The Relationship Between ESG Scores and Cost of Debt – Evidence from the S&P 500

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COMPULSORY DECLARATION

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Abstract

The purpose of this study was to determine the relationship between environmental, social, and governance (ESG) disclosure scores and a firm's cost of debt.

Previous studies relating to ESG and cost of debt produced mixed results, with most finding that a relationship exists. Most of the research found superior ESG to decrease a company's credit risk and therefore borrowing rates. This was the relationship that this study expected.

The study focused on all the companies on the Standard and Poor's 500 (S&P 500) that had both an ESG disclosure score and a cost of debt figure. The study collected panel data over a five-year period from 2016 to 2020. Fifty-six panel data regressions, including robustness checks were used to test the relationship between ESG and its components and cost of debt. The preferred regression model for ESG and its components from 2016 to 2020 was a panel data regression with fixed effects.

In contrast to prior research, no material relationship was detected between ESG disclosures scores and the cost of debt of the sample companies for the period under consideration. Therefore, it was inferred that superior ESG does not decrease cost of debt for a company. It was found that liquidity and firm size variables – rather than ESG variables – had an influence on cost of debt.

The findings of this study have both professional / real-world implications for investors and debt providers and academic implications for researchers. For professionals, including investors and debt providers, the results showed that ESG is not as advanced in the debt markets as previously perceived, owing to no relationship being found, and that ESG scores are more important to equity holders than to holders of debt. From the academic point of view, the results add to the existing body of knowledge and provide academics and researchers with an additional standpoint on the relationship between ESG and cost of debt.

1. Introduction

Not only has the COVID-19 pandemic resulted in arguably the worst recession since World War II, but it can also be referred to as the 21st century's first sustainability crisis. This has renewed and increased the focus on climate change, providing key lessons on how to address climate change (Pinner, Rogers & Samandari, 2020). In addition to this, debt levels of both financial and nonfinancial listed companies continue to rise, and this is happening on a global scale (spglobal, 2020). The question arises: Will the increased focus on sustainability and the increasing debt levels have some sort of relationship with each other? If this is the case, it will be important for firms to turn their attention to ESG as this could affect their ability to acquire debt for future growth.

The pandemic created a large bear market and companies across the globe struggled to stay open as lockdowns were introduced. The researcher's train of thought was that these companies would need capital in some form or other in order to get back to their former pre-pandemic levels of output and resume growth. The reference to the pandemic as a sustainability crisis raised the question as to whether companies with a stronger emphasis on ESG practices would be affected to the same extent as companies with little [or no] emphasis on ESG practices. The researcher's subsequent question – which became the main motivation for this study – was whether companies which strive to be sustainable, through having a positive impact on society and the environment, are compensated by lenders for their efforts towards a more sustainable future. Some research had been done in this area and it was found that most of this earlier research focused on public equity (Cantino, Devalle & Fiandrino, 2017). Therefore, this study took a different approach and looked at the debt side of the capital structure. The goal was to discover whether companies were compensated for superior ESG levels, in the form of lower interest rates when taking on debt.

Back in the mid-1900s, Levitt (1958:47) stated that welfare and society are not a firm's business; its business is making money. Levitt's view was supported by lending institutions, in the way that they made credit decisions, using financial performance and financial position as the major estimators of credit risk (Devalle, Fiandrino & Cantino, 2017). Hemingway and Maclagan (2004) also agreed with Levitt, asserting that the main incentive to pursue corporate social responsibility (CSR) was to conceal other corporate concerns. However, more recent

literature shows that ESG integration and the profitability of a firm do not have an inverse relationship (Scholtens, 2006, 2009; Zeidan, Boechat & Fleury, 2015). This ESG integration shows that solely having good financial indicators is not valid anymore. The need for strong non-financial performance has started to become important, as lending institutions have started to incorporate this into their credit risk calculations (Birindelli et al., 2015; Hoepner et al., 2016).

The salience of ESG has increased tremendously over the past couple of years. It has been found that 67% of people prefer to work for socially responsible companies and 55% of people are willing to pay more for goods and services from companies making a positive social and environmental impact (The Nielsen Company, 2014:2). The number of sustainable and green bonds being sold has been increasing over the past couple of years (Mutua & Poh, 2019). Also, the main credit rating agencies have gained more interest in acquiring ESG data (Hester, 2020).

