinitiv |
| Interest Coverage rate | INTCOV | Total operating income divided by the total interest expense | 2017/12/31 – 2021/12/31 Refinitiv |

| | | | |
|---|---|---|---|
| Market Beta | BETA | Beta calculated using the market model. | 2017/12/31 – 2021/12/31 Refinitiv |
| Year | T | Dummy variable | Calendar Date |
| Industry | IND | Dummy variable | GICS |
| **ESG Variables** | | | |
| Composite ESG rating | ESG | ESG Performance based on Refinitiv's rating | 2017/12/31 – 2021/12/31 Refinitiv |
| E – Rating | ENV | The environmental dimension of ESG Performance | 2017/12/31 – 2021/12/31 Refinitiv |
| S – Rating | SOC | The social dimension of ESG Performance | 2017/12/31 – 2021/12/31 Refinitiv |
| G – Rating | GOV | The governance dimension of ESG Performance | 2017/12/31 – 2021/12/31 Refinitiv |
| ESG Reporting Scope (disclose/n) | DISL | The % of activities covered in its E and S reporting If extra-financial reporting covers both E and S, SCOPE = 100 | 2017/12/31 – 2021/12/31 Refinitiv |
| ESG Controversies Score | MEDIA | Exposure to ESG controversies and negative events as reflected in global media news | 2017/12/31 – 2021/12/31 Refinitiv |
| Emission Score | EMIS | Commitment and effectiveness towards reducing emission in the company's production and operational processes | 2017/12/31 – 2021/12/31 Refinitiv |

## 5.2 Data and Sample Collection

The sample consists of 150 firms in the Climate Action 100+. Up till April 2021, 166 carbon-intensive companies were already included in the CA100+. Due to a lack of information in the Refinitiv database, the study only included 150 companies out of 166. The sample consists of 750 observations covering the period from 2017 to 2021. We use the Refinitiv database for both control variables and ESG variables. Table 3 and Graph 3 reports the total number and percentage of firms per industry according to their GIC industry number. Approximately 26% of the sample comprises companies from the energy sector, 22% from materials, 21.3% from utilities, 12.7% from industrials, and 6% from consumer discretionary.

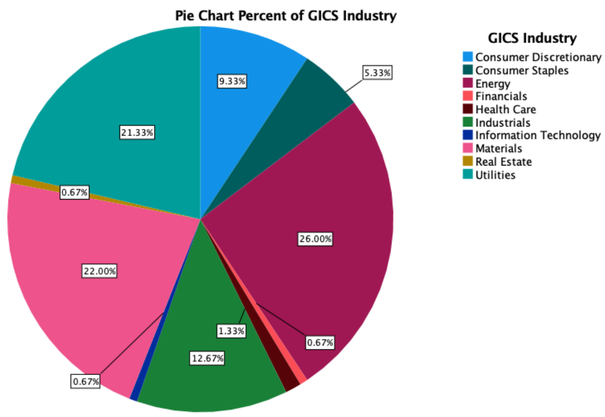
Table 4 reports the descriptive statistics regarding the primary variables: ESG performances, the cost of capital, the cost of debt, the cost of equity, and the firms' characteristics for the final sample. All continuous variables are winsorised at 1% and 99% percentile. For the dependent variables, the mean of the cost of capital is 6.27%, with a standard deviation of 3.11%. The mean of the cost of debt is 2.20%, with a standard deviation of 1.35%. The mean of the cost of equity is 8.52%, with a standard deviation of 4.10%. Regarding control variables, the mean of interest coverage is 10.46%, and the standard deviation is 13.81%. The mean return on assets is 3.97%, with a standard deviation of 5.89%. The mean beta is 1.07, and the standard deviation is 0.46. The average leverage ratio is 120.34%, with a standard deviation of 170.88%. In terms of independent ESG variables, the mean ESG disclosure score is 89.27, with a standard deviation of 23.59. The mean ESG media score is 73.05, with a standard deviation of 16.88. For ESG composite score, the mean is 65.32 with a standard deviation of 37.50. The average environment pillar score is 60.18, with a standard deviation of 14.59. The average social pillar score is 71.77, with a standard deviation of 16.71. The governance pillar score has a mean of 68.03 with a standard deviation of 18.65. The average emission score is 79.10, with a standard deviation of 17.49.

## Table 3 - Total number of firms per industry

*GICS Industry*

| | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Consumer Discretionary | 14 | 9.3 | 9.3 |
| Consumer Staples | 8 | 5.3 | 14.7 |
| Energy | 39 | 26.0 | 40.7 |
| Financials | 1 | 0.7 | 41.3 |
| Health Care | 2 | 1.3 | 42.7 |
| Industrials | 19 | 12.7 | 55.3 |
| Information Technology | 1 | 0.7 | 56.0 |
| Materials | 33 | 22.0 | 78.0 |
| Real Estate | 1 | 0.7 | 78.7 |
| Utilities | 32 | 21.3 | 100.0 |
| Total | 150 | 100.0 | |

## Graph 3 - Percentage of firms per industry




## Table 4 - Descriptive Statistics

*Descriptive Statistics*

| | N | Minimum | Maximum | Mean | 25 Percentiles | 75 Percentiles | Std. Deviation |
|---|---|---|---|---|---|---|---|
| COC | 743 | 1.54% | 16.33% | 6.27% | 3.98% | 7.92% | 3.11% |
| COD | 743 | 0.05% | 7.00% | 2.20% | 1.28% | 2.85% | 1.35% |
| COE | 743 | 1.52% | 23.30% | 8.52% | 6.06% | 10.58% | 4.10% |
| INTCOV | 739 | -8.20 | 79.79 | 10.46 | 2.98 | 12.96 | 13.81 |
| BETA | 743 | 0.10 | 2.42 | 1.07 | 0.74 | 1.35 | 0.46 |
| ROA | 732 | -14.80% | 24.45% | 3.97% | 1.40% | 6.34% | 5.89% |
| LEV | 732 | 7.49% | 1233.83% | 120.34% | 42.94% | 128.38% | 170.88% |
| SIZE | 744 | 21.50 | 27.01 | 24.73 | 24.04 | 25.49 | 1.09 |
| DISL | 733 | 9.11 | 100.00 | 89.27 | 98.25 | 100.00 | 23.59 |
| MEDIA | 743 | 23.95 | 96.36 | 73.05 | 63.31 | 85.66 | 16.88 |
| ESG | 743 | 1.22 | 100.00 | 65.32 | 23.68 | 100.00 | 37.50 |
| ENV | 743 | 28.07 | 88.70 | 60.18 | 48.38 | 70.90 | 14.59 |
| SOV | 743 | 25.26 | 97.22 | 71.77 | 60.43 | 85.12 | 16.71 |
| GOV | 743 | 20.81 | 97.18 | 68.03 | 55.84 | 82.42 | 18.65 |
| EMIS | 743 | 19.03 | 99.72 | 79.10 | 71.91 | 92.14 | 17.49 |
| Valid N (listwise) | 682 | | | | | | |

## Table 5 - Pearson correlations (CoC, CoD, CoE, Control Variables. ESG Variables)

| | | COC | COD | COE | INTCOV | BETA | ROA | LEV | SIZE | DISL | MEDIA | ESG | ENV | SOV | GOV | EMIS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COC | Pearson Correlation | -- | | | | | | | | | | | | | | |
| COD | Pearson Correlation | 0.491 | -- | | | | | | | | | | | | | |
| | Sig. (2-tailed) | 0.000 | | | | | | | | | | | | | | |
| COE | Pearson Correlation | 0.876 | 0.318 | -- | | | | | | | | | | | | |
| | Sig. (2-tailed) | 0.000 | 0.000 | | | | | | | | | | | | | |
| INTCOV | Pearson Correlation | 0.089 | -0.083 | -0.011 | -- | | | | | | | | | | | |
| | Sig. (2-tailed) | 0.020 | 0.031 | 0.783 | | | | | | | | | | | | |
| BETA | Pearson Correlation | 0.492 | 0.088 | 0.649 | -0.042 | -- | | | | | | | | | | |
| | Sig. (2-tailed) | 0.000 | 0.022 | 0.000 | 0.275 | | | | | | | | | | | |
| ROA | Pearson Correlation | 0.245 | 0.155 | 0.002 | 0.416 | -0.218 | -- | | | | | | | | | |
| | Sig. (2-tailed) | 0.000 | 0.000 | 0.963 | 0.000 | 0.000 | | | | | | | | | | |
| LEV | Pearson Correlation | -0.169 | 0.054 | -0.131 | -0.078 | -0.089 | 0.043 | -- | | | | | | | | |
| | Sig. (2-tailed) | 0.000 | 0.157 | 0.001 | 0.042 | 0.020 | 0.261 | | | | | | | | | |
| SIZE | Pearson Correlation | -0.278 | -0.267 | -0.114 | -0.009 | -0.081 | -0.195 | -0.034 | -- | | | | | | | |
| | Sig. (2-tailed) | 0.000 | 0.000 | 0.003 | 0.807 | 0.033 | 0.000 | 0.377 | | | | | | | | |
| DISL | Pearson Correlation | 0.114 | 0.198 | 0.057 | -0.269 | -0.059 | 0.067 | 0.012 | -0.045 | -- | | | | | | |
| | Sig. (2-tailed) | 0.003 | 0.000 | 0.138 | 0.000 | 0.122 | 0.078 | 0.763 | 0.239 | | | | | | | |
| MEDIA | Pearson Correlation | 0.008 | -0.142 | 0.098 | -0.023 | 0.133 | -0.082 | 0.139 | 0.323 | 0.028 | -- | | | | | |
| | Sig. (2-tailed) | 0.825 | 0.000 | 0.010 | 0.542 | 0.001 | 0.032 | 0.000 | 0.000 | 0.458 | | | | | | |
| ESG | Pearson Correlation | 0.101 | 0.185 | -0.044 | -0.023 | -0.111 | 0.135 | -0.123 | -0.457 | 0.009 | -0.378 | -- | | | | |
| | Sig. (2-tailed) | 0.008 | 0.000 | 0.252 | 0.540 | 0.004 | 0.000 | 0.001 | 0.000 | 0.825 | 0.000 | | | | | |
| ENV | Pearson Correlation | 0.064 | 0.030 | -0.002 | -0.056 | -0.035 | 0.046 | -0.004 | -0.162 | 0.025 | 0.325 | 0.646 | -- | | | |
| | Sig. (2-tailed) | 0.096 | 0.441 | 0.961 | 0.145 | 0.361 | 0.226 | 0.915 | 0.000 | 0.513 | 0.000 | 0.000 | | | | |
| SOV | Pearson Correlation | -0.164 | -0.286 | -0.048 | 0.055 | 0.031 | -0.066 | 0.096 | 0.398 | -0.002 | 0.596 | -0.334 | 0.297 | -- | | |
| | Sig. (2-tailed) | 0.000 | 0.000 | 0.207 | 0.153 | 0.418 | 0.086 | 0.012 | 0.000 | 0.957 | 0.000 | 0.000 | 0.000 | | | |
| GOV | Pearson Correlation | 0.027 | 0.002 | -0.005 | -0.038 | 0.020 | -0.016 | 0.036 | 0.058 | 0.009 | 0.233 | -0.107 | 0.255 | 0.075 | -- | |
| | Sig. (2-tailed) | 0.477 | 0.962 | 0.905 | 0.325 | 0.610 | 0.677 | 0.351 | 0.127 | 0.814 | 0.000 | 0.005 | 0.000 | 0.052 | | |
| EMIS | Pearson Correlation | -0.096 | -0.175 | 0.016 | 0.006 | 0.084 | -0.128 | 0.018 | 0.391 | -0.039 | 0.523 | -0.243 | 0.289 | 0.747 | 0.078 | -- |
| | Sig. (2-tailed) | 0.012 | 0.000 | 0.674 | 0.885 | 0.028 | 0.001 | 0.638 | 0.000 | 0.312 | 0.000 | 0.000 | 0.000 | 0.000 | 0.043 | |

a. Listwise N=682

## Table 6 - Spearman's correlations between Cost of Capital, Cost of Equity, Cost of Debt, Control Variables and ESG Variables

| | | COC | COD | COE | INTCOV | BETA | ROA | LEV | SIZE | DISL | MEDIA | ESG | ENV | SOV | GOV | EMIS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COC | Correlation Coefficient | -- | | | | | | | | | | | | | | |
| | Sig. (2-tailed) | | | | | | | | | | | | | | | |
| COD | Correlation Coefficient | 0.452 | -- | | | | | | | | | | | | | |
| | Sig. (2-tailed) | 0.000 | | | | | | | | | | | | | | |
| COE | Correlation Coefficient | 0.849 | 0.274 | -- | | | | | | | | | | | | |
| | Sig. (2-tailed) | 0.000 | 0.000 | | | | | | | | | | | | | |
| INTCOV | Correlation Coefficient | 0.172 | -0.103 | 0.041 | -- | | | | | | | | | | | |
| | Sig. (2-tailed) | 0.000 | 0.007 | 0.290 | | | | | | | | | | | | |
| BETA | Correlation Coefficient | 0.503 | 0.064 | 0.720 | -0.012 | -- | | | | | | | | | | |
| | Sig. (2-tailed) | 0.000 | 0.093 | 0.000 | 0.761 | | | | | | | | | | | |
| ROA | Correlation Coefficient | 0.288 | 0.156 | 0.041 | 0.593 | -0.159 | -- | | | | | | | | | |
| | Sig. (2-tailed) | 0.000 | 0.000 | 0.290 | 0.000 | 0.000 | | | | | | | | | | |
| LEV | Correlation Coefficient | -0.407 | -0.048 | -0.202 | -0.285 | -0.118 | -0.180 | -- | | | | | | | | |
| | Sig. (2-tailed) | 0.000 | 0.211 | 0.000 | 0.000 | 0.002 | 0.000 | | | | | | | | | |
| SIZE | Correlation Coefficient | -0.276 | -0.268 | -0.090 | -0.005 | -0.057 | -0.197 | 0.155 | -- | | | | | | | |
| | Sig. (2-tailed) | 0.000 | 0.000 | 0.018 | 0.904 | 0.135 | 0.000 | 0.000 | | | | | | | | |
| DISL | Correlation Coefficient | 0.094 | 0.206 | 0.027 | -0.094 | -0.086 | 0.068 | -0.037 | -0.043 | -- | | | | | | |
| | Sig. (2-tailed) | 0.014 | 0.000 | 0.481 | 0.014 | 0.025 | 0.076 | 0.332 | 0.263 | | | | | | | |
| MEDIA | Correlation Coefficient | 0.013 | -0.162 | 0.108 | 0.080 | 0.166 | -0.047 | 0.161 | 0.332 | 0.003 | -- | | | | | |
| | Sig. (2-tailed) | 0.728 | 0.000 | 0.005 | 0.036 | 0.000 | 0.222 | 0.000 | 0.000 | 0.929 | | | | | | |
| ESG | Correlation Coefficient | 0.092 | 0.215 | -0.068 | -0.055 | -0.123 | 0.148 | -0.178 | -0.499 | 0.076 | -0.397 | -- | | | | |
| | Sig. (2-tailed) | 0.017 | 0.000 | 0.077 | 0.148 | 0.001 | 0.000 | 0.000 | 0.000 | 0.048 | 0.000 | | | | | |
| ENV | Correlation Coefficient | 0.062 | 0.057 | -0.008 | -0.031 | -0.022 | 0.049 | -0.014 | -0.184 | 0.068 | 0.242 | 0.579 | -- | | | |
| | Sig. (2-tailed) | 0.104 | 0.138 | 0.838 | 0.420 | 0.558 | 0.202 | 0.706 | 0.000 | 0.075 | 0.000 | 0.000 | | | | |
| SOV | Correlation Coefficient | -0.199 | -0.312 | -0.062 | 0.092 | 0.054 | -0.108 | 0.171 | 0.404 | 0.009 | 0.559 | -0.342 | 0.232 | -- | | |
| | Sig. (2-tailed) | 0.000 | 0.000 | 0.105 | 0.016 | 0.160 | 0.005 | 0.000 | 0.000 | 0.815 | 0.000 | 0.000 | 0.000 | | | |
| GOV | Correlation Coefficient | 0.066 | 0.032 | 0.049 | 0.053 | 0.052 | 0.010 | 0.020 | 0.069 | -0.018 | 0.246 | -0.130 | 0.216 | 0.063 | -- | |
| | Sig. (2-tailed) | 0.085 | 0.397 | 0.206 | 0.167 | 0.174 | 0.792 | 0.596 | 0.071 | 0.643 | 0.000 | 0.001 | 0.000 | 0.102 | | |
| EMIS | Correlation Coefficient | -0.161 | -0.206 | -0.011 | 0.009 | 0.093 | -0.196 | 0.140 | 0.341 | -0.008 | 0.433 | -0.246 | 0.190 | 0.714 | 0.060 | -- |
| | Sig. (2-tailed) | 0.000 | 0.000 | 0.781 | 0.805 | 0.015 | 0.000 | 0.000 | 0.000 | 0.827 | 0.000 | 0.000 | 0.000 | 0.000 | 0.120 | |

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Table 5 shows the Pearson correlation among the primary variables. Table 6 shows the Spearman nonparametric correlation among the primary variables. Most of the correlation results are similar. However, some of the results do not align between the two tests. For example, the correlation between the INTCOV and COE under the Pearson test is -0.011. But for the Spearman's test is 0.041. The correlation between LEV and COD under the Pearson test is 0.054, while under Spearman's test is -0.048. The correlation between LEV and ROA under the Pearson test is 0.043, while under Spearman's test is -0.180. The correlation between SIZE and LEV under Pearson's test is -0.034, while Spearmen's test result shows a positive correlation of 0.155. The correlation between DISL and LEV is 0.012 under Pearson's test, while under the Spearman's test is -0.037. The correlation between MEDIA and INTCOV is -0.023, whereas the result under the Spearman's test is 0.080. The correlation between SOC and DISL under the Pearson test is -0.002, while under Spearman's test is 0.009.