Environmental issues have received the most attention in the early 2020s but, as the pandemic spread across the entire globe, people realised that social and governance risks were just as crucial and in need of attention (Kuh, 2020). Social issues such as worker health and safety, as well as systematic risks such as income inequality, became accentuated when the effects of COVID-19 hit (Kuh 2020). During past economic recessions, ESG risks were of secondary importance to investors and were seen as somewhat of a luxury by investors, but the general consensus – this time around (COVID-19) – is that ESG investors and stakeholders will not allow corporates to use an economic recession as an excuse to downplay the need for improved ESG (Kuh, 2020).

Since 1 January 2019, global debt from financial and non-financial corporate firms have grown by 6% to $20.6 trillion on 1 April 2020 (spglobal, 2020). According to research done by Morgan Stanley Capital International (MSCI, 2020), it was recorded that there were in excess of 600 ESG regulations globally over the period 2010–2019. All the pressure on governments, more transparency demanded from corporates, and ESG being a public concern could result in credit markets starting to include ESG risks and concerns into the pricing of debt.

Existing literature explains why sampling ESG and cost of debt data from the S&P 500 is effective. One reason for using the S&P 500 is that larger firms have much more influence and

power to force change such as social impact (Semenova & Hassel, 2019). Another reason for using S&P 500 data is that the United States has the largest number of corporates which participate in the bond market. The number of corporates which are classified as investment grade are higher and the United States has the most liquid credit markets (Semenova & Hassel, 2019).

All the data used in the research were collected from the Bloomberg database: this included cost of debt, ESG and its components, and the control variables. The sample comprised firms from the S&P 500 from 2016 to 2020, and the data were mainly collected on 25 January 2021. On the date of data collection there were 504 companies included in the sample. To be included in the final sample, a company had to have both an ESG and cost of debt figure. The EViews software was used to complete the analysis.

The following steps were followed to complete the analysis. The first step in the analysis was to set up a graph of the core variables, which were cost of debt, ESG, and its components. This was done to identify any trends in the data. The next step in the analysis was to look at the descriptive statistics of the data. This was done to gain an understanding of the data. A co-variance analysis was then conducted where the 1:1 correlation groups of the variables were examined, focusing on the core variables and their relationship with cost of debt. The main purpose of the correlation group was to understand in which direction the variables moved relative to cost of debt. In the next part of the analysis, pairwise granger causality tests were conducted. This was done to find out whether any of the core variables caused a change in cost of debt. The next test that was done was the cointegration test. This test was essential to ensure that the residuals were stationary before the regression analysis was done. Finally, before the regression results were analysed, the residuals were plotted on a graph to examine whether there were any unwanted patterns. The final step in the analysis was to determine the relationship between ESG and its components and cost of debt. This was done by running a multiple regression on the variables.

Initial results showed that 2020 was a slight outlier year and that this was possibly due to the COVID-19 pandemic. Initial observations showed that the core variables were normally distributed. The 1:1 correlation table shows that ESG and its components all have a negative relationship with cost of debt. The granger causality tests showed that neither ESG nor its components caused a change in cost of debt. This changed when removing 2020 from the

sample, with the social score causing a change in cost of debt. The cointegration test showed that the residuals were stationary. The residual plots of the regressions showed that no patterns existed and that the regressions were consistent with random error. A histogram of the residuals also showed that the residuals followed a normal distribution. The regression analysis showed that neither ESG nor its components affected cost of debt in a material way. The only component that had a slight material impact on cost of debt was the governance disclosure score. Not finding a relationship between cost of debt and ESG does not mean that there was no relationship; it just means that the method and data used in the research did not find a relationship. Using different data and methods such as before tax cost of debt instead of after tax cost of debt is one alternative approach that could bring different results.

Since literature points to increasing debt levels and the growing importance of ESG practices to ensure future sustainability, it is vital that this relationship is studied. As mentioned previously, the majority of the existing research has been done on the relationship between equity and ESG scores (Cantino, Devalle & Fiandrino, 2017). This research will therefore contribute towards increasing the body of knowledge with regard to ESG and the credit markets. ESG factors that affect a company's stock price have a direct impact on an equity holder, but not a debt holder, as the debt is paid whether the stock price does well or does poorly. Therefore, if the slightest impact is made by ESG on cost of debt, it means that ESG metrics have come a long way. The results of this study demonstrated that ESG did not have a material impact on cost of debt and that ESG was possibly not yet as mainstream as previously thought. Using before-tax cost of debt figures is suggested for future research as using after-tax cost of debt figures creates more variability owing to differing tax policies.

The rest of the study is structured as follows. Section 2 discusses the objectives of the research and poses questions to answer the objectives. In section 3, the study looks at existing literature on certain topics to gain an understanding of the results of research done previously. Section 4 explains the data and method used for the research. Section 5 contains the discussion of the results of the study. Finally, section 6 of the study draws conclusions.

2. Problem Statement, Research Objectives and Questions

Debt levels from financial and nonfinancial corporate firms across the globe continue to rise (spglobal, 2020). This is coupled with the growing pertinence of ESG levels, prompted by the increased focus on sustainability. The recovery from the 2020 bear market is a major reason for increased debt levels. This raises the question of whether superior ESG scores benefit companies looking to acquire debt. Therefore, the problem statement for this dissertation was that debt providers don't consider the sustainability of the companies that they provide debt instruments to.

Broadly, this study aimed to investigate whether a relationship exists between ESG and cost of debt. The study had three objectives. The first objective was to investigate whether a relationship exists between a company's ESG and its cost of debt on the S&P 500 during the period under consideration. The second objective was to investigate whether the financial control variables are more important than ESG in determining cost of debt. The final objective was to provide results that are useful for any stakeholders interested in this topic and for future researchers desiring to expand upon this field, by adding to the existing literature.

To fulfil the stated objectives of the study, certain questions had to be asked. These questions were formulated around finding out whether businesses are compensated for improvements to their ESG variables. The first question was: do the disclosure scores of ESG and its components have a relationship with cost of debt? The second question was: which one of ESG or its components has the strongest relationship with a company's cost of debt? The final question was: are the financial conntrol variables more important in the calculation of cost of debt than ESG and its components?

The first objective was achieved by using descriptive statistics in order to estimate whether ESG affects cost of debt. Regression techniques were applied in order to analyse the drivers of cost of debt and whether ESG or its components form part of these drivers. Data included environmental, social and governance disclosure scores, as well as an ESG disclosure score. The goal was to discover the relationship that exists between ESG and its components and cost of debt. The second objective was achieved by applying further econometric techniques, such as running a regression on the variables, but adding in control variables that could affect the

relationship between ESG and cost of debt. These factors included items such as financial ratios and enterprise value. The aim of the second objective was to discover whether the hypothesised relationship exists between ESG disclosure scores and cost of debt and the extent of the coefficients. The third objective was achieved through the same techniques that were used for finding a relationship between ESG and cost of debt.

3. Review of Previous Literature

The amount of literature focusing on environmental, social and governance (ESG) issues has been increasing in recent years, as the public has raised awareness of their importance. Sustainability is at the forefront of responsible investors decision-making processes. Since financial performance is no longer their only goal, a growing number of responsible investors place emphasis on incorporating ESG aspects into their investment mandates and investment practices in an attempt to increase the possibility of long-term sustainability (Mutezo, 2014).

3.1 Sustainability

Being sustainable means providing in the present without depleting the ability of future generations to provide (Bruntland, 1987). This statement is supported by stakeholder theory, which encourages the incorporation of additional factors into the investment decision making process, including the mitigation of ESG risks, which often have an impact on the performance of companies over the longer term (Bavoso, 2014). The 21st century presents management and directors of corporate firms with a variety of sustainability and ESG-related issues, which are mostly addressed by a change in the way that firms operate (Viviers & Els, 2017).