However, some of the results do not align between the two tests. For example, the correlation between the INTCOV and COE under the Pearson test is -0.011. But for the Spearman's test is 0.041. The correlation between LEV and COD under the Pearson test is 0.054, while under Spearman's test is -0.048. The correlation between LEV and ROA under the Pearson test is 0.043, while under Spearman's test is -0.180. The correlation between SIZE and LEV under Pearson's test is -0.034, while Spearmen's test result shows a positive correlation of 0.155. The correlation between DISL and LEV is 0.012 under Pearson's test, while under the Spearman's test is -0.037. The correlation between MEDIA and INTCOV is -0.023, whereas the result under the Spearman's test is 0.080. The correlation between SOC and DISL under the Pearson test is -0.002, while under Spearman's test is 0.009.

Based on the commonalities of these two tables, the following correlations are worth further discussion. For the cost of capital, it is noted that the COC is positively associated with the interest coverage ratio and Beta, which is consistent with the prior study; however, ROA demonstrates a positive correlation with the COC under both tests, which is inconsistent with existing literature (Sattar, 2015). Regarding the cost of debt, it is noted that the COD is negatively correlated with the interest coverage ratio, which is consistent with the prior findings as firms with high INTCOV would have a lower cost of debt. Consistent with the prior study, we also identify a negative correlation between the cost of debt and the firm size, suggesting that larger firms tend to have a relatively lower cost of debt than those of small firms. However, ROA is positively correlated with COD, inconsistent with the prior study by Francis et al. (2015). For the cost of equity, there is a positive correlation between the COE and a negative correlation with LEV, and it is positively correlated with Beta and negatively correlated with LEV and SIZE.

In terms of ESG performances, the ESG composite score is negatively correlated with LEV and INTCOV, which is consistent with prior research (Yasser Eliwa, 2021). In the meantime, the table shows that ESG performance is positively correlated with ESG Disclosure (DISL), Size, and ROA, which are consistent with prior studies (Francis et al., 2005; Gray et al., 2009).

Moreover, in alignment with previous study (Yasser Eliwa, 2021), the results show a positive correlation between ESG disclosure and ESG performances. However, the correlation between the DISC and ESG (0.007) is far from a perfect correlation, suggesting that ESG disclosure and ESG performance composite score capture different attributes of ESG rating, or put in other words, at least not correlated. This result can not verify the previous study of Al-Tuwaijri, Christensen, and Hughes (2003) that good environmental performance is positively associated with good environmental disclosure. Nor could it justify the research conclusion of Pour Bahman, Nazari, and Emami (2014) that there is a positive association between actual corporate social responsibility performance and readability and the level of corporate social responsibility disclosure. Therefore, the use of both attributes in the model will better capture the influence of ESG practices in understanding the cost of capital, particularly the separate effects on the cost of debt and the cost of equity, respectively.

## 6. Main Test and Result

In this section, three sets of tests are presented to examine the association between ESG practices and Cost of Capital, Cost of Debt and Cost of Equity, respectively. First, we examine the effect of the impact of these ESG variables without the fixed effect. Second, we examine the association between ESG variables and COC, COE and COD with industry effect, and year effect fixed, respectively. Lastly, we examine the association between ESG variables and COC, COD and COE with industry and year effect fixed at the same time.

### 6.1 non-fixed effect

#### *6.1.1 With ESG Composite Score*

We include firm characteristics that are reported to affect the cost of capital, alternatively, the cost of debt, and cost of equity specifically. Along with ESG performance, ESG disclosure, and ESG controversies, we include market capitalizations (Size), leverage (LEV), return on assets (ROA), and liquidity measure of interest coverage (INTCOV). First, we examine their correlation without any fixed effect on industries and years.

$$\mathrm{CoC} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\mathrm{BETA} + \beta_6\mathrm{ESG} + \beta_7\mathrm{DISL} + \beta_8\mathrm{MEDIA}$$

$$\mathrm{CoD} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\mathrm{BETA} + \beta_6\mathrm{ESG} + \beta_7\mathrm{DISL} + \beta_8\mathrm{MEDIA}$$

$$\mathrm{CoE} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\mathrm{BETA} + \beta_6\mathrm{ESG} + \beta_7\mathrm{DISL} + \beta_8\mathrm{MEDIA}$$

## Table 7 - Pooled regressions of ESG performance, disclosure, and media controversies on CoC (Non-fixed Effect, Composite ESG score)

*Coefficients* [a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 11.447 | 2.571 | | 4.452 | 0.000 | | |
| | INTCOV | -0.001 | 0.008 | -0.006 | -0.167 | 0.868 | 0.719 | 1.390 |
| | BETA | 3.507 | 0.200 | 0.542 | 17.527 | 0.000 | 0.877 | 1.140 |
| | ROA | 0.178 | 0.019 | 0.331 | 9.635 | 0.000 | 0.712 | 1.404 |
| | LEV | -0.003 | 0.001 | -0.145 | -4.823 | 0.000 | 0.929 | 1.076 |
| | SIZE | -0.471 | 0.098 | -0.167 | -4.808 | 0.000 | 0.698 | 1.432 |
| | DISL | 0.015 | 0.004 | 0.115 | 3.727 | 0.000 | 0.883 | 1.133 |
| | MEDIA | 0.009 | 0.006 | 0.049 | 1.524 | 0.128 | 0.796 | 1.256 |
| | ESG | 0.003 | 0.003 | 0.040 | 1.166 | 0.244 | 0.701 | 1.426 |

a. Dependent Variable: COC

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .660[a] | 0.436 | 0.429 | 2.3104% | 0.436 | 64.943 | 8 | 673 | 0.000 |

a. Predictors: (Constant), ESG, DISL, LEV

## Table 8 - Pooled regressions of ESG performance, disclosure, and media controversies on CoD (Non-fixed Effect, Composite ESG Score)

*Coefficients* [a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 5.464 | 1.327 | | 4.117 | 0.000 | | |
| | INTCOV | -0.009 | 0.004 | -0.098 | -2.345 | 0.019 | 0.719 | 1.390 |
| | BETA | 0.392 | 0.103 | 0.144 | 3.796 | 0.000 | 0.877 | 1.140 |
| | ROA | 0.038 | 0.010 | 0.167 | 3.956 | 0.000 | 0.712 | 1.404 |
| | LEV | 0.001 | 0.000 | 0.067 | 1.824 | 0.069 | 0.929 | 1.076 |
| | SIZE | -0.177 | 0.051 | -0.149 | -3.500 | 0.000 | 0.698 | 1.432 |
| | DISL | 0.009 | 0.002 | 0.163 | 4.302 | 0.000 | 0.883 | 1.133 |
| | MEDIA | -0.007 | 0.003 | -0.085 | -2.124 | 0.034 | 0.796 | 1.256 |
| | ESG | 0.003 | 0.001 | 0.083 | 1.959 | 0.050 | 0.701 | 1.426 |

a. Dependent Variable: COD

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .387[a] | 0.150 | 0.140 | 1.1925% | 0.150 | 14.812 | 8 | 673 | 0.000 |

a. Predictors: (Constant), ESG, DISL, LEV

## Table 9 - Pooled regressions of ESG performance, disclosure, and media controversies on CoE (Non-fixed Effect, Composite ESG Score)

*Coefficients* [a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 4.698 | 3.382 | | 1.389 | 0.165 | | |
| | INTCOV | -0.010 | 0.010 | -0.034 | -1.021 | 0.308 | 0.719 | 1.390 |
| | BETA | 5.801 | 0.263 | 0.667 | 22.041 | 0.000 | 0.877 | 1.140 |
| | ROA | 0.113 | 0.024 | 0.156 | 4.637 | 0.000 | 0.712 | 1.404 |
| | LEV | -0.002 | 0.001 | -0.091 | -3.088 | 0.002 | 0.929 | 1.076 |
| | SIZE | -0.181 | 0.129 | -0.048 | -1.403 | 0.161 | 0.698 | 1.432 |
| | DISL | 0.013 | 0.005 | 0.074 | 2.468 | 0.014 | 0.883 | 1.133 |
| | MEDIA | 0.011 | 0.008 | 0.044 | 1.394 | 0.164 | 0.796 | 1.256 |
| | ESG | -0.001 | 0.004 | -0.008 | -0.248 | 0.804 | 0.701 | 1.426 |

a. Dependent Variable: COE

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .678[a] | 0.460 | 0.453 | 3.0391% | 0.460 | 71.536 | 8 | 673 | 0.000 |

a. Predictors: (Constant), ESG, DISL, LEV

First, we examine their correlation without any fixed effect on industries and years. Regarding the cost of capital, the results show a significant positive association between ESG disclosure and the cost of capital. The estimated coefficient of ESG disclosure is 0.115 and is statistically significant at 1% level (t-statistics is 3.727), which is inconsistent with our hypothesis. However, we did not observe a significant correlation between either the ESG composite performance score or the ESG controversies score with the cost of capital. The adjusted R square under this model is 0.429.

In terms of the cost of debt, the results show a significant positive association between ESG disclosure and the cost of debt. The estimated coefficient of ESG disclosure is 0.163 and is statistically significant at 1% level (t-statistics is 4.302), which rejected our previous hypothesis. Similar to the result of the cost of capital, we do not observe any significant correlation between the cost of debt and either the ESG performance or ESG controversies score. The adjusted R square under this model is 0.140.

Lastly, regarding the cost of equity, the results show a significant positive association between ESG disclosure and the cost of equity. The estimated coefficient of ESG disclosure is 0.074 and is statistically significant at 5% level (t-statistics is 2.468), which is against our previous hypothesis. At the same time, we do not observe any significant correlation between COE and the ESG performance or controversies score. The adjusted R square under this model is 0.453.

### *6.1.2 Replacing ESG composite score by pillar scores (Environment, Social and Environment Pillar Score)*

In section 6.1.2, we further decompose the total score of ESG performance into its dimensions under environment, social, and governance aspects, with no fixed effect for IND and YEAR variables.

$$\mathrm{CoC} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\mathrm{BETA} + \beta_6\mathrm{ENV} + \beta_7\mathrm{SOV} + \beta_8\mathrm{GOV} + \beta_9\mathrm{DISL} + \beta_{10}\mathrm{MEDIA}$$

$$\mathrm{CoD} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\mathrm{BETA} + \beta_6\mathrm{ENV} + \beta_7\mathrm{SOV} + \beta_8\mathrm{GOV} + \beta_9\mathrm{DISL} + \beta_{10}\mathrm{MEDIA}$$

$$\mathrm{CoE} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\mathrm{BETA} + \beta_6\mathrm{ENV} + \beta_7\mathrm{SOV} + \beta_8\mathrm{GOV} + \beta_9\mathrm{DISL} + \beta_{10}\mathrm{MEDIA}$$

## Table 10 - Pooled regressions of ESG performance, disclosure, and media controversies on CoC (Non-fixed Effect, with detailed ESG pillar scores)

*Coefficients* [a]

| Model | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|
| (Constant) | 9.226 | 2.484 | | 3.715 | 0.000 | | |
| INTCOV | 0.003 | 0.007 | 0.012 | 0.349 | 0.727 | 0.709 | 1.410 |
| BETA | 3.511 | 0.197 | 0.542 | 17.787 | 0.000 | 0.876 | 1.141 |
| ROA | 0.176 | 0.018 | 0.327 | 9.668 | 0.000 | 0.713 | 1.403 |
| LEV | -0.002 | 0.001 | -0.137 | -4.632 | 0.000 | 0.932 | 1.073 |
| SIZE | -0.343 | 0.099 | -0.121 | -3.459 | 0.001 | 0.662 | 1.510 |
| DISL | 0.016 | 0.004 | 0.119 | 3.903 | 0.000 | 0.882 | 1.134 |
| MEDIA | 0.019 | 0.007 | 0.103 | 2.676 | 0.008 | 0.546 | 1.830 |
| ENV | 0.013 | 0.007 | 0.063 | 1.852 | 0.065 | 0.702 | 1.424 |
| SOV | -0.034 | 0.007 | -0.179 | -4.637 | 0.000 | 0.545 | 1.836 |
| GOV | 0.001 | 0.005 | 0.006 | 0.212 | 0.833 | 0.891 | 1.123 |

a. Dependent Variable: COC

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .673[a] | 0.453 | 0.445 | 2.2777% | 0.453 | 55.602 | 10 | 671 | 0.000 |

a. Predictors: (Constant), GOV, DISL, LEV

## Table 11 - Pooled regressions of ESG performance, disclosure, and media controversies on CoD (Non-fixed Effect, with disaggregated ESG Pillar Scores)

*Coefficients* [a]

| Model | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|
| (Constant) | 4.597 | 1.275 | | 3.607 | 0.000 | | |
| INTCOV | -0.007 | 0.004 | -0.075 | -1.816 | 0.070 | 0.709 | 1.410 |
| BETA | 0.383 | 0.101 | 0.141 | 3.780 | 0.000 | 0.876 | 1.141 |
| ROA | 0.037 | 0.009 | 0.163 | 3.946 | 0.000 | 0.713 | 1.403 |
| LEV | 0.001 | 0.000 | 0.075 | 2.084 | 0.038 | 0.932 | 1.073 |
| SIZE | -0.111 | 0.051 | -0.093 | -2.184 | 0.029 | 0.662 | 1.510 |
| DISL | 0.009 | 0.002 | 0.167 | 4.505 | 0.000 | 0.882 | 1.134 |
| MEDIA | 0.000 | 0.004 | -0.001 | -0.028 | 0.978 | 0.546 | 1.830 |
| ENV | 0.008 | 0.004 | 0.084 | 2.026 | 0.043 | 0.702 | 1.424 |
| SOV | -0.021 | 0.004 | -0.269 | -5.698 | 0.000 | 0.545 | 1.836 |
| GOV | -7.546E-05 | 0.003 | -0.001 | -0.029 | 0.977 | 0.891 | 1.123 |

a. Dependent Variable: COD

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .431[a] | 0.185 | 0.173 | 1.1689% | 0.185 | 15.280 | 10 | 671 | 0.000 |

a. Predictors: (Constant), GOV, DISL, LEV

## Table 12 - Pooled regressions of ESG performance, disclosure, and media controversies on CoE (Non-fixed Effect, with disaggregated ESG Pillar Scores)

*Coefficients* [a]

| Model | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|
| (Constant) | 2.747 | 3.298 | | 0.833 | 0.405 | | |
| INTCOV | -0.007 | 0.010 | -0.025 | -0.739 | 0.460 | 0.709 | 1.410 |
| BETA | 5.808 | 0.262 | 0.668 | 22.158 | 0.000 | 0.876 | 1.141 |
| ROA | 0.111 | 0.024 | 0.153 | 4.585 | 0.000 | 0.713 | 1.403 |
| LEV | -0.002 | 0.001 | -0.084 | -2.891 | 0.004 | 0.932 | 1.073 |
| SIZE | -0.061 | 0.132 | -0.016 | -0.465 | 0.642 | 0.662 | 1.510 |
| DISL | 0.014 | 0.005 | 0.077 | 2.547 | 0.011 | 0.882 | 1.134 |
| MEDIA | 0.025 | 0.009 | 0.102 | 2.676 | 0.008 | 0.546 | 1.830 |
| ENV | 0.004 | 0.010 | 0.015 | 0.434 | 0.664 | 0.702 | 1.424 |
| SOV | -0.027 | 0.010 | -0.106 | -2.768 | 0.006 | 0.545 | 1.836 |
| GOV | -0.007 | 0.007 | -0.033 | -1.089 | 0.277 | 0.891 | 1.123 |

a. Dependent Variable: COE

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .683[a] | 0.466 | 0.458 | 3.0248% | 0.466 | 58.605 | 10 | 671 | 0.000 |

a. Predictors: (Constant), GOV, DISL, LEV

In terms of the cost of capital, the social pillar score shows a significant negative association with the cost of capital. The estimated coefficient of social performance is -0.179 and is statistically significant at 1% level (t-statistics is - 4.637). The results also show a significant positive association between ESG disclosure and the cost of capital. The estimated coefficient of ESG disclosure is 0.119 and is statistically significant at 1% level (t-statistics is 3.903). Regarding ESG controversies, we observe a positive correlation between ESG controversies score and cost of capital and cost of equity. For the cost of capital, the estimated coefficient of ESG controversies is 0.103 and is statistically significant at 1% level (t-statistics is 2.676). This result is inconsistent with our previous hypothesis. The adjusted R square under this model is 0.445.

For the cost of debt, the estimated coefficient of social performance is -0.269 and is statistically significant at 1% level (t-statistics is – 5.698). In addition, the results show a significant positive association between ESG disclosure and the cost of debt. The estimated coefficient of ESG disclosure is 0.167 and is statistically significant at 1% level (t-statistics is 4.505). In terms of the ESG controversies, we do not observe a significant correlation between the Cost of Debt and the ESG controversies score. The adjusted R square under this model is 0.173.

Lastly, regarding the cost of equity, the estimated coefficient of social performance is -0.106 and is statistically significant at 1% level (t-statistics is -2.768). Moreover, the results unveil a significant positive association between the cost of equity and ESG disclosure. The estimated coefficient of ESG disclosure is 0.077 and is statistically significant at 5% level (t-statistics is 2.547), which is inconsistent with our previous hypothesis. Moreover, a positive correlation between the ESG controversies score and the cost of equity is observed. The estimated coefficient of ESG controversies is 0.102 and is statistically significant at 1% level (t-statistics is 2.676). This result is also inconsistent with our previous hypothesis. The adjusted R square under this model is 0.458.

## 6.2 Fixed Year effect

### *6.2.1 Taking ESG Composite Score into account*

In this section, we examine the correlation between the ESG performance, ESG disclosure, and ESG controversies with fix year effect are considered. In section 6.2.1, we examine the ESG composite score, and in section 6.2.2, the composite score is decomposed again by the pillar score.

$$CoC = \alpha + \beta_1 Size_t + \beta_2 LEV_t + \beta_3 ROA_t + \beta_4 INTCOV_t + \beta_5 BETA_t + \beta_6 ESG_t + \beta_7 DISL_t + \beta_8 MEDIA_t + \beta_9 YearFixedEffect_i + V_t$$

$$CoD = \alpha + \beta_1 Size_t + \beta_2 LEV_t + \beta_3 ROA_t + \beta_4 INTCOV_t + \beta_5 BETA_t + \beta_6 ESG_t + \beta_7 DISL_t + \beta_8 MEDIA_t + \beta_9 YearFixedEffect_i + V_t$$

$$CoE = \alpha + \beta_1 Size_t + \beta_2 LEV_t + \beta_3 ROA_t + \beta_4 INTCOV_t + \beta_5 BETA_t + \beta_6 ESG_t + \beta_7 DISL_t + \beta_8 MEDIA_t + \beta_9 YearFixedEffect_i + V_t$$

## Table 13 - Pooled regressions of ESG performance, disclosures, and media controversies on CoC (Fixed Years, Composite ESG Score)

*Coefficients* [a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 13.489 | 2.390 | | 5.645 | 0.000 | | |
| | INTCOV | -0.005 | 0.007 | -0.024 | -0.762 | 0.446 | 0.712 | 1.404 |
| | BETA | 3.642 | 0.185 | 0.563 | 19.672 | 0.000 | 0.869 | 1.151 |
| | ROA | 0.161 | 0.018 | 0.298 | 9.050 | 0.000 | 0.656 | 1.524 |
| | LEV | -0.002 | 0.000 | -0.139 | -5.006 | 0.000 | 0.926 | 1.080 |
| | SIZE | -0.531 | 0.091 | -0.188 | -5.857 | 0.000 | 0.690 | 1.450 |
| | DISL | 0.016 | 0.004 | 0.117 | 4.131 | 0.000 | 0.881 | 1.135 |
| | MEDIA | 0.010 | 0.005 | 0.052 | 1.729 | 0.084 | 0.793 | 1.261 |
| | ESG | 0.000 | 0.003 | -0.005 | -0.160 | 0.873 | 0.689 | 1.452 |

a. Dependent Variable: COC

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | Change Statistics F Change | Change Statistics df1 | Change Statistics df2 | Change Statistics Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .724[a] | 0.524 | 0.516 | 2.1280% | 0.524 | 61.390 | 12 | 669 | 0.000 |

a. Predictors: (Constant), Index1=5.0, DISL, MEDIA, ROA, LEV

## Table 14 - Pooled regressions of ESG performance, disclosures, and media controversies on CoD (Fixed Years, Composite ESG Score)

*Coefficients* [a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 6.589 | 1.229 | | 5.360 | 0.000 | | |
| | INTCOV | -0.011 | 0.004 | -0.118 | -3.050 | 0.002 | 0.712 | 1.404 |
| | BETA | 0.451 | 0.095 | 0.166 | 4.732 | 0.000 | 0.869 | 1.151 |
| | ROA | 0.026 | 0.009 | 0.113 | 2.795 | 0.005 | 0.656 | 1.524 |
| | LEV | 0.001 | 0.000 | 0.073 | 2.167 | 0.031 | 0.926 | 1.080 |
| | SIZE | -0.214 | 0.047 | -0.181 | -4.594 | 0.000 | 0.690 | 1.450 |
| | DISL | 0.009 | 0.002 | 0.168 | 4.826 | 0.000 | 0.881 | 1.135 |
| | MEDIA | -0.006 | 0.003 | -0.083 | -2.255 | 0.024 | 0.793 | 1.261 |
| | ESG | 0.001 | 0.001 | 0.025 | 0.646 | 0.518 | 0.689 | 1.452 |

a. Dependent Variable: COD

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | Change Statistics F Change | Change Statistics df1 | Change Statistics df2 | Change Statistics Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .536[a] | 0.288 | 0.275 | 1.0948% | 0.288 | 22.509 | 12 | 669 | 0.000 |

a. Predictors: (Constant), Index1=5.0, DISL, MEDIA, ROA, LEV

**Table 15 - Pooled regressions of ESG performance, disclosures, and media controversies on CoE (Fixed Years, Composite ESG Score)**

*Coefficients[a]*

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 6.437 | 3.244 | | 1.984 | 0.048 | | |
| | INTCOV | -0.015 | 0.009 | -0.051 | -1.609 | 0.108 | 0.712 | 1.404 |
| | BETA | 5.962 | 0.251 | 0.685 | 23.721 | 0.000 | 0.869 | 1.151 |
| | ROA | 0.102 | 0.024 | 0.141 | 4.235 | 0.000 | 0.656 | 1.524 |
| | LEV | -0.002 | 0.001 | -0.084 | -3.011 | 0.003 | 0.926 | 1.080 |
| | SIZE | -0.230 | 0.123 | -0.061 | -1.868 | 0.062 | 0.690 | 1.450 |
| | DISL | 0.013 | 0.005 | 0.075 | 2.616 | 0.009 | 0.881 | 1.135 |
| | MEDIA | 0.011 | 0.007 | 0.045 | 1.496 | 0.135 | 0.793 | 1.261 |
| | ESG | -0.005 | 0.004 | -0.042 | -1.298 | 0.195 | 0.689 | 1.452 |

a. Dependent Variable: COE

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | Change Statistics F Change | Change Statistics df1 | Change Statistics df2 | Change Statistics Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .717[a] | 0.515 | 0.506 | 2.8887% | 0.515 | 59.112 | 12 | 669 | 0.000 |

a. Predictors: (Constant), Index1=5.0, DISL, MEDIA, ROA, LEV

Given the fixed-year effect, we firstly proceed to regress the ESG composite score on the overall cost of capital. The results for the model flag a significant positive association between the ESG disclosure and the cost of capital. The estimated coefficient of ESG disclosure is 0.117 and is statistically significant at 1% level (t-statistics is 4.131). However, we do not observe a significant correlation between either the ESG composite scores or ESG controversies and the overall cost of capital. The adjusted R square is 0.516.

Regarding the cost of debt financing, the results show a significant positive association between ESG disclosure and the cost of debt. The estimated coefficient of ESG disclosure is 0.168 and is statistically significant at 1% level (t-statistics is 4.826). This result is inconsistent with our previous hypothesis but consistent with the earlier findings in Sections 6.1.1 to 6.1.2. Furthermore, the model also shows a negative correlation between the ESG controversies (MEDIA) and the cost of debt. The estimated coefficient of MEDIA is -0.083 and is statistically significant at 5% level (t-statistics is -2.555). This result is consistent with our previous hypothesis that a more negative media coverage would correlate to a higher debt financing rate. At the composite level of ESG performance, we do not observe a significant correlation between ESG performance and the cost of debt. The adjusted R square under this model is 0.275.

Lastly, regarding the cost of equity financing, we see a significant positive association between ESG disclosure and the cost of equity. The estimated coefficient of ESG disclosure is 0.075. It is statistically significant at 1% level (t-statistics is 2.616), which is inconsistent with our previous hypothesis but consistent with the earlier findings in Section 6.1. In terms of both ESG controversies (MEDIA) and composite ESG performance, we do not observe a significant correlation between these factors and the cost of equity. The adjusted R square under this model is 0.506.

### *6.2.2 Replacing ESG composite score by pillar scores (Environment, Social and Environment Pillar Score)*

With the fixed year's effect, we then decompose the total ESG performance into its dimensions under the 'Environmental' (ENV), 'Social' (SOC), and 'Governance' (GOV) aspects.

$$\mathrm{CoC} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\,\mathrm{BETA} + \beta_6\mathrm{ENV} + \beta_7\mathrm{SOV} + \beta_8\mathrm{GOV} + \beta_9\mathrm{DISL} + \beta_{10}\mathrm{MEDIA} + \beta_{11}\mathrm{YearFixedEffect_i} + \mathrm{V_t}$$

$$\mathrm{CoC} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\,\mathrm{BETA} + \beta_6\mathrm{ENV} + \beta_7\mathrm{SOV} + \beta_8\mathrm{GOV} + \beta_9\mathrm{DISL} + \beta_{10}\mathrm{MEDIA} + \beta_{11}\mathrm{YearFixedEffect_i} + \mathrm{V_t}$$

$$\mathrm{CoC} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\,\mathrm{BETA} + \beta_6\mathrm{ENV} + \beta_7\mathrm{SOV} + \beta_8\mathrm{GOV} + \beta_9\mathrm{DISL} + \beta_{10}\mathrm{MEDIA} + \beta_{11}\mathrm{YearFixedEffect_i} + \mathrm{V_t}$$

**Table 16 - Pooled regressions of ESG performance, disclosures, and media controversies on CoC (Fixed Years, with disaggregated ESG Pillar Scores)**

*Coefficients* [a]

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| | (Constant) | 11.440 | 2.306 | | 4.961 | 0.000 | | |
| | INTCOV | -0.002 | 0.007 | -0.009 | -0.291 | 0.771 | 0.702 | 1.424 |
| | BETA | 3.636 | 0.182 | 0.562 | 19.941 | 0.000 | 0.869 | 1.151 |
| | ROA | 0.159 | 0.017 | 0.295 | 9.102 | 0.000 | 0.657 | 1.523 |
| | LEV | -0.002 | 0.000 | -0.131 | -4.814 | 0.000 | 0.929 | 1.076 |
| | SIZE | -0.412 | 0.092 | -0.146 | -4.490 | 0.000 | 0.653 | 1.531 |
| | DISL | 0.016 | 0.004 | 0.120 | 4.302 | 0.000 | 0.880 | 1.136 |
| | MEDIA | 0.025 | 0.007 | 0.135 | 3.775 | 0.000 | 0.541 | 1.847 |
| | ENV | 0.001 | 0.007 | 0.007 | 0.214 | 0.831 | 0.683 | 1.464 |
| | SOV | -0.031 | 0.007 | -0.166 | -4.651 | 0.000 | 0.543 | 1.840 |
| | GOV | 0.001 | 0.005 | 0.004 | 0.151 | 0.880 | 0.888 | 1.126 |

a. Dependent Variable: COC

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| | .735[a] | 0.540 | 0.530 | 2.0952% | 0.540 | 55.935 | 14 | 667 | 0.000 |

a. Predictors: (Constant), Index1=5.0, DISL, SOV, GOV, BETA, LEV

## Table 17 - Pooled regressions of ESG performance, disclosures, and media controversies on CoD (Fixed Years, with disaggregated ESG Pillar Scores)

*Coefficients* [a]

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| | (Constant) | 5.824 | 1.176 | | 4.951 | 0.000 | | |
| | INTCOV | -0.009 | 0.004 | -0.098 | -2.584 | 0.010 | 0.702 | 1.424 |
| | BETA | 0.437 | 0.093 | 0.161 | 4.698 | 0.000 | 0.869 | 1.151 |
| | ROA | 0.025 | 0.009 | 0.109 | 2.780 | 0.006 | 0.657 | 1.523 |
| | LEV | 0.001 | 0.000 | 0.081 | 2.452 | 0.014 | 0.929 | 1.076 |
| | SIZE | -0.154 | 0.047 | -0.129 | -3.283 | 0.001 | 0.653 | 1.531 |
| | DISL | 0.010 | 0.002 | 0.171 | 5.044 | 0.000 | 0.880 | 1.136 |
| | MEDIA | 0.003 | 0.003 | 0.037 | 0.856 | 0.392 | 0.541 | 1.847 |
| | ENV | 0.001 | 0.003 | 0.012 | 0.323 | 0.747 | 0.683 | 1.464 |
| | SOV | -0.020 | 0.003 | -0.250 | -5.793 | 0.000 | 0.543 | 1.840 |
| | GOV | 0.000 | 0.002 | -0.003 | -0.091 | 0.927 | 0.888 | 1.126 |

a. Dependent Variable: COD

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| | .568[a] | 0.323 | 0.309 | 1.0687% | 0.323 | 22.748 | 14 | 667 | 0.000 |

a. Predictors: (Constant), Index1=5.0, DISL, SOV, GOV, BETA, LEV

## Table 18 - Pooled regressions of ESG performance, disclosures, and media controversies on CoE (Fixed Years, with disaggregated ESG Pillar Scores)

*Coefficients* [a]

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| | (Constant) | 4.683 | 3.161 | | 1.481 | 0.139 | | |
| | INTCOV | -0.013 | 0.009 | -0.044 | -1.385 | 0.167 | 0.702 | 1.424 |
| | BETA | 5.960 | 0.250 | 0.685 | 23.842 | 0.000 | 0.869 | 1.151 |
| | ROA | 0.101 | 0.024 | 0.139 | 4.201 | 0.000 | 0.657 | 1.523 |
| | LEV | -0.002 | 0.001 | -0.078 | -2.809 | 0.005 | 0.929 | 1.076 |
| | SIZE | -0.119 | 0.126 | -0.031 | -0.946 | 0.344 | 0.653 | 1.531 |
| | DISL | 0.014 | 0.005 | 0.076 | 2.680 | 0.008 | 0.880 | 1.136 |
| | MEDIA | 0.031 | 0.009 | 0.126 | 3.454 | 0.001 | 0.541 | 1.847 |
| | ENV | -0.008 | 0.009 | -0.028 | -0.859 | 0.391 | 0.683 | 1.464 |
| | SOV | -0.024 | 0.009 | -0.096 | -2.652 | 0.008 | 0.543 | 1.840 |
| | GOV | -0.008 | 0.006 | -0.036 | -1.264 | 0.207 | 0.888 | 1.126 |

a. Dependent Variable: COE

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| | .722[a] | 0.522 | 0.511 | 2.8724% | 0.522 | 51.931 | 14 | 667 | 0.000 |

a. Predictors: (Constant), Index1=5.0, DISL, SOV, GOV, BETA, LEV

The results for the models above unveil a significant negative association between the 'Social' pillar and the cost of capital. The estimated coefficient of the ESG social pillar score is -0.166. It is statistically significant at 1% level (t-statistics is -4.651), which is consistent with our previous hypothesis that higher social performance correlates with a lower capital cost. Regarding the other two ESG pillar scores, we do not identify any statistically significant correlation between the cost of capital and either the environmental pillar score or the governance pillar score. The results also show a positive correlation between the ESG disclosures (DISL) and the cost of capital. The estimated coefficient of ESG disclosure is 0.120 and is statistically significant at 1% level (t-statistics is 4.302). However, we do not observe a significant correlation between the ESG controversies and the cost of capital. The adjusted R square under this model is 0.530.