Managing corporate sustainability should address the ethical aspects of sustainability, through the use of sustainable resource allocation (Schuler et al., 2017). This implies that business strategy regarding the allocation of resources should incorporate the interests of environmental, social and governance aspects in a way that creates overall stakeholder value (Freeman et al., 2010; Schuler et al., 2017). Furthering this concept, sustainability should create synergy between environmental, social and financial interests in a manner that is fair and ethical, while incorporating stakeholders' interests throughout the process (Hoepner et al., 2016). In order to ensure long-term corporate sustainability, firms should structure their ESG and financial targets with the aim to maximise value, while reducing the associated risks. These ESG and financial targets can only be achieved by incorporating a strategy that is efficient in allocating resources

and effective in the commitment towards the desired goals (Harrison & Wicks, 2013). These concepts of ESG are related in that sustainability means sustaining the business as a whole with an outlook that incorporates economic, financial and ethical aspects.

Corporate social responsibility (CSR) and ESG are similar in nature, however significant differences do exist. CSR is a representation of the company's effort to have a positive effect on the environment, its community, its consumers and its employees. It is however based on self-regulation by the company and most big companies release annual reports on CSR. ESG is a more accurate measure of the activities that the company practises. ESG is more transparent and comparable, relative to CSR. This is because, in using CSR, a company can report activities with the sole purpose of presenting a good public image, whereas ESG demands metrics and evidence of progress (Antea Group, 2021).

3.2 Corporate Social Responsibility Impact

The votes by shareholders on CSR proposals was investigated by Flammer (2015). The research found that proposals which received the most votes from the shareholders were those that focused on fixing labour concerns and treating all people equally (Flammer, 2015). Another proposal that was widely accepted was one that aimed to decrease environmental concerns. Results obtained by Krueger (2015), provide evidence of CSR practices having the aim of fixing irresponsible corporate behaviour and having a positive impact on shareholder value. The chances of litigation risks that could occur in the future is decreased with good CSR practices (Koh, Qian & Wang, 2014). However, the main incentive of pursuing CSR is to cover up for other corporate concerns (Hemingway & Maclaglan, 2004). Empirical evidence was found that showed that improved CSR performance decreases unexplained risk (Godfrey, Merrill & Hansen, 2009; Goss & Roberts, 2011; El Ghoul et al., 2011; Bouslah, Kryzanowski & M'zali, 2013).

In literature emanating from the period 1972–2007, it was found that various elements of CSR and strong environmental performance mostly have a positive effect on the financial performance of firms (Margolis, Elfenbein & Walsh, 2007). The relationship that exists between environmental performance and financial performance seems to be fairly clear. However, the impact that CSR performance has on firms' corporate performance remains relatively difficult to establish. An increase in the effectiveness and efficiency with which firms allocate their resources has shown to have a positive impact on corporate performance

(Sharfman & Fernando, 2008). A decrease in operational risk is a further benefit from the practice of CSR investing (An & Pivo, 2018; Albuquerque, Koskinen & Zhang, 2018). The reduced risk could open up the opportunity to access capital with ease and even decrease the cost of capital.

The effect that environmental and other CSR activities have on the cost of debt has not been studied thoroughly as most of the research related to CSR activities has focused on cost of equity (Goss & Roberts, 2011). Older studies have even produced results showing that these activities have no effect on cost of debt and some studies have even suggested that better CSR performance leads to higher interest rate spreads. This is evidenced by D'Antonio, Johnsen and Hutton (1997), who studied the performance of bond mutual funds screened for social risks and found that CSR does not relate to yield differences, while adjusting for risk. Sharfman and Fernando (2008) gather results showing that higher environmental performance is related to companies with a higher capacity for debt. These companies, however, also show higher cost of debt.

More recently, literature has been producing contradictory results. Bauer and Hann (2010) concluded that environmental performance is linked to lower bond spreads. Stellner, Klein and Zwergel (2015) further found that strong CSR activities in the corporate bond market are rewarded and this effect is emphasised when the sovereign has a high ESG rating. Research conducted by Attig et al. (2013) obtained results showing that, when companies with better CSR performance issue a bond, they have better credit ratings and, all else being equal, firms with better credit ratings can obtain financing at better rates. It is said that CSR practices create stakeholder value when a negative occurrence is attributed to the ineptitudes of management rather than the intentions of management (Godfrey et al., 2009).