Regarding the cost of debt, we only observe a significant negative correlation between the social pillar score and the cost of debt among the three ESG pillar scores, similar to the cost of capital. The social (SOC) pillar score's estimated coefficient is -0.250 and is statistically significant at 1% level (t-statistics is –5.793). This result is also inconsistent with our previous hypothesis. In addition, a significant positive relationship between ESG disclosure and the cost of debt is identified. The estimated coefficient of ESG disclosure is 0.171 and is statistically significant at 1% level (t-statistics is 5.044). Contrary to the composite ESG scores, for the decomposed ESG pillar scores, we do not observe a statistically significant relationship between ESG controversies and the cost of debt. The adjusted R square under this model is 0.309.

As for the cost of equity, we also observe a significant negative correlation between the social pillar score and the cost of equity among the three ESG pillar scores, akin to the overall capital cost observations. The social (SOC) pillar score's estimated coefficient is -0.096 and is statistically significant at 1% level (t-statistics is -2.652). The ESG disclosures (DISL) and ESG controversies (MEDIA) also show a positive correlation between both variables and the cost of equity. This result is consistent with our previous sub-hypothesis, as a higher media coverage of ESG controversies would correlate with the more difficult financing condition. But the result is not compatible with the sub-hypothesis that more ESG disclosures would be associated with a lower cost of capital. The estimated coefficient of ESG disclosure is 0.076 and is statistically significant at 1% level (t-statistics is 2.680). The estimated coefficient of ESG controversies is 0.126 and is statistically significant at 1% level (t-statistics is 3.454). The adjusted R square under this model is 0.511.

In summation, under the fixed year effect with composite ESG score, only the ESG controversies demonstrate a negative correlation with the Cost of Debt, which does not align with the regression result from Section 6.1.1. All other findings are consistent with the regression results with non-fixed time or industry effect (Section 6.1.1 and Section 6.1.2).

## 6.3 Fixed Industry effect

### *6.3.1 Taking ESG Composite Score into account*

In this section, we have examined the correlation between the ESG performance, ESG disclosure and ESG controversies with fix industries effect considered. In section 6.3.1 we examine the ESG composite score, and in section 6.3.2 the composite score is decomposed again by the pillar score.

$$\mathrm{CoC} = \alpha + \beta_1 \mathrm{Size}_i + \beta_2 \mathrm{LEV}_i + \beta_3 \mathrm{ROA}_i + \beta_4 \mathrm{INTCOV}_i + \beta_5 \mathrm{BETA}_i + \beta_6 \mathrm{ESG}_i + \beta_7 \mathrm{DISL}_i + \beta_8 \mathrm{MEDIA}_i + \beta_9 \mathrm{IndustryFixedEffect}_i + \mathrm{V}_i$$

$$\mathrm{CoD} = \alpha + \beta_1 \mathrm{Size}_i + \beta_2 \mathrm{LEV}_i + \beta_3 \mathrm{ROA}_i + \beta_4 \mathrm{INTCOV}_i + \beta_5 \mathrm{BETA}_i + \beta_6 \mathrm{ESG}_i + \beta_7 \mathrm{DISL}_i + \beta_8 \mathrm{MEDIA}_i + \beta_9 \mathrm{IndustryFixedEffect}_i + \mathrm{V}_i$$

$$\mathrm{CoE} = \alpha + \beta_1 \mathrm{Size}_i + \beta_2 \mathrm{LEV}_i + \beta_3 \mathrm{ROA}_i + \beta_4 \mathrm{INTCOV}_i + \beta_5 \mathrm{BETA}_i + \beta_6 \mathrm{ESG}_i + \beta_7 \mathrm{DISL}_i + \beta_8 \mathrm{MEDIA}_i + \beta_9 \mathrm{IndustryFixedEffect}_i + \mathrm{V}_i$$

**Table 19 - Pooled regressions of ESG performance, disclosures, and media controversies on CoC (Fixed Industries, Composite ESG Score)**

Coefficients[a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 7.516 | 2.71 | | 2.773 | 0.006 | | |
| | INTCOV | 0.007 | 0.008 | 0.031 | 0.900 | 0.368 | 0.624 | 1.604 |
| | BETA | 2.998 | 0.236 | 0.463 | 12.722 | 0.000 | 0.565 | 1.771 |
| | ROA | 0.166 | 0.018 | 0.307 | 9.104 | 0.000 | 0.66 | 1.515 |
| | LEV | -0.001 | 0.001 | -0.054 | -1.708 | 0.088 | 0.751 | 1.332 |
| | SIZE | -0.293 | 0.106 | -0.104 | -2.766 | 0.006 | 0.531 | 1.883 |
| | DISL | 0.011 | 0.004 | 0.086 | 2.916 | 0.004 | 0.856 | 1.168 |
| | MEDIA | 0.004 | 0.006 | 0.019 | 0.592 | 0.554 | 0.715 | 1.398 |
| | ESG | 0.002 | 0.003 | 0.03 | 0.888 | 0.375 | 0.648 | 1.544 |

a. Dependent Variable: COC

Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics: R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| 1 | .709a | 0.502 | 0.490 | 2.183% | 0.502 | 41.919 | 16 | 665 | 0.000 |

b. Predictors: (Constant), GICS=Real Estate, GICS=Information Technology, GICS=Health Care, GICS=Consumer Staples, LEV, DISL, SIZE, ROA, GICS=Industrials, BETA, GICS=Energy, MEDIA, INTCOV, ESG, GICS=Consumer Discretionary, GICS=Materials

**Table 20 - Pooled regressions of ESG performance, disclosures, and media controversies on CoD (Fixed Industries, Composite ESG Score)**

Coefficients[a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| 2 | (Constant) | 5.182 | 1.422 | | 3.645 | 0.000 | | |
| | INTCOV | -0.008 | 0.004 | -0.084 | -1.941 | 0.053 | 0.624 | 1.604 |
| | BETA | 0.088 | 0.124 | 0.032 | 0.709 | 0.479 | 0.565 | 1.771 |
| | ROA | 0.033 | 0.01 | 0.144 | 3.422 | 0.001 | 0.66 | 1.515 |
| | LEV | 0.001 | 0 | 0.163 | 4.137 | 0.000 | 0.751 | 1.332 |
| | SIZE | -0.161 | 0.056 | -0.135 | -2.886 | 0.004 | 0.531 | 1.883 |
| | DISL | 0.008 | 0.002 | 0.137 | 3.717 | 0.000 | 0.856 | 1.168 |
| | MEDIA | -0.008 | 0.003 | -0.097 | -2.413 | 0.016 | 0.715 | 1.398 |
| | ESG | 0.002 | 0.001 | 0.069 | 1.63 | 0.104 | 0.648 | 1.544 |

a. Dependent Variable: COD

Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics: R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| 2 | .475[a] | 0.225 | 0.207 | 1.145% | 0.225 | 12.081 | 16 | 665 | 0.000 |

Predictors: (Constant), GICS=Real Estate, GICS=Information Technology, GICS=Health Care, GICS=Consumer Staples, LEV, DISL, SIZE, ROA, GICS=Industrials, BETA, GICS=Energy, MEDIA, INTCOV, ESG, GICS=Consumer Discretionary, GICS=Materials

**Table 21 - Pooled regressions of ESG performance, disclosures, and media controversies on CoE (Fixed Industries, Composite ESG Score)**

Coefficientsa

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| 3 | (Constant) | 3.097 | 3.703 | | 0.836 | 0.403 | | |
| | INTCOV | -0.009 | 0.01 | -0.03 | -0.85 | 0.396 | 0.624 | 1.604 |
| | BETA | 5.385 | 0.322 | 0.619 | 16.729 | 0.000 | 0.565 | 1.771 |
| | ROA | 0.106 | 0.025 | 0.147 | 4.284 | 0.000 | 0.66 | 1.515 |
| | LEV | -0.001 | 0.001 | -0.041 | -1.284 | 0.199 | 0.751 | 1.332 |
| | SIZE | -0.11 | 0.145 | -0.029 | -0.762 | 0.447 | 0.531 | 1.883 |
| | DISL | 0.01 | 0.005 | 0.059 | 1.961 | 0.050 | 0.856 | 1.168 |
| | MEDIA | 0.013 | 0.008 | 0.051 | 1.555 | 0.120 | 0.715 | 1.398 |
| | ESG | -0.001 | 0.004 | -0.012 | -0.357 | 0.722 | 0.648 | 1.544 |

a. Dependent Variable: COE

Model Summary

| | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 3 | .697a | 0.486 | 0.473 | 2.982% | 0.486 | 39.263 | 16 | 665 | 0.000 |

b. Predictors: (Constant), GICS=Real Estate, GICS=Information Technology, GICS=Health Care, GICS=Consumer Staples, LEV, DISL, SIZE, ROA, GICS=Industrials, BETA, GICS=Energy, MEDIA, INTCOV, ESG, GICS=Consumer Discretionary, GICS=Materials

After controlling for industry-idiosyncratic effect on the cost of capital, the results show a significant positive association between the cost of capital and ESG disclosures. The estimated coefficient of ESG disclosure is 0.086 and is statistically significant at 1% level (t-statistics is 2.916). However, at the level of an aggregate ESG score without breaking into pillars and further into specific measurement areas, we do not observe a statistically significant correlation between and the cost of capital and the composite ESG performance (ESG) or ESG controversies (MEDIA). The adjusted R square under this model is 0.49.

Regarding of the cost of debt, the table for model 2 also does not show a statistically significant relationship between composite ESG performance and the cost of debt. Nevertheless, the results show a significant positive association between ESG disclosure and the cost of debt. The estimated coefficient of ESG disclosure is 0.137 and is statistically significant at 1% level (t-statistics is 3.717). This is inconsistent with our previous hypothesis, but consistent with the previous findings in Section 5.1 to 5.2. Regarding ESG controversies, we observe a significant negative correlation between the cost of debt and ESG controversies score at -0.097 at 2% significance level, which is not aligned to our initial hypothesis. The adjusted R square under this model is 0.207.

Lastly, regarding the cost of equity, we see a significant positive association between the level of ESG disclosure and the cost of equity. The estimated coefficient of ESG disclosure is 0.059 and is statistically significant at 5% level (t-statistics is 1.961). This is inconsistent with our previous hypothesis, but consistent with the previous findings in Section 6.1 to 6.2. The table does not show any statistically significant association between ESG controversies and the cost of equity. The adjusted R square under this model is 0.473.

### *6.3.2 Replacing ESG composite score by pillar scores (Environment, Social and Environment Pillar Score)*

With between-industry variation fixed, we then deconstruct the aggregate score on ESG performance (ESG) from the previous partition into its individual dimensions under environmental (ENV), social (SOC) and governance (GOV) aspects.

$$\mathrm{CoC} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\,\mathrm{BETA} + \beta_6\mathrm{ENV} + \beta_7\mathrm{SOV} + \beta_8\mathrm{GOV} + \beta_9\mathrm{DISL} + \beta_{10}\mathrm{MEDIA} + \beta_{11}\mathrm{IndustryFixedEffect}_i + V_i$$

$$\mathrm{CoD} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\,\mathrm{BETA} + \beta_6\mathrm{ENV} + \beta_7\mathrm{SOV} + \beta_8\mathrm{GOV} + \beta_9\mathrm{DISL} + \beta_{10}\mathrm{MEDIA} + \beta_{11}\mathrm{IndustryFixedEffect}_i + V_i$$

$$\mathrm{CoE} = \alpha + \beta_1\mathrm{Size} + \beta_2\mathrm{LEV} + \beta_3\mathrm{ROA} + \beta_4\mathrm{INTCOV} + \beta_5\,\mathrm{BETA} + \beta_6\mathrm{ENV} + \beta_7\mathrm{SOV} + \beta_8\mathrm{GOV} + \beta_9\mathrm{DISL} + \beta_{10}\mathrm{MEDIA} + \beta_{11}\mathrm{IndustryFixedEffect}_i + V_i$$

**Table 22 - Pooled regressions of ESG performance, disclosures, and Media controversies on CoC (Fixed Industry, with disaggregated ESG Pillar Scores)**

Coefficientsa

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | | Tolerance | VIF |
| 1 | (Constant) | 5.551 | 2.639 | | 2.103 | 0.036 | | |
| | INTCOV | 0.008 | 0.008 | 0.037 | 1.062 | 0.289 | 0.621 | 1.611 |
| | BETA | 2.956 | 0.234 | 0.457 | 12.637 | 0.000 | 0.565 | 1.771 |
| | ROA | 0.161 | 0.018 | 0.299 | 8.918 | 0.000 | 0.658 | 1.52 |
| | LEV | -0.001 | 0.001 | -0.054 | -1.735 | 0.083 | 0.753 | 1.327 |
| | SIZE | -0.187 | 0.108 | -0.066 | -1.723 | 0.085 | 0.502 | 1.992 |
| | DISL | 0.012 | 0.004 | 0.089 | 3.047 | 0.002 | 0.856 | 1.169 |
| | MEDIA | 0.009 | 0.007 | 0.049 | 1.267 | 0.206 | 0.496 | 2.018 |
| | ENV | 0.012 | 0.007 | 0.056 | 1.660 | 0.097 | 0.646 | 1.548 |
| | SOV | -0.025 | 0.007 | -0.131 | -3.346 | 0.001 | 0.481 | 2.078 |
| | GOV | 0.001 | 0.005 | 0.006 | 0.185 | 0.854 | 0.829 | 1.206 |

a. Dependent Variable: COC

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .715[a] | 0.511 | 0.498 | 2.17% | 0.511 | 38.458 | 18 | 663 | 0 |

b. Predictors: (Constant), GICS=Real Estate, GICS=Information Technology, GICS=Health Care, GICS=Consumer Staples, LEV, DISL, ENV, ROA, SIZE, GICS=Industrials, BETA, GOV, GICS=Energy, INTCOV, MEDIA, GICS=Consumer Discretionary, SOV, GICS=Materials

b. Dependent Variable: COC

**Table 23 - Pooled regressions of ESG performance, disclosures, and media controversies on CoD (Fixed Industry, with disaggregated ESG Pillar Scores)**

Coefficientsa

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| 2 | (Constant) | 4.285 | 1.376 | | 3.115 | 0.002 | | |
| | INTCOV | -0.007 | 0.004 | -0.078 | -1.817 | 0.070 | 0.621 | 1.611 |
| | BETA | 0.043 | 0.122 | 0.016 | 0.353 | 0.725 | 0.565 | 1.771 |
| | ROA | 0.03 | 0.009 | 0.132 | 3.181 | 0.002 | 0.658 | 1.52 |
| | LEV | 0.001 | 0 | 0.158 | 4.062 | 0.000 | 0.753 | 1.327 |
| | SIZE | -0.098 | 0.056 | -0.083 | -1.741 | 0.082 | 0.502 | 1.992 |
| | DISL | 0.008 | 0.002 | 0.142 | 3.903 | 0.000 | 0.856 | 1.169 |
| | MEDIA | -0.003 | 0.004 | -0.038 | -0.789 | 0.430 | 0.496 | 2.018 |
| | ENV | 0.007 | 0.004 | 0.079 | 1.893 | 0.059 | 0.646 | 1.548 |
| | SOV | -0.018 | 0.004 | -0.228 | -4.691 | 0.000 | 0.481 | 2.078 |
| | GOV | 0 | 0.003 | 0.003 | 0.078 | 0.938 | 0.829 | 1.206 |

a. Dependent Variable: COD

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| 2 | .498a | 0.248 | 0.228 | 1.13% | 0.248 | 12.179 | 18 | 663 | 0 |

b. Predictors: (Constant), GICS=Real Estate, GICS=Information Technology, GICS=Health Care, GICS=Consumer Staples, LEV, DISL, ENV, ROA, SIZE, GICS=Industrials, BETA, GOV, GICS=Energy, INTCOV, MEDIA, GICS=Consumer Discretionary, SOV, GICS=Materials

b. Dependent Variable: COD

**Table 24 - Pooled regressions of ESG performance, disclosures, and media controversies on CoE (Fixed Industry, with disaggregated ESG Pillar Scores)**

Coefficientsa

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| 3 | (Constant) | 1.02 | 3.621 | | 0.282 | 0.778 | | |
| | INTCOV | -0.008 | 0.01 | -0.028 | -0.803 | 0.422 | 0.621 | 1.611 |
| | BETA | 5.363 | 0.321 | 0.617 | 16.71 | 0.000 | 0.565 | 1.771 |
| | ROA | 0.102 | 0.025 | 0.14 | 4.102 | 0.000 | 0.658 | 1.52 |
| | LEV | -0.001 | 0.001 | -0.04 | -1.243 | 0.214 | 0.753 | 1.327 |
| | SIZE | 0.012 | 0.149 | 0.003 | 0.078 | 0.938 | 0.502 | 1.992 |
| | DISL | 0.011 | 0.005 | 0.061 | 2.032 | 0.043 | 0.856 | 1.169 |
| | MEDIA | 0.024 | 0.01 | 0.097 | 2.464 | 0.014 | 0.496 | 2.018 |
| | ENV | 0.005 | 0.01 | 0.017 | 0.482 | 0.630 | 0.646 | 1.548 |
| | SOV | -0.023 | 0.01 | -0.091 | -2.277 | 0.023 | 0.481 | 2.078 |
| | GOV | -0.008 | 0.007 | -0.037 | -1.215 | 0.225 | 0.829 | 1.206 |

a. Dependent Variable: COE

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| 3 | .700a | 0.49 | 0.477 | 2.973% | 0.490 | 35.441 | 18 | 663 | 0.000 |

b. Predictors: (Constant), GICS=Real Estate, GICS=Information Technology, GICS=Health Care, GICS=Consumer Staples, LEV, DISL, ENV, ROA, SIZE, GICS=Industrials, BETA, GOV, GICS=Energy, INTCOV, MEDIA, GICS=Consumer Discretionary, SOV, GICS=Materials

b. Dependent Variable: COE

For the cost of capital, the social (SOC) pillar score has a negative estimated coefficient -0.131 and is statistically significant at 1% level (t-statistics is -3.346). The estimated coefficient of ESG disclosure is 0.089 and is statistically significant at 1% level (t-statistics is 3.047), inconsistent with our hypothesis. There is no statistically significant relationship identified between the ESG controversies and the cost of capital. The adjusted R square under this model is 0.498 under the decomposed ESG pillar model, which is slightly higher than the explanatory power using the composite ESG score.

In respect of the cost of debt, the estimated coefficient of the social pillar score is -0.228 and is statistically significant at 1% level (t-statistics is – 4.691). For cost of debt, the estimated coefficient of ESG disclosure is 0.142 and is statistically significant at 1% level (t-statistics is 3.903). This is inconsistent with our previous hypothesis. Similarly, for the cost of capital, no statistically significant relationship is identified for the ESG controversies for the cost of debt. The adjusted R square under this model is 0.248, which is higher than the explanatory power using the composite ESG score.

For the cost of equity, the estimated coefficient of social pillar score is -0.091 and is statistically significant at 5% level (t-statistics is -2.277). The estimated coefficient of ESG disclosure is positive at 0.061 with a significance level of 5% (t-statistics 2.032), in contrary to the negative relationship under our hypothesis H3b. For cost of equity, we further observe a significant positive association between the ESG controversies score and the cost of equity at 0.097, which is significant at 1% level (t-statistics is 2.464). The adjusted R square under this model is 0.477.

## 6.4 Fixed Year and Industry effect

### *6.4.1 Taking ESG Composite Score into account*

This section shows the correlation between the ESG performance, ESG disclosure, and ESG controversies while considering the inter-year effect and between-industry influence. In section 6.4.1, we look at the composite ESG variable; then, in section 6.4.2, the combined score is decomposed into its three-pillar scores.

$$\begin{aligned}\mathrm{CoC} = {} & \alpha + \beta_1\mathrm{Size}_{i,t} + \beta_2\mathrm{LEV}_{i,t} + \beta_3\mathrm{ROA}_{i,t} + \beta_4\mathrm{INTCOV}_{i,t} + \beta_5\mathrm{BETA}_{i,t} + \beta_6\mathrm{ESG}_{i,t} + \beta_7\mathrm{DISL}_{i,t} + \beta_8\mathrm{MEDIA}_{i,t} + \beta_9\mathrm{YearFixedEffect}_t \\ & + \beta_{10}\mathrm{IndustryFixedEffect}_i + v_{i,t}\end{aligned}$$

$$\begin{aligned}\mathrm{CoD} = {} & \alpha + \beta_1\mathrm{Size}_{i,t} + \beta_2\mathrm{LEV}_{i,t} + \beta_3\mathrm{ROA}_{i,t} + \beta_4\mathrm{INTCOV}_{i,t} + \beta_5\mathrm{BETA}_{i,t} + \beta_6\mathrm{ESG}_{i,t} + \beta_7\mathrm{DISL}_{i,t} + \beta_8\mathrm{MEDIA}_{i,t} + \beta_9\mathrm{YearFixedEffect}_t \\ & + \beta_{10}\mathrm{IndustryFixedEffect}_i + v_{i,t}\end{aligned}$$

$$\begin{aligned}\mathrm{CoE} = {} & \alpha + \beta_1\mathrm{Size}_{i,t} + \beta_2\mathrm{LEV}_{i,t} + \beta_3\mathrm{ROA}_{i,t} + \beta_4\mathrm{INTCOV}_{i,t} + \beta_5\mathrm{BETA}_{i,t} + \beta_6\mathrm{ESG}_{i,t} + \beta_7\mathrm{DISL}_{i,t} + \beta_8\mathrm{MEDIA}_{i,t} + \beta_9\mathrm{YearFixedEffect}_t \\ & + \beta_{10}\mathrm{IndustryFixedEffect}_i + v_{i,t}\end{aligned}$$

## Table 25 - Pooled regressions of ESG performance, disclosures, and media controversies on CoC (Fixed Industry & Year, Composite ESG Score)

*Coefficients* [a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 8.067 | 2.599 | | 3.103 | 0.002 | | |
| | INTCOV | 0.004 | 0.007 | 0.018 | 0.553 | 0.581 | 0.620 | 1.614 |
| | BETA | 3.188 | 0.216 | 0.493 | 14.740 | 0.000 | 0.556 | 1.797 |
| | ROA | 0.149 | 0.017 | 0.276 | 8.620 | 0.000 | 0.605 | 1.652 |
| | LEV | -0.001 | 0.001 | -0.045 | -1.564 | 0.118 | 0.748 | 1.337 |
| | SIZE | -0.349 | 0.097 | -0.124 | -3.596 | 0.000 | 0.526 | 1.902 |
| | DISL | 0.012 | 0.004 | 0.088 | 3.269 | 0.001 | 0.855 | 1.170 |
| | MEDIA | 0.004 | 0.005 | 0.025 | 0.829 | 0.407 | 0.711 | 1.406 |
| | ESG | -0.001 | 0.003 | -0.016 | -0.513 | 0.608 | 0.636 | 1.572 |

a. Dependent Variable: COC

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .767[a] | 0.589 | 0.577 | 1.9894% | 0.589 | 47.374 | 20 | 661 | 0.000 |

a. Predictors: (Constant), Index1=5.0, GICS=Energy, MEDIA, INTCOV, GICS=Information Technology, GICS=Real Estate, GICS=Health Care, GICS=Consumer Staples, Index1=2.0, LEV
, DISL, GICS=Industrials, BETA, Index1=3.0, SIZE, ROA, ESG, Index1=4.0, GICS=Materials, GICS=Utilities

## Table 26 Pooled regressions of ESG performance, disclosures, and media controversies on CoD (Fixed Industry & Year, Composite ESG Score)

*Coefficients* [a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 6.075 | 1.362 | | 4.460 | 0.000 | | |
| | INTCOV | -0.009 | 0.004 | -0.099 | -2.518 | 0.012 | 0.620 | 1.614 |
| | BETA | 0.166 | 0.113 | 0.061 | 1.465 | 0.143 | 0.556 | 1.797 |
| | ROA | 0.021 | 0.009 | 0.091 | 2.267 | 0.024 | 0.605 | 1.652 |
| | LEV | 0.001 | 0.000 | 0.172 | 4.783 | 0.000 | 0.748 | 1.337 |
| | SIZE | -0.196 | 0.051 | -0.165 | -3.848 | 0.000 | 0.526 | 1.902 |
| | DISL | 0.008 | 0.002 | 0.141 | 4.207 | 0.000 | 0.855 | 1.170 |
| | MEDIA | -0.007 | 0.003 | -0.093 | -2.516 | 0.012 | 0.711 | 1.406 |
| | ESG | 0.000 | 0.001 | 0.011 | 0.271 | 0.786 | 0.636 | 1.572 |

a. Dependent Variable: COD

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .601[a] | 0.362 | 0.342 | 1.0426% | 0.362 | 18.719 | 20 | 661 | 0.000 |

a. Predictors: (Constant), Index1=5.0, GICS=Energy, MEDIA, INTCOV, GICS=Information Technology, GICS=Real Estate, GICS=Health Care, GICS=Consumer Staples, Index1=2.0, LEV
, DISL, GICS=Industrials, BETA, Index1=3.0, SIZE, ROA, ESG, Index1=4.0, GICS=Materials, GICS=Utilities

## Table 27 - Pooled regressions of ESG performance, disclosures, and media controversies on CoE (Fixed Industry & Year, Composite ESG Score)

*Coefficients* [a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 4.258 | 3.689 | | 1.154 | 0.249 | | |
| | INTCOV | -0.013 | 0.010 | -0.043 | -1.287 | 0.199 | 0.620 | 1.614 |
| | BETA | 5.620 | 0.307 | 0.646 | 18.309 | 0.000 | 0.556 | 1.797 |
| | ROA | 0.097 | 0.025 | 0.134 | 3.954 | 0.000 | 0.605 | 1.652 |
| | LEV | -0.001 | 0.001 | -0.032 | -1.053 | 0.293 | 0.748 | 1.337 |
| | SIZE | -0.155 | 0.138 | -0.041 | -1.124 | 0.261 | 0.526 | 1.902 |
| | DISL | 0.010 | 0.005 | 0.059 | 2.074 | 0.038 | 0.855 | 1.170 |
| | MEDIA | 0.014 | 0.008 | 0.055 | 1.758 | 0.079 | 0.711 | 1.406 |
| | ESG | -0.005 | 0.004 | -0.047 | -1.432 | 0.153 | 0.636 | 1.572 |

a. Dependent Variable: COE

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .736[a] | 0.542 | 0.528 | 2.8232% | 0.542 | 39.100 | 20 | 661 | 0.000 |

a. Predictors: (Constant), Index1=5.0, GICS=Energy, MEDIA, INTCOV, GICS=Information Technology, GICS=Real Estate, GICS=Health Care, GICS=Consumer Staples, After fixing the effect of years and industries, the results flag a positive association between the ESG disclosure and the cost of capital overall. The estimated coefficient of ESG disclosure is 0.088 and is statistically significant at 1% level (t-statistics is 3.269). In terms of ESG performance and controversies, we do not observe a significant correlation between these two factors and the cost of capital. The adjusted R square under this model is 0.577.

Regarding the cost of debt, the results show a significant positive association between ESG disclosure and the cost of debt. The estimated coefficient of ESG disclosure is 0.141 and is statistically significant at 1% level (t-statistics is 4.207). Regarding ESG controversies and ESG performances, we do not observe a significant correlation between the cost of debt and these two factors, which is not aligned to our initial hypothesis. The adjusted R square under this model is 0.342.

Lastly, concerning the cost of equity, we did not see a significant positive association between the cost of equity and neither of the three ESG pillars scores, which is again against our initial hypothesis. The adjusted R square under this model is 0.528.

### *6.4.2 Replacing ESG composite score by pillar scores (Environment, Social and Environment Pillar Score)*

With both fixed effects in the year and industry, we then decompose the total score of ESG performance into its dimensions under environment, social, and governance aspects.

$$\begin{aligned}\mathrm{CoC} = {} & \alpha + \beta_1\mathrm{Size}_{i,t} + \beta_2\mathrm{LEV}_{i,t} + \beta_3\mathrm{ROA}_{i,t} + \beta_4\mathrm{INTCOV}_{i,t} + \beta_5\mathrm{BETA}_{i,t} + \beta_6\mathrm{ENV}_{i,t} + \beta_7\mathrm{SOV}_{i,t} + \beta_8\mathrm{GOV}_{i,t} + \beta_9\mathrm{DISL}_{i,t} + \beta_{10}\mathrm{MEDIA}_{i,t} \\ & + \beta_{11}\mathrm{YearFixedEffect}_t + \beta_{12}\mathrm{IndustryFixedEffect}_i + v_{i,t}\end{aligned}$$

$$\begin{aligned}\mathrm{CoD} = {} & \alpha + \beta_1\mathrm{Size}_{i,t} + \beta_2\mathrm{LEV}_{i,t} + \beta_3\mathrm{ROA}_{i,t} + \beta_4\mathrm{INTCOV}_{i,t} + \beta_5\mathrm{BETA}_{i,t} + \beta_6\mathrm{ENV}_{i,t} + \beta_7\mathrm{SOV}_{i,t} + \beta_8\mathrm{GOV}_{i,t} + \beta_9\mathrm{DISL}_{i,t} + \beta_{10}\mathrm{MEDIA}_{i,t} \\ & + \beta_{11}\mathrm{YearFixedEffect}_t + \beta_{12}\mathrm{IndustryFixedEffect}_i + v_{i,t}\end{aligned}$$

$$\begin{aligned}\mathrm{CoE} = {} & \alpha + \beta_1\mathrm{Size}_{i,t} + \beta_2\mathrm{LEV}_{i,t} + \beta_3\mathrm{ROA}_{i,t} + \beta_4\mathrm{INTCOV}_{i,t} + \beta_5\mathrm{BETA}_{i,t} + \beta_6\mathrm{ENV}_{i,t} + \beta_7\mathrm{SOV}_{i,t} + \beta_8\mathrm{GOV}_{i,t} + \beta_9\mathrm{DISL}_{i,t} + \beta_{10}\mathrm{MEDIA}_{i,t} \\ & + \beta_{11}\mathrm{YearFixedEffect}_t + \beta_{12}\mathrm{IndustryFixedEffect}_i + v_{i,t}\end{aligned}$$

## Table 28 - Pooled regressions of ESG performance, disclosures, and media controversies on CoC (Fixed Industry & Year, with disaggregated ESG Pillar Scores)

*Coefficients* [a]

| Model | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|
| (Constant) | 6.586 | 2.523 | | 2.611 | 0.009 | | |
| INTCOV | 0.005 | 0.007 | 0.020 | 0.648 | 0.517 | 0.616 | 1.623 |
| BETA | 3.143 | 0.215 | 0.486 | 14.632 | 0.000 | 0.556 | 1.797 |
| ROA | 0.145 | 0.017 | 0.269 | 8.436 | 0.000 | 0.604 | 1.657 |
| LEV | -0.001 | 0.001 | -0.046 | -1.621 | 0.106 | 0.751 | 1.332 |
| SIZE | -0.255 | 0.099 | -0.090 | -2.566 | 0.011 | 0.497 | 2.013 |
| DISL | 0.012 | 0.004 | 0.091 | 3.398 | 0.001 | 0.854 | 1.171 |
| MEDIA | 0.015 | 0.006 | 0.083 | 2.348 | 0.019 | 0.491 | 2.038 |
| ENV | 0.000 | 0.007 | -0.002 | -0.061 | 0.952 | 0.629 | 1.591 |
| SOV | -0.021 | 0.007 | -0.114 | -3.198 | 0.001 | 0.480 | 2.082 |
| GOV | 0.001 | 0.005 | 0.004 | 0.152 | 0.879 | 0.827 | 1.209 |

a. Dependent Variable: COC

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .772[a] | 0.596 | 0.583 | 1.9755% | 0.596 | 44.188 | 22 | 659 | 0.000 |

a. Predictors: (Constant), GICS=Utilities, SIZE, Index1=4.0, LEV

## Table 29 - Pooled regressions of ESG performance, disclosures, and media controversies on CoD (Fixed Industry & Year, with disaggregated ESG Pillar scores)

*Coefficients* [a]

| Model | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|
| (Constant) | 5.489 | 1.310 | | 4.190 | 0.000 | | |
| INTCOV | -0.009 | 0.004 | -0.096 | -2.472 | 0.014 | 0.616 | 1.623 |
| BETA | 0.120 | 0.112 | 0.044 | 1.074 | 0.283 | 0.556 | 1.797 |
| ROA | 0.018 | 0.009 | 0.079 | 2.008 | 0.045 | 0.604 | 1.657 |
| LEV | 0.001 | 0.000 | 0.165 | 4.689 | 0.000 | 0.751 | 1.332 |
| SIZE | -0.140 | 0.052 | -0.118 | -2.717 | 0.007 | 0.497 | 2.013 |
| DISL | 0.008 | 0.002 | 0.146 | 4.412 | 0.000 | 0.854 | 1.171 |
| MEDIA | 0.000 | 0.003 | 0.004 | 0.081 | 0.935 | 0.491 | 2.038 |
| ENV | 0.001 | 0.003 | 0.006 | 0.153 | 0.878 | 0.629 | 1.591 |
| SOV | -0.016 | 0.003 | -0.207 | -4.687 | 0.000 | 0.480 | 2.082 |
| GOV | 0.000 | 0.002 | 0.002 | 0.050 | 0.960 | 0.827 | 1.209 |

a. Dependent Variable: COD

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square | F Change | df1 | df2 | Sig. F |
|---|---|---|---|---|---|---|---|---|---|
| | .620[a] | 0.384 | 0.363 | 1.0258% | 0.384 | 18.669 | 22 | 659 | 0.000 |

a. Predictors: (Constant), GICS=Utilities, SIZE, Index1=4.0, LEV

## Table 30 - Pooled regressions of ESG performance, disclosures, and media controversies on CoE (Fixed Industry & Year, with disaggregated ESG Pillar Scores)