The relationship between environmental risks and their effect on both bank loans and cost of equity was recently studied by Chava (2014). The results showed that companies with little to no environmental risks mostly have lower interest rates. Often firms with weak CSR struggle to source capital as they are constrained by some institutional lenders, as evidenced by Cheng, Ioannou and Serafeim (2014), who found that companies that have strong social and environmental performance are not as constrained with regard to capital. Oikonomou, Brooks and Pavelin (2014) found that, across various industries, superior CSR performance is related to higher credit ratings and a lower cost of debt.

Empirical data attempting to find the relationship between returns and CSR is inconsistent, as the theory behind the measures is not standardised, which makes it difficult to draw comparisons across different studies. On the risk management side, the research that has been done has provided merging conclusions, because the results have been realised through intangible assets and so called ethical capital (the collective value that derives from the organisation's commitment to ethics, governance and good corporate citizenship).

The literature reviewed thus far mostly implies that stronger CSR has a positive impact on financial performance and is often associated with lower risk. However, as stated earlier, the intent behind the CSR is difficult to recognise and the reporting of CSR is not as transparent as reporting on ESG (Antea Group, 2021). Therefore, research will now be investigated that gives contradicting results between CSR and ESG measures and why it is that way.

3.3 Differences Regarding Corporate Social Responsibility and ESG

It is suggested by Edmans (2011) and Derwall, Koedijk & Ter Horst (2011) that ESG concerns are far more important than most investors consider and that many market participants do not pay enough attention to these concerns. This leads to inefficiencies with regard to the incorporation of CSR practices relating to pricing in the market. The effects of CSR practices are therefore only realised at a later stage, affecting the stocks negatively if ESG performance is low and positively if ESG performance is good.

Godfrey et al. (2009) find that the protection against negative events lent by strong CSR is much stronger for bigger companies. Jang et al. (2020) find the opposite for ESG, namely that ESG has a greater effect on smaller companies. This difference is due to the following: although CSR and ESG share many similarities, ESG is more complete in the way that it incorporates most variables relating to environmental, social and governance factors. This will naturally yield different results, as the factors that are being measured are slightly different in nature. Jang et al. (2020) obtained results that provide evidence of financial benefits being gained as a result of improved ESG activities. This is especially prevalent in the form of lower cost of debt when issuing bonds. When a firm shows strong CSR activity, this provides information that influences investors who are looking to invest in socially responsible firms. The impact of these CSR activities helps to reduce the cost for investors in finding these socially responsible firms (Godfrey et al., 2009).

3.4 Markets' View on ESG Practitioners

The capital markets perceive firms actively involved in improving their participation in environmental, social and governance areas in a positive light, as adopting these initiatives often increases earnings quality (Choi & Moon, 2016).

According to Sustainable Returns for Pensions & Society (2013), sustainable investing is based upon the thoughts that ESG risks can affect financial performance in a negative way and therefore these risks should be included in the decision-making process. Additionally, the efficient and effective integration of ESG opens up numerous investment avenues and options to obtain additional sources of capital (Sustainable Returns for Pensions & Society, 2013). Speaking publicly and reporting how the firm makes provisions for ESG risks brings many additional benefits to the firm, including increased access to markets, an increase in valuation by the market, a stronger brand, and ultimately a lower cost of capital (Isa, 2019).

Corporate institutions and responsible investors have a large number of ESG risks to consider, the obvious ones being climate change, unemployment, health and safety, and the board's performance, to name a few (Kocmanová & Dočekalová, 2012; Mans-Kemp & Viviers, 2015).

It seems that the markets view firms that partake in ESG practices in a positive light and that these firms benefit to a certain extent. In the next section, ESG investing between the equity and debt markets is compared.

3.5 Differences between ESG Investing in Equity and Bond Markets

The most efficient combination of debt and equity must be selected by firms when planning to raise capital. This combination must be decided on by how lenders view the risk associated with the firm and how shareholders view the profits produced by the firm.