*Coefficients* [a]

| Model | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|
| (Constant) | 2.703 | 3.593 | | 0.752 | 0.452 | | |
| INTCOV | -0.013 | 0.010 | -0.044 | -1.309 | 0.191 | 0.616 | 1.623 |
| BETA | 5.597 | 0.306 | 0.643 | 18.298 | 0.000 | 0.556 | 1.797 |
| ROA | 0.093 | 0.024 | 0.128 | 3.789 | 0.000 | 0.604 | 1.657 |
| LEV | -0.001 | 0.001 | -0.031 | -1.026 | 0.305 | 0.751 | 1.332 |
| SIZE | -0.046 | 0.141 | -0.012 | -0.323 | 0.747 | 0.497 | 2.013 |
| DISL | 0.011 | 0.005 | 0.061 | 2.137 | 0.033 | 0.854 | 1.171 |
| MEDIA | 0.030 | 0.009 | 0.123 | 3.288 | 0.001 | 0.491 | 2.038 |
| ENV | -0.008 | 0.009 | -0.028 | -0.842 | 0.400 | 0.629 | 1.591 |
| SOV | -0.020 | 0.010 | -0.078 | -2.070 | 0.039 | 0.480 | 2.082 |
| GOV | -0.009 | 0.007 | -0.040 | -1.380 | 0.168 | 0.827 | 1.209 |

a. Dependent Variable: COE

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .739[a] | 0.547 | 0.531 | 2.8132% | 0.547 | 36.104 | 22 | 659 | 0.000 |

a. Predictors: (Constant), GICS=Utilities, SIZE, Index1=4.0, LEV

With both fixed effects for time-varying and between-industry variations, we then decompose the total score of ESG performance into its dimensions under environment, social, and governance aspects. In terms of ESG pillar scores, only the social pillar score has a significant negative association with the cost of capital. For the cost of capital, the estimated coefficient of social performance is -0.114 and is statistically significant at 1% level (t-statistics is –3.198). The results also show a significant positive association between ESG disclosure and the cost of capital. The estimated coefficient of ESG disclosure is 0.091 and is statistically significant at 1% level (t-statistics is 3.398). Moreover, we observed a positive correlation between the ESG controversies score (MEDIA) and the cost of capital. The coefficient of controversies (MEDIA) is 0.083 with a significance level of 5% (t- statistics is 2.348). The adjusted R square for this model is 0.583.

The results also show a significant positive association between ESG disclosures and the cost of debt. The estimated coefficient of ESG disclosure is 0.146 and is statistically significant at 1% level (t-statistics is 4.412). Regarding the ESG pillar scores, the estimated coefficient of only the social (SOC) pillar is statistically significant at 1% level and is negative at -0.207 (t-statistics is – 4.687). The adjusted R square under this model is 0.363.

Lastly, the result shows a positive correlation between the disclosure and the cost of equity; the coefficient of the ESG disclosure is 0.061 and is statistically significant at 5% level (t-statistics is 2.137). Regarding the pillar score, the estimated coefficient of social performance is -0.078 and is statistically significant at 5% level (t-statistics is – 2.070). Regarding ESG controversies, we observe a significant positive correlation between ESG controversies score and the cost of equity. The estimated coefficient of ESG controversies is 0.123 and is statistically significant at 1% level (t-statistics is 3.288). The adjusted R square under this model is 0.531.

### 6.5 Summary

With the analysis from non-fixed effect for both IND and Years variables, to fixed one of the variables, to both fixed effect for IND and Years, we observed an increasing adjusted R square with more fixed effect considered. Such an increase in R-value suggests that the industry group and year effect may be an important explanatory factor for the variance of cost of capital and by extension, the cost of debt and cost of equity among different companies.

Regarding ESG performances, we do not observe a significant correlation between the ESG performances with Cost of Capital, Cost of Debt, or Cost of Equity under different fixed effect scenarios. After decomposing the ESG composite scores into ESG pillar scores, only the social dimension exhibits a negative and statistically significant relationship across the cost of debt, the cost of equity, and the cost of capital by extension for the Refinitiv ESG using the panel dataset of CA100+ signatories. We do not observe a significant correlation of either the Environmental pillar score or Governance Pillar score with the Costs of Capital, Cost of Debt, or Cost of Equity. Apart from the lack of statistical significance for the environmental (ENV) and governance (GOV) pillar scores, the levels of coefficient are also low in our models. For example, in the general regression without fixed effects, the ENV's coefficient, the coefficients of the ENV and the GOV pillars were 0.063 and 0.006 respectively, as compared to the coefficient for the SOC pillar at –0.179. After controlling for both time variation and industry affiliation, the coefficient of the ENV pillar dropped below zero at –0.002, and the coefficient for the GOV pillar also shrunk to 0.004. In this model with both effects fixed, the coefficient for the SOC pillar remained high in absolute value, at –0.014. While this low relationship for two of the ESG pillars is not unexpected, it confirms that investing in high-scoring ESG companies outright does not necessarily assure that such tilting will includes companies that have received high ratings for managing their carbon emissions or board management.

In terms of the ESG disclosure, inconsistent with our initial hypothesis, the results under different fixed-effect models indicate that firms with higher ESG disclosure have a higher cost of capital and typically a higher cost of debt, which is against our previous hypothesis H1b and H2b. For the cost of equity, all models except for both-fixed effect regression on the composite ESG score indicate a positive correlation between the ESG disclosure scope and the cost of equity, which is also against our hypothesis of H3b. However, the result is aligned with the findings of Richardson and Welker (2001)'s. In a sample of Canadian companies, their study observed a positive relationship between the disclosure of the 'Social' pillar of ESG (Corporate Social Responsibility) and the cost of equity. In addition, Dhaliwal et al. (2011) examined the internal control disclosure by 577 US-listed firms as a mechanism of corporate governance and its impact on the cost of debt. They provided evidence that disclosure of corporate governance material weaknesses results in increased cost of debt. Additionally, in the tourism industry, Xu et al. (2020) demonstrated a positive relationship between CSR disclosures and the cost of debt.

Regarding the ESG Controversies Score (MEDIA), we do not observe a significant correlation between the ESG controversies and the Cost of Capital and Cost of Equity in most cases when implementing the ESG composite score into the model. Only within the fixed year effect and within the fixed industry effect do we observe a negative correlation between the ESG controversies score and the cost of debt. These are aligned with the initial hypothesis of H2c. However, after rebuilding models by replacing the ESG composite score with the ESG pillar scores, we do not observe a significant correlation between the ESG controversies score and the cost of capital or debt. This lack of significant correlation between COC and MEDIA and COE – MEDIA may indicate that the ESG controversies score displays a more substantial impact on equity financing than debt financing. Singularly, we identify a significantly positive correlation between the ESG controversies score and the Cost of Equity, which is also against our initial hypothesis of H3a, H3b, and H3c.

We reckon the following explanations would be plausible regarding the discrepancies between our research result with our initial hypothesis and with the prior literature review. Firstly, some endogenous factors might affect the mechanism between the DISL-COC and MEDIA-COC, which our current model has not moderated. Secondly, an analysis could be taken to examine whether the impact of the ESG disclosure and the ESG controversies on the cost of debt financing would become more pronounced as company size increases. We reckon a priori that the impact of ESG practices on the cost of capital would be greater in companies with a more significant market capitalization. Whilst causality is empirically hard to establish with limited history of disclosed ESG data, any industry-specific studies on the sectoral cost of capital would complement existing research on the impact of forwards-looking ESG ratings.

Moreover, based on our further literature review, we noticed a non-linearity in the Cost of Debt – ESG Practices relationship, as shown by the research results of Ye and Zhang (2011) and Zhou, Zhang, Wen, Zeng, and Chen (2018). Both papers find a U-shaped relationship between CSR/ESG performance and the cost of debt in China. Their research is also supported by the prior study by a paper from Bae, Chang, and Yi (2018). They document the same non-linear relationship between corporate social responsibility and the cost of bank debt in an extensive sample of 5,810 private syndicated bank loans issued by U.S. companies between 1991 and 2008. Therefore, the U-shaped of Cost of Debt and ESG practices may imply that an optimal level of ESG spending exists, beyond which lenders consider CSR spending a waste of firm resources. These preliminary results suggest that the relationship exists at least in China and the U.S. Given the difference between these two markets in terms of their level of development, economic and social context, and culture, one might universally assume a U-shape of the relationship between the cost of debt and the ESG corporate social responsibility. However, non-linearity could be a plausible explanation for the positive directionality we observe for ESG Disclosure – COC/COD/COE relationship and the ESG Controversies – COE among the sample companies in the Climate Action 100+.

Therefore, it would be interesting to distinguish the potential factors influencing the ESG disclosure variable, namely a favorable effect of ESG enforcement thanks to larger resource base and an adverse impact on cost of capital because of higher emissions or social and governance issues (ESG-COC) from larger operations of the same company, or because of the very fact that the disclosure from more comprehensive ESG data shows more problems to affect the cost of capital (DISL-COC).

Our finding of a positive correlation between the cost of debt and ESG ratings can be extended to sub-clusters of firms with various size. As suggested by literature reviews, there are two counter-balancing directions with respect to the influence of ESG disclosure on cost of capital. On the one hand, LaBella (2019) and Drempetic (2020) demonstrated a general 'company size bias', suggesting that companies with larger market capitalization may be subject to more vigorous enforcement of ESG policies and related resources to enact such policies and practices, leading to more transparent and comprehensive disclosure and thus lowering the cost of financing. On the other hand, the risk premium on the cost of debt owing to a 'carbon risk' from a higher carbon dioxides emission intensity is rendered apparent by Ehlers (2022), and future research is needed to verify and extend this study to other markets as well as to other measures of the cost of capital (Gianfranco Gianfrate, 2020).

**Table 30 – Tabular Summary of regression results under detailed ESG pillar model and one ESG composite model with fixed/non-fixed effects**[1]

| **Pillar Score** | **Non-Fixed** | | | **Fixed Year** | | | **Fixed Industries** | | | **Both-Fixed** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **COC** | **COD** | **COE** | **COC** | **COD** | **COE** | **COC** | **COD** | **COE** | **COC** | **COD** | **COE** |
| **ENV** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **SOC** | - | - | - | - | - | - | - | - | - | - | - | - |
| **GOV** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **ESG Disclosure** | + | + | + | + | + | + | + | + | + | + | + | + |
| **ESG Controversies** | N/A | N/A | + | N/A | N/A | + | N/A | N/A | + | + | N/A | + |
| **Adjsuted R square** | 0.445 | 0.173 | 0.458 | 0.530 | 0.309 | 0.511 | 0.498 | 0.228 | 0.477 | 0.583 | 0.363 | 0.531 |

| Composite Score | **Non-Fixed** | | | **Fixed Year** | | | **Fixed Industries** | | | **Both-Fixed** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **COC** | **COD** | **COE** | **COC** | **COD** | **COE** | **COC** | **COD** | **COE** | **COC** | **COD** | **COE** |
| ESG Performances | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| ESG Disclosure | + | + | + | + | + | + | + | + | + | + | + | N/A |
| ESG Controversies | N/A | N/A | N/A | N/A | - | N/A | N/A | - | N/A | N/A | N/A | N/A |
| Adjsuted R square | 0.429 | 0.14 | 0.453 | 0.516 | 0.275 | 0.506 | 0.49 | 0.207 | 0.473 | 0.577 | 0.342 | 0.528 |

[1] Note: the yellow-shaded ones are with 5% significance level, others are with 1% significance level.

# 7. Additional analysis

## 7.1 Correlation between EMIS – ENV, EMIS – COC, EMIS – COD and EMIS – COE

In this section of the additional analysis, we investigate the lack of statistical significance for the two other pillar scores (ENV and GOV) from Refinitiv, namely by regressing the additional emission variable (EMIS) on the environmental (ENV) scores. As already seen in the Pearson and the Spearman's correlation tables, there is a strong pairwise correlation between the 'emissions' variable and the environmental dimension (ENV-EMIS correlation is 0.289 for Pearson, 0.190 for Spearman) as well as the social dimension of the ESG pillar scores (SOC-EMIS correlation is 0.747 for Pearson, 0.714 for Spearman).

Therefore, our further hypothesis is that conditional on the significant and negative correlation between the emission variable and cost of capital; we can reserve for better performance to the environmental (ENV) pillar after excluding some idiosyncratic themes that are not significant. The addition of data points for the environmental (ENV) pillar may echo the expansion of data points for the social (SOC) pillar. The reduction of themes within one ESG pillar may conserve some scope for future improvement on the statistically insignificant pillar scores of ESG composite scores to better elucidate their impacts on the cost of capital.

We do this by running a regression between the Emission Score (EMIS) with Environmental pillar score (ENV) and EMIS with COC, COE, and COD respectively for the five-year data under the CA100+ sample. Based on the calculation method of ESG thematic score from the Refinitiv database, we hypothesize that there is a positive relationship between the Environmental Pillar Score and the Emission score. We hypothesize a negative association for all these regression results for the directionality of the correlation between EMIS and COC, EMIS and COD, and EMIS and COE.

To do this, we consider both fixed effects for industry and years. The regression result can be found in the following table.

**Table 31 - Pooled Regression of Environmental Pillar Score and the Emission Score (Both Industry & Year Fixed)**

*Coefficients* [a]

| Model | | Unstandardized Coefficients B | Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 33.353 | 3.126 | | 10.669 | 0.000 | | |
| | EMIS | 0.274 | 0.030 | 0.328 | 9.089 | 0.000 | 0.869 | 1.151 |

a. Dependent Variable: ENV

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .420[a] | 0.177 | 0.161 | 13.368895076120100 | 0.177 | 11.166 | 14 | 728 | 0.000 |

a. Predictors: (Constant), GICS=Utilities, Index1=5.0, GICS=Real Estate, GICS=Information Technology, GICS=Financials,

The table above shows indeed a significant positive correlation between the Environmental Pillar Score and the Emission Score. The coefficient of EMIS is 0.328, which is significant at 1% (t-statistic is 9.089). The result suggests that the higher the Emission Score is, the higher the Environmental Pillar Score is, which is aligned to our hypothesis and justifies the Environmental Pillar Score construction method disclosed by Refinitiv.

As already discussed in the determinants of the ENV pillar score in the Refinitiv methodologies, the ENV pillar contains more components than the 'emissions' metric. This can be valuable when such elements help gain a better understanding of long-term transition. Yet users should take care not to misinterpret the information content of the ENV score as a substitute for low emissions alone, or solely portfolio with low waste, high biodiversity, or system of environmental management. For instance, investing in high ENV scores may unintentionally result in greater lifecycle-emission.

**Table 32 - Pooled Regression of Emission Score and CoC (Both Industry & Year Fixed)**

*Coefficients* [a]

| Model | | Unstandardized B | Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 7.159 | 0.553 | | 12.957 | 0.000 | | |
| | EMIS | -0.032 | 0.005 | -0.186 | -6.032 | 0.000 | 0.868 | 1.151 |

a. Dependent Variable: COC

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .637[a] | 0.406 | 0.394 | 2.3487% | 0.406 | 35.248 | 14 | 723 | 0.000 |

a. Predictors: (Constant), GICS=Utilities, Index1=5.0, GICS=Real Estate, GICS=Information Technology, GICS=Financials,

**Table 33 - Pooled Regression of Emission Score and CoD (Both Industry & Year Fixed)**

*Coefficients [a]*

| Model | | Unstandardized B | Unstandardized Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 2.990 | 0.274 | | 10.907 | 0.000 | | |
| | EMIS | -0.018 | 0.003 | -0.230 | -6.725 | 0.000 | 0.868 | 1.151 |

a. Dependent Variable: COD

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics: R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .518[a] | 0.268 | 0.254 | 1.1653% | 0.268 | 18.904 | 14 | 723 | 0.000 |

a. Predictors: (Constant), GICS=Utilities, Index1=5.0, GICS=Real Estate, GICS=Information Technology, GICS=Financials,

**Table 34 - Pooled Regression of Emission Score and CoE (Both Industry & Year Fixed)**

*Coefficients [a]*

| Model | | Unstandardized B | Unstandardized Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| | (Constant) | 9.344 | 0.825 | | 11.321 | 0.000 | | |
| | EMIS | -0.015 | 0.008 | -0.064 | -1.867 | 0.062 | 0.868 | 1.151 |

a. Dependent Variable: COE

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics: R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| | .509[a] | 0.259 | 0.245 | 3.5084% | 0.259 | 18.037 | 14 | 723 | 0.000 |

a. Predictors: (Constant), GICS=Utilities, Index1=5.0, GICS=Real Estate, GICS=Information Technology, GICS=Financials,

In terms of the relationship between EMIS – COC, EMIS – COD, and EMIS – COE, we observe a significant negative correlation in the regression results. For COC, the coefficient of EMIS is -0.186, which is significant at 1% (t-statistic is -6.032). Regarding COD, the coefficient of EMIS is -0.230, which is significant at 1% (t-statistic is -6.725). Lastly, for COE, the coefficient of EMIS is -0.064, which is significant at 1% (t-statistic is -1.867). This result indicates the less the companies emit, the less cost of capital, or speaking, less cost of debt and cost of equity they will undertake, which aligns with our initial hypothesis. More importantly, it is noticeable that the absolute value of the coefficient for the EMIS-COD relationship is higher than that of the EMIS-COE relationship. Simultaneously, the adjusted R square for the EMIS-COD model (0.254) is higher than that of the EMIS-COE model (0.245). All these differences suggest that the 'Emission' scoring may have a greater impact on a company' financing of debt capital than equity capital.

### 7.2 Heterogeneity in cost of capital within industries

Further analyzing the reasons for industry-level divergence, we identify three ways in which ESG ratings can differ; the scope, measurement, and weighting. Firstly, regarding potential divergence between the scope of each ESG indicators such as the scope-1, scope-2, and scope-3 emissions as measured by the Environment pillar by Refinitiv, our decomposition of ESG rating divergence is not insignificant, because at the COD and COE levels, the structures of different ESG ratings are incompatible.

Indeed, in research by MSCI (Lodh, 2020), the within-industry variations on cost of capital are more than insignificant. As illustrated by the following tabular list, the differentials in cost of capital from companies with low ESG scores displayed significantly higher cost of capital than high-scoring companies within most GICS sectors As the differentials between the top- and bottom-percentile companies in each GICS sector remains significant for both general MSCI World index and the MSCI Emerging Market index, we cannot reject the hypothesis that industry-specific impact on cost of capital persists for both developed and emerging markets.

**Graph 4 – Industry heterogeneity exists also in MSCI index in both developed and developing markets**

**Difference in cost of capital (in %) between high- and low-scoring (Q1 – Q5) companies by GICS sector**

| GICS Sectors | MSCI World | MSCI Emerging Markets |
|---|---|---|
| Energy | 0.38 | 0.59 |
| Materials | 0.23 | 0.90 |
| Industrials | 0.39 | 1.03 |
| Consumer discretionary | 0.43 | 1.00 |
| Consumer staples | 0.39 | 0.69 |
| Health care | 0.35 | 0.61 |
| Financials | 0.39 | 1.06 |
| Information technology | 0.46 | 1.14 |
| Telecommunication services | 0.41 | 0.75 |
| Utilities | 0.55 | 0.73 |
| Real estate | 0.43 | 0.46 |

**Table 35 - Pooled regressions of industry average impact on CoC (Industry fixed Effect, Composite ESG Score)**

| Coefficients^a | Unstandardized Coefficients | | Standardized Coefficients | | | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| Model | B | Std. Error | Beta | t | Sig. | Tolerance | VIF |
| GICS=Consumer Discretionary | -1.215 | 0.403 | -0.119 | -3.014 | 0.003 | 0.479 | 2.086 |
| GICS=Consumer Staples | -0.184 | 0.422 | -0.014 | -0.435 | 0.664 | 0.726 | 1.377 |
| GICS=Energy | 1.483 | 0.288 | 0.215 | 5.151 | 0.000 | 0.428 | 2.336 |
| GICS=Health Care | 1.504 | 0.939 | 0.046 | 1.602 | 0.110 | 0.909 | 1.1 |
| GICS=Industrials | 0.466 | 0.355 | 0.048 | 1.313 | 0.190 | 0.566 | 1.767 |
| GICS=Information Technology | 0.525 | 1.012 | 0.015 | 0.518 | 0.604 | 0.938 | 1.067 |
| GICS=Materials | 1.463 | 0.322 | 0.198 | 4.541 | 0.000 | 0.392 | 2.549 |
| GICS=Real Estate | -0.065 | 1.035 | -0.002 | -0.063 | 0.950 | 0.896 | 1.116 |

a. Dependent Variable: COC

Regarding the cost of capital, Consumer Discretionary, Materials and Energy sectors are the three industries that exhibit a positive and statistically significant industry-specific impact on raising the cost of capital, even after controlling for the between-industry effect. The Consumer Discretionary industry witnesses a better cost of capital as evidenced by the estimated coefficient being negative at -0.119 at 1% significance level (t-statistics is -3.014). On the contrary, at 1% significance level, the estimated coefficient for the Energy industry is positive at 0.215 (t-statistics is 5.151; Materials industry experiences a positive estimated coefficient at 0.198 at 1% significance level (t-statistics is 4.541). These imply the inherently riskier environment that the market perceives for the aggregate cost of financing for the Energy and Materials industries.

**Table 36 - Pooled regressions of industry average impact on CoD (Industry fixed Effect, Composite ESG Score)**

| Coefficients^a | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | Collinearity Statistics | |
|---|---|---|---|---|---|---|---|
| Model | B | Std. Error | Beta | | | Tolerance | VIF |
| GICS=Consumer Discretionary | -0.123 | 0.211 | -0.029 | -0.58 | 0.562 | 0.479 | 2.086 |
| GICS=Consumer Staples | -0.132 | 0.222 | -0.024 | -0.597 | 0.551 | 0.726 | 1.377 |
| GICS=Energy | 0.85 | 0.151 | 0.294 | 5.627 | 0.000 | 0.428 | 2.336 |
| GICS=Health Care | 0.71 | 0.493 | 0.052 | 1.441 | 0.150 | 0.909 | 1.1 |
| GICS=Industrials | -0.041 | 0.186 | -0.01 | -0.219 | 0.826 | 0.566 | 1.767 |
| GICS=Information Technology | 0.336 | 0.531 | 0.022 | 0.633 | 0.527 | 0.938 | 1.067 |
| GICS=Materials | 0.613 | 0.169 | 0.198 | 3.628 | 0.000 | 0.392 | 2.549 |
| GICS=Real Estate | 0.767 | 0.543 | 0.051 | 1.413 | 0.158 | 0.896 | 1.116 |

a. Dependent Variable: COD

In reference to the between-industry effects for cost of debt, the Energy and Materials industries remain to be adversely impacted in terms of raising debt holding all ESG variables constant. The estimated coefficients for Energy and Materials are 0.294 and 0.198 at 1% significance level (t-statistics are 5.627 and 3.628 respectively).

**Table 37 - Pooled regressions of industry average impact on CoE (Industry fixed Effect, Composite ESG Score)**

Coefficientsa

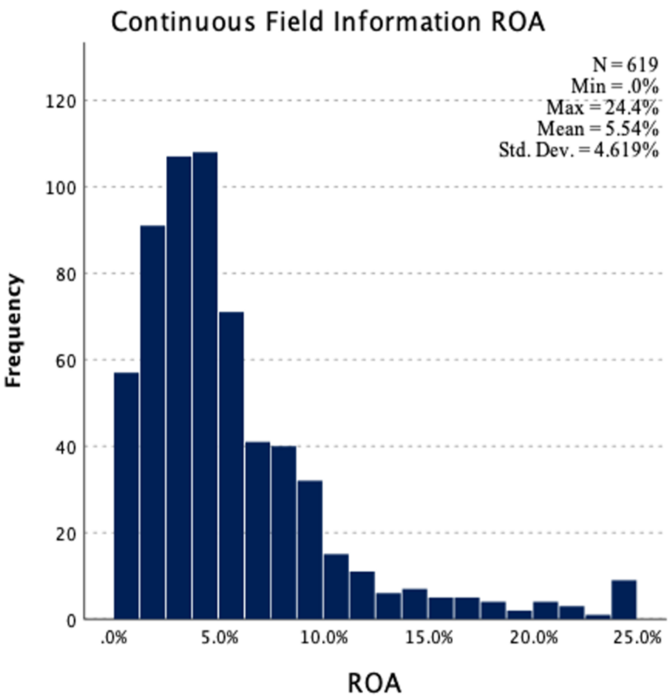
| Model | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|
| Discretionary | -0.261 | 0.55 | -0.019 | -0.474 | 0.636 | 0.479 | 2.086 |
| Staples | -1.04 | 0.577 | -0.059 | -1.802 | 0.072 | 0.726 | 1.377 |
| GICS=Energy | 0.843 | 0.393 | 0.091 | 2.143 | 0.032 | 0.428 | 2.336 |
| GICS=Health Care | 0.094 | 1.283 | 0.002 | 0.073 | 0.942 | 0.909 | 1.1 |
| GICS=Industrials | -0.573 | 0.485 | -0.044 | -1.182 | 0.238 | 0.566 | 1.767 |
| GICS=Information Technology | 0.188 | 1.382 | 0.004 | 0.136 | 0.892 | 0.938 | 1.067 |
| GICS=Materials | 1.186 | 0.44 | 0.12 | 2.694 | 0.007 | 0.392 | 2.549 |
| GICS=Real Estate | -2.386 | 1.414 | -0.05 | -1.687 | 0.092 | 0.896 | 1.116 |

a. Dependent Variable: COE

Ceteris paribus, the Energy and Materials industries would have a higher cost of equity financing regardless of ESG-specific indicators. The estimated coefficient for the Material industry is 0.12 at 1% significance level (t-statistics is 2.694). However, as for the cost of equity, the adverse industry-effect on the Energy industry is lower, as the coefficient is only slightly positive at 0.091 at 5% significance level (t-statistics is 2.143).

## 7.3 Controlling for ROA by sub-sample regressions

**Graph 5 – ROA descriptive statistics in the 'Climate Action 100+' sample**




As can be glimpsed from the distribution of ROAs in our CA100+ sample, we are aware that the companies tend to have an asymmetric profitability profile, with the positively skewed ROA to the mean of 5.54%.

To render our regressions robust towards the sign of ROA, we re-run the partitioned primary dataset of 750 observations by dividing into profitable companies with positive ROAs and loss-making entities which happened to have negative ROAs. To re-construct the winsorised dataset, we removed all fiscal years in which ROAs were undisclosed. The results are two truncated samples of 618 firms in the 'Profitable' sub-sample and 113 'Loss-making' sample of entities. Details on the sample determination process are provided in Table 38.

**Table 38 - Truncated Regression for 'Loss' (Negative ROA) Firms on CoC**

| | |
|---|---|
| Number of observations for 2017 - 2021 | 750 |
| *Dropping:* | |
| Omitted Variables (Miss) | 19 |
| Valid data points | 731 |
| Negative ROA (Loss) | **113** |
| Positive ROA | **618** |

**Table 39 - Truncated Regression for 'Profitable' (Positive ROAs) Firms on CoC**

**Positive ROA**

*Coefficients*[a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | Collinearity Statistics VIF |
|---|---|---|---|---|---|---|---|---|
| 1 | (Constant) | 5.423 | 2.696 | | 2.011 | 0.045 | | |
| | INTCOV | 0.002 | 0.007 | 0.009 | 0.274 | 0.784 | 0.609 | 1.641 |
| | BETA | 3.153 | 0.246 | 0.452 | 12.822 | 0.000 | 0.576 | 1.736 |
| | ROA\{Z} | 0.167 | 0.023 | 0.243 | 7.254 | 0.000 | 0.636 | 1.572 |
| | LEV | -0.001 | 0.001 | -0.047 | -1.485 | 0.138 | 0.722 | 1.386 |
| | SIZE | -0.169 | 0.110 | -0.060 | -1.545 | 0.123 | 0.478 | 2.093 |
| | DISL | 0.011 | 0.004 | 0.080 | 2.702 | 0.007 | 0.819 | 1.220 |
| | MEDIA | 0.016 | 0.007 | 0.089 | 2.324 | 0.021 | 0.484 | 2.067 |
| | Index1=2.0 | 1.023 | 0.261 | 0.134 | 3.918 | 0.000 | 0.608 | 1.645 |
| | Index1=3.0 | -0.288 | 0.262 | -0.038 | -1.100 | 0.272 | 0.607 | 1.648 |
| | Index1=4.0 | -1.231 | 0.284 | -0.142 | -4.327 | 0.000 | 0.661 | 1.512 |
| | Index1=5.0 | -1.457 | 0.266 | -0.191 | -5.484 | 0.000 | 0.591 | 1.693 |
| | GICS=Consumer Discretionary | -1.054 | 0.405 | -0.105 | -2.606 | 0.009 | 0.437 | 2.291 |
| | GICS=Consumer Staples | -0.190 | 0.411 | -0.015 | -0.461 | 0.645 | 0.678 | 1.475 |
| | GICS=Energy | 1.537 | 0.296 | 0.213 | 5.195 | 0.000 | 0.427 | 2.343 |
| | GICS=Health Care | 0.862 | 1.065 | 0.023 | 0.810 | 0.418 | 0.904 | 1.106 |
| | GICS=Industrials | 0.504 | 0.364 | 0.050 | 1.385 | 0.167 | 0.548 | 1.826 |
| | GICS=Information | 0.484 | 0.948 | 0.014 | 0.511 | 0.610 | 0.913 | 1.095 |
| | GICS=Materials | 1.625 | 0.331 | 0.217 | 4.916 | 0.000 | 0.367 | 2.726 |
| | GICS=Real Estate | -0.387 | 1.077 | -0.010 | -0.360 | 0.719 | 0.884 | 1.132 |
| | ENV | -0.003 | 0.007 | -0.014 | -0.417 | 0.677 | 0.611 | 1.636 |
| | SOV | -0.020 | 0.007 | -0.107 | -2.760 | 0.006 | 0.476 | 2.101 |
| | GOV | 0.002 | 0.005 | 0.012 | 0.410 | 0.682 | 0.813 | 1.230 |

a. Dependent Variable: COC

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | Change Statistics F Change | Change Statistics df1 | Change Statistics df2 | Change Statistics Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| 1 | .774[a] | 0.599 | 0.584 | 2.0179% | 0.599 | 38.088 | 22 | 560 | 0.000 |

a. Predictors: (Constant), GICS=Real Estate, GICS=Health Care, Index1=2.0, GICS=Information Technology, GICS=Consumer Staples, LEV, DISL, SIZE, ENV, Index1=4.0, GICS=Industrials, BETA, INTCOV, GOV, Index1=3.0, GICS=Energy, ROA, Index1=5.0, MEDIA, GICS=Consumer Discretionary, SOV, GICS=Materials

**Table 40 - Truncated Regression for 'Loss' (Negative ROAs) Firms on CoC**

**Negative ROA**

*Coefficients a*

| Model | | Unstandardized Coefficients B | Std. Error | Standardized Coefficients Beta | t | Sig. | Collinearity Statistics Tolerance | VIF |
|---|---|---|---|---|---|---|---|---|
| 2 | (Constant) | 18.975 | 5.921 | | 3.205 | 0.002 | | |
| | INTCOV | -0.083 | 0.035 | -0.164 | -2.381 | 0.020 | 0.755 | 1.325 |
| | BETA | 3.171 | 0.41 | 0.64 | 7.738 | 0.000 | 0.524 | 1.91 |
| | ROA\{-Z} | 0.071 | 0.045 | 0.121 | 1.579 | 0.118 | 0.614 | 1.63 |
| | LEV | 0 | 0.001 | -0.031 | -0.359 | 0.720 | 0.473 | 2.113 |
| | SIZE | -0.712 | 0.248 | -0.268 | -2.867 | 0.005 | 0.409 | 2.446 |
| | DISL | 0.018 | 0.008 | 0.168 | 2.385 | 0.020 | 0.719 | 1.392 |
| | MEDIA | 0.02 | 0.016 | 0.117 | 1.25 | 0.215 | 0.41 | 2.439 |
| | Index1=2.0 | 1.154 | 0.666 | 0.138 | 1.732 | 0.087 | 0.561 | 1.783 |
| | Index1=3.0 | -0.939 | 0.752 | -0.113 | -1.248 | 0.216 | 0.44 | 2.273 |
| | Index1=4.0 | -1.452 | 0.513 | -0.289 | -2.83 | 0.006 | 0.343 | 2.913 |
| | Index1=5.0 | -2.095 | 0.627 | -0.314 | -3.341 | 0.001 | 0.404 | 2.476 |
| | GICS=Consumer Discretionary | -2.244 | 1 | -0.176 | -2.245 | 0.028 | 0.583 | 1.716 |
| | GICS=Consumer Staples | 0.686 | 1.703 | 0.027 | 0.403 | 0.688 | 0.778 | 1.285 |
| | GICS=Energy | 0.151 | 0.551 | 0.029 | 0.274 | 0.785 | 0.311 | 3.213 |
| | GICS=Health Care | 1.468 | 1.232 | 0.082 | 1.192 | 0.237 | 0.752 | 1.329 |
| | GICS=Industrials | -0.62 | 0.695 | -0.081 | -0.892 | 0.375 | 0.439 | 2.279 |
| | GICS=Materials | 0.536 | 0.654 | 0.084 | 0.819 | 0.415 | 0.34 | 2.939 |
| | GICS=Real Estate | 1.592 | 1.732 | 0.063 | 0.919 | 0.361 | 0.753 | 1.329 |
| | ENV | 0.01 | 0.014 | 0.054 | 0.685 | 0.496 | 0.568 | 1.761 |
| | SOV | -0.022 | 0.018 | -0.124 | -1.249 | 0.216 | 0.362 | 2.764 |
| | GOV | -0.01 | 0.01 | -0.072 | -1.016 | 0.313 | 0.702 | 1.424 |

a. Dependent Variable: COC

*Model Summary*

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics R Square Change | F Change | df1 | df2 | Sig. F Change |
|---|---|---|---|---|---|---|---|---|---|
| 2 | .851a | 0.725 | 0.649 | 1.50% | 0.725 | 9.647 | 21 | 77 | 0.000 |

a. Predictors: (Constant), GICS=Real Estate, GICS=Health Care, Index1=2.0, GICS=Information Technology, GICS=Consumer Staples, LEV, DISL, SIZE, ENV, Index1=4.0, GICS=Industrials, BETA, INTCOV, GOV, Index1=3.0, GICS=Energy, ROA, Index1=5.0, MEDIA, GICS=Consumer Discretionary, SOV, GICS=Materials