Investing in ESG via bond markets is quite different from investing in ESG in equity markets. ESG investors in the fixed income markets are not as advanced in managing their portfolios as equity portfolios, as ESG investing in the equity markets integrates various strategies, such as best versus worst in class, exclusion, screening, and stock picking, to name a few. ESG investing in fixed income is more complex than in equities because implementing ESG decreases the size of the investment universe, which could decrease the liquidity. Corporate bonds are slightly more advanced in the implementation of ESG disclosure scores but have a

long way to go in reaching the levels of complexity of equity portfolios (Kölbel & Busch, 2013). The research of Kölbel and Busch (2013) produced results to confirm this, by identifying that negative news on a firm's ESG has a negative effect on the price of the shares. As bonds are mostly less efficiently priced than stocks, the impact is suggested to be even larger.

Investors seem to have two main goals in mind when considering ESG in their investment decisions. They search for stocks that have lower extra-financial risks (ESG related risks) than the average firm over the long term. A better environmental score prepares the firm for a transition to renewables and reduces its climate risks. Reputational and public image risks are reduced by an improved governance score. For these reasons, analysing ESG components is an additional method to improve on traditional security analysis and to enhance the available information included in the process of picking stocks. Long-term equity investors are ahead of most when it comes to the incorporation of ESG risks into the forecasting process of the future stock performance.

ESG implementation with regard to investing in debt is not yet as advanced as investing in equities (Goss & Roberts, 2011). In recent years, the efforts from credit rating agencies to incorporate ESG risks for leveraged companies are increasing (Hester, 2020). This is as a result of an increase in sustainable investment interest from investors and competition from independent ESG rating firms. It is important that traditional credit rating agencies start to incorporate ESG risks as they have access to information about privately owned firms, where independent ESG rating companies mostly have access to public information (Ho, 2019). This is an indication of how ESG rating and credit rating is becoming a combined exercise. Fitch was named the most transparent agency with regard to ESG scoring for two consecutive years (2019–2020). This shows the increased importance of ESG variables ("Fitch ratings named…", 2020). With a portfolio that is investment grade and diversified, the active bets that exist are credit risk and duration, and therefore the manager cannot alter the unexplained risk as much as in a portfolio of stocks. Most bond portfolio managers use a buy-and-hold strategy, which is explained by the lower liquidity of these types of portfolios. For this reason, actively managing a bond portfolio using ESG risks is considerably more complicated than an equity portfolio.

The goal of a bondholder and stockholder is naturally very different. A stockholder is an owner and therefore the long-term prospects of the company are directly related to the stock's value and the future profitability of the firm, whereas a bondholder is not an owner, but receives a known and constant amount and is therefore only concerned with the default risk until the bond matures (Merton, 1974). It intuitively makes sense that extra-financial risks such as ESG are more advantageous to the stockholder, because the return for the stockholder is directly dependent on the future performance of the stock. If the stock does not perform well, the bondholder still receives the payments. Till now, ESG investing in bonds has been more in line with the investor's mindset and has been more closely related to impact investing.

Since the focus of the study is the cost of debt financing, the investigation is now directed at how ESG and its components are related to the cost of debt.

3.6 Corporate Social Performance and Cost of Debt Relationship

Corporate social performance (CSP) is the metric used to measure the performance of the social (S) variable.

The private debt market is larger than the public debt market. Owing to the private debt market being more informationally efficient, it is considered to reflect and update default probabilities at a faster rate than the public debt market (Altman, Gande & Saunders, 2010). This adds to researchers' contention that the private debt market incorporates social aspects when determining a firm's credit risk profile.

Firm-specific information to which banks can obtain access is mostly unavailable to people outside the specific organisation. Private lenders can be seen as semi-insiders. This is why Goss and Roberts (2011) investigated whether private lenders incorporate various levels of CSP in their decision-making processes. A study conducted by Scholtens and Zhou (2008) found that higher social risks generally cause higher financial risk. Barnea and Rubin (2010) found that a negative relationship existed between a firm's CSP and how much they were leveraged with regard to debt.

The volatility of a firm's financial performance over time often determines the risk associated with the firm. Therefore, if the operational risk of a firm is reduced by improved CSP, this could result in more stable cash flows and ultimately lower the firm's cost of debt (Orlitzky &

Benjamin, 2001). Sun and Cui (2014) provided evidence that firms which manage their risk effectively and practise superior CSR activities have lower associated cost of debt. However, it has also been mentioned that, owing to the limited number of studies and the variety of studies regarding the CSP–cost of debt relationship, this area of study still requires more research.