In brief, the robustness test for our hypothesis 1 shows no differences than our main regression in signs or amplitude because the estimated coefficients between the three ESG pillars is only significant for the 'Social' pillar and cost of capital. Further deconstructing our sample has the benefit of demonstrating that it is only the firms with positive ROAs (Table 39 - 'Profitable' sub-sample) that contributed to the statistically significant relationship for this pillar score. The estimated coefficient in the positive-ROAs subsample is –0.101 at 1% level of significance (t-statistics is –2.76), and the ROA variable itself has an estimated degree of influence of 0.243 at 1% level of significance (t-statistics is 7.254). ROA is not significant in the negative-ROA sample, implying either that once the firm is loss-making, the market does not attribute further value in this regard to determine its cost of capital, or that the sample is not large enough.

In response to the robustness of the results for hypothesis 2 and 3, the results for ESG disclosures (DISL) and controversies (MEDIA) in both subsamples confirm our results for DISL in the main regressions (a positive coefficient at 1% level of significance), whilst the controversies became masked by insignificance at the negative-ROAs subsample for MEDIA. This may insinuate that for profit-making companies, it is more meaningful to take out the resources to publish disclosures and manage controversies.

Lastly, focusing on the difference for the negative-ROA subsample, it is appreciable that the BETA and SIZE variables became statistically significant, meaning that the cost of equity will meaningfully influence the cost of capital through the company's Beta (coefficient to market risk premium in the CAPM, or sensitivity to systematic volatility) and the market capitalizations will meaningfully change the cost of capital for loss-making firms. More specifically, at 1% significance level, the influence of BETA on the cost of capital is positive at 0.64 (t-statistics is 7.738), whilst the impact of SIZE on the cost of capital is negative at -0.268 (t-statistics is -2.867). The unprofitable firms have worse average cost of equity due to the beta effect, but a larger firm size neutralizes this aggravating effect on the cost of capital.

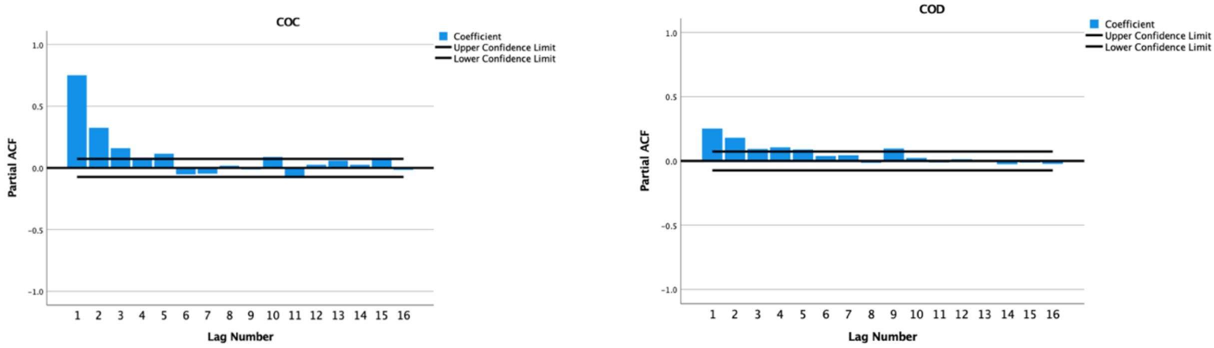
## 8. Robustness Test and Limitation

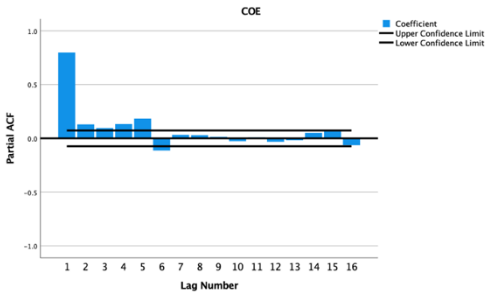
In this section, we performed a sensitivity analysis to examine whether our primary evidence on the association between ESG practices and the cost of capital, cost of debt, and cost of equity is robust to alternative assumptions and model specifications. Overall, the results from these sensitivity tests are not quantitatively different from those of the primary analysis.

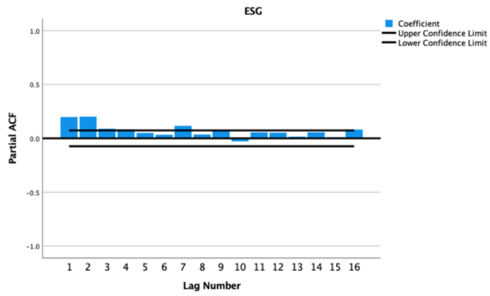
Regarding ESG pillar scores, our regressions do not address whether the Environment and the Governance pillars are insignificant due to the Refinitiv providing noisy measures of ESG performance or alternatively such insignificance is due to a lack of economic correlation between the true factors of interest and components of cost of capital. The auto-correlation check and industry categorization clustering in the next passages expound on this issue.

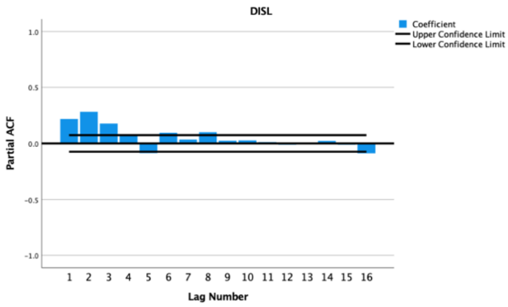
Firstly, to mitigate the issue of reverse causality, or speaking, the cost of capital, the cost of debt, and the cost of equity in the previous period would affect the current financing, we performed the time series of autocorrelation of these three dependent factors, and ESG performances, disclosures, and controversies. According to the graphs below, the partial autocorrelation results show that most of the observations lie within the confidence limit, meaning that there is not much variation across time among the data points. We further performed the Pearson correlation test to further verify the time series correlation. As seen in the Pearson correlation table, most of the control variables do not demonstrate a significant correlation with the time series. However, we do observe certain variables with a significant correlation with the time series, such as the COC, COD, COE, ROA within certain years. Therefore, further improvement over the dataset extraction process could be made following the method of Chen et al. (2011) to include lagged dependent variables (COC, COD & COE) to improve the endogeneity issue further.

**Graph 6 Autocorrelation Result**





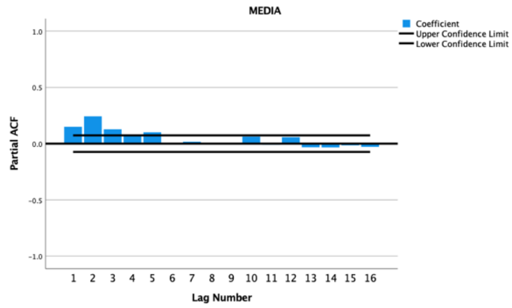




**Table 41 Pearson Correlation with Time Series**

*Correlations* [a]

| | | COC | COD | COE | INTCOV | BETA | ROA | LEV | SIZE | DISL | MEDIA | ESG | ENV | SOV | GOV | EMIS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Index1=1.0 | Pearson Correlation | 0.037 | 0.045 | 0.009 | -0.016 | -0.051 | 0.002 | 0.006 | -0.022 | 0.003 | -0.070 | 0.062 | 0.013 | -0.037 | -0.033 | -0.015 |
| | Sig. (2-tailed) | 0.340 | 0.238 | 0.819 | 0.686 | 0.180 | 0.968 | 0.880 | 0.571 | 0.936 | 0.069 | 0.105 | 0.729 | 0.338 | 0.386 | 0.692 |
| Index1=2.0 | Pearson Correlation | 0.236 | 0.319 | 0.147 | 0.075 | -0.066 | 0.119 | -0.028 | 0.004 | -0.021 | -0.041 | 0.107 | 0.098 | -0.015 | 0.025 | 0.003 |
| | Sig. (2-tailed) | **0.000** | **0.000** | **0.000** | 0.050 | 0.084 | **0.002** | 0.470 | 0.927 | 0.576 | 0.289 | **0.005** | 0.010 | 0.695 | 0.523 | 0.928 |
| Index1=3.0 | Pearson Correlation | 0.036 | 0.018 | 0.014 | 0.083 | -0.033 | 0.083 | -0.015 | -0.010 | 0.011 | 0.042 | -0.012 | 0.040 | 0.023 | 0.036 | 0.017 |
| | Sig. (2-tailed) | 0.347 | 0.648 | 0.724 | 0.031 | 0.392 | 0.031 | 0.697 | 0.792 | 0.775 | 0.274 | 0.759 | 0.291 | 0.546 | 0.343 | 0.663 |
| Index1=4.0 | Pearson Correlation | -0.180 | -0.220 | -0.058 | -0.107 | 0.083 | -0.290 | -0.022 | 0.002 | 0.004 | 0.035 | -0.094 | -0.083 | 0.020 | 0.009 | 0.007 |
| | Sig. (2-tailed) | **0.000** | **0.000** | 0.131 | **0.005** | 0.030 | **0.000** | 0.560 | 0.966 | 0.913 | 0.359 | 0.014 | 0.029 | 0.593 | 0.807 | 0.862 |
| Index1=5.0 | Pearson Correlation | -0.125 | -0.158 | -0.109 | -0.033 | 0.066 | 0.088 | 0.058 | 0.026 | 0.003 | 0.032 | -0.061 | -0.067 | 0.008 | -0.036 | -0.012 |
| | Sig. (2-tailed) | **0.001** | **0.000** | **0.004** | 0.384 | 0.087 | 0.022 | 0.127 | 0.495 | 0.935 | 0.401 | 0.110 | 0.082 | 0.838 | 0.341 | 0.764 |

a. Listwise N=682

Secondly, following our research, we did more literature review to understand the difference between our results and the conclusions from other research papers. One possible explanation could be that the country-level factors, such as the cultural, social, economic, and institutional context in which investors and businesses operate, play a significant role in determining the strength, direction, and sometimes even the existence of ESG and Cost of Capital relationship for both costs of equity and cost of capital. As discussed by the literature review by (Gianfranco Gianfrate, 2020), country-specific factors that have been shown to impact the relationship between cost of capital and underlying ESG variables are stakeholder orientation, financial transparency (Dan Dhaliwal, 2014), the degree of investor protection and commitment to ESG (Shantanu Banerjee, 2016), institutional environment (Gong, 2016) and country-level sustainability (Hoepner, 2016). As our sample contains countries from different countries with possible diverse levels of ESG regulations and commitments, the difference between our results and the prior literatures for the relationship between the cost of capital and the ESG practices could be explained.

## 9. Conclusion

The primary objective of this paper is to gain a deeper understanding of the ESG practices, including ESG performances, their related disclosures, and their associated controversies in the media presentation in the context of Climate Actions 100+ companies. In our primary research, we undertook a fixed effect with the years and industries variables to examine the relationship between the cost of debt and cost equity and their relationship with the ESG practices scores. Secondly, in the additional analysis, we investigated the relationship between the emission score and the cost of capital. Thirdly, we performed a sub-clustering regression analysis to address the role of the ROA in shaping the effects of ESG practices on the lending decision model.

With a sample of 750 firm-year observations, our main findings add to existing academic research on ESG rating and the cost of capital by four main suggestions: 1) There is no significant correlation between the ESG performances with Cost of Capital, Cost of Debt, or Cost of Equity under different fixed or non-fixed Year/Industries effect scenarios. After decomposing the ESG composite scores into ESG pillar scores, only the 'Social' dimension exhibits a negative and statistically significant relationship across the cost of debt, equity, and capital. 2) No significant correlation of either the Environmental pillar score or Governance Pillar score with the Costs of Capital, Cost of Debt, or Cost of Equity is observed. 3) In terms of the ESG disclosure, results under different fixed-effect models consistently indicate that firms with higher ESG disclosure have a higher cost of capital and typically a higher cost of debt. 4) Regarding the ESG Controversies Score, in most cases, when implementing the ESG composite score into the model, no significant correlation between ESG controversies and the Cost of Capital and Cost of Equity is observed. Only within the fixed year effect- and within the fixed industry effect regressions, do we observe a negative correlation between the ESG controversies score and the cost of debt. These findings reflect the non-linearity in the Cost of Debt - ESG Practices relationship (Zhou et al. 2018), where the U-shaped of Cost of Debt and ESG practices may imply that an optimal level of ESG spending exists, beyond which lenders consider CSR spending a waste of firm resources. Therefore, the research would provide further empirical evidence that the U-shape curve may not only take place in the ESG practices – COD relationship but also in the ESG practices – COC/COE relationship.

In addition to our primary analysis, the study also discussed three additional insights: 1) There is a negative correlation between the emission score and the cost of capital. Our findings support the idea that the less the companies emit, the less cost of capital, or speaking, less cost of debt and cost of equity the companies will undertake. The emission score's impact on the debt financing is markedly higher than its impact on equity financing. 2) Through fixed-industry robustness testing, there is no significant within-industry effect across all forms of cost of capitals except for the Energy industry and the materials industry, in the shape of a positive estimated coefficient on cost of equity and especially on cost of debt. 3) By controlling for ROA by sub-sample regressions, we noted that for the companies with positive ROA, there is a significant positive correlation between the cost of capital and the ESG disclosure and between the cost of capital and ESG controversies, as well as a significant negative correlation between the cost of capital and the Social Pillar Score. However, we do not witness a significant correlation within the sub-group demonstrating negative ROA values.

The results of our study have practical implications for all firms wishing to raise debt and equity capitals who also issue ESG data for rating agencies. First, incorporating an ESG-driven evaluation of a company's five-year track record of cost of debt and equity capital that has a meaningful impact for both issuers of ESG data to be rated by score providers, capital providers to such issuer, and users (Investors, Regulators, Consumers) of the ESG scores in the downstream of the ESG rating ecosystem. Secondly, rather than resorting to a stock return perspective for the ultimate investors in the long-tailed downstream, we adopt a cost of capital angle to help the immediate reporters of ESG data to dynamically learn from their gaps in ESG performance, disclosure, and management. Last and most importantly, the findings allow for a cross-sectoral comparison of companies without compromising the best-in-class applications. Therefore, our research should be of interest both to industry bodies and individual companies, who are considering mandating ESG practices into their daily business operations.

Although this study sheds new light on the association between ESG practices and the cost of capital, it has some limitations that represent avenues for future research. Firstly, this study employed secondary data obtained from Refinitiv. Although the database is widely accepted in management and accounting literature, collecting primary data would strongly support our findings. Secondly, further improvements to the data extraction process could be made following the method by Chen et al. (2011) to include lagged dependent variables to mitigate the endogeneity issue further. For example, even without significant variations among the years, the year-end ESG performances data would influence the following year-beginning cost of capital. Therefore, future studies could include lagged dependent variables to avoid this limitation. Thirdly, since our samples include public companies in different sectors within different countries, it would be interesting to understand how various factors, including the cultural, social, economic, and institutional context in which investors and businesses operate, play a role in determining the relationship between ESG practices and the cost of capital.

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