3.7 Corporate Governance and Cost of Debt Relationship

The general perception with regard to corporate governance (G) is that creditors will more likely consider the firm to be trustworthy and transparent, if their corporate governance practices are appropriate as this will result in the firm having a lower perceived default risk. It is suggested that those who invest in bonds are benefitted by superior corporate governance practices, as these companies are generally managed more carefully (Bhoiraj & Sengupta, 2003; Klock, Mansi & Maxwell, 2005; Chava, Livdan & Purnanandam, 2009). Research was conducted into bond pricing and it was found that lower interest rates are associated with high-quality corporate governance practices and high-quality disclosure (Sengupta, 1998; Bhoiraj & Sengupta, 2003; Anderson, Mansi & Reeb, 2004). Results found by Klock, Mansi & Maxwell (2005) showed that better management rights are given favour in the bond market, although these are not going to benefit shareholders. Results were obtained which find that the risk of a firm's share price crashing is higher when the company has poor corporate governance or when the company lacks transparency (Kim, Li & Li, 2014; Callen & Fang, 2015). This higher firm risk is often priced into the cost of debt, as it can affect the future ability of the firm to make timely payments.

Andrade, Bernile and Hood III (2014) explored the manner in which the Sarbanes–Oxley (SOX) Act affected the cost of debt of firms as a consequence of the Act's impact on superior reliability in financial reporting. Credit default swap spreads were used, along with a credit default swap pricing model. The results produced indicate that corporate transparency increased and the cost of debt decreased, after SOX was introduced. Aldamen and Duncan (2012) conducted an investigation into the Australian corporate bonds market to examine the impact that corporate governance has on cost of debt and the results were that superior corporate governance led to lower costs of debt. Results obtained by Aman and Nguyen (2013) showed that better corporate governance mostly leads to better quality credit, which implies that continuous monitoring by shareholders and more consistent and reliable information as a result of improved disclosure reduces the risk to holders of debt.

Altman and Hotchkiss (2010) stated that the most likely cause of a firm's lack of success or even failure is due to managerial ineptitudes. However, controversial corporate governance practices and the effect that these have on a firm's cost of debt leave significant room for further study. Altman and Hotchkiss (2010) further emphasised that, although there are many reasons for the failure of firms, it is often management that is at the centre of the problems. Poor corporate governance by a firm often places the company in a negative light with investors and people external to the firm and often increases the perceived risk of the firm (Nooteboom, Berger & Noorderhaven, 1997; Bedard & Johnstone, 2004). Researchers have observed that, when firms having problems, their corporate governance practices have a large impact on the probability of the company defaulting (Fich & Slezak, 2008; Goss, 2009). The observations are further backed up by Altman et al. (2010), who found that more information efficiency exists in the syndicated loan market relative to bond markets, and that this is due to the ability to reflect new information in the probability of default in a shorter time.

3.8 Environmental Performance and Cost of Debt

Analysing previous literature on the effect of environmental practices on cost of debt is crucial, as climate change and other related environmental concerns are continually escalating in pertinence, as the global population continues to grow. Most literature of the literature that follows in this section draws the conclusion that environmental practices have a significant impact on a firm's financing costs.

The degree of environmental consideration that goes into the decision-making process with regard to corporate lending by UK banks was investigated by Thompson and Cowton (2004). The statement was made in that study that banks are not necessarily directly concerned about the environment, but they are incentivised to have an understanding about the implications that their lending has on the environment.

Environmental concerns affect credit risk in various ways: directly, indirectly or on a reputational level (Mengze & Wei, 2015). An example of direct risk for the creditor is when the borrower becomes insolvent and the creditor becomes responsible for cleaning up pollution caused by the borrower. Indirect risk is caused when financial penalties are incurred by the borrower for damage caused to the environment through operations. This will have an impact on the borrowers' cash flows and profitability which could affect the ability to make interest payments. If a creditor finances borrowers who are known to do damage to the environment, it is most likely that this will damage the reputation of the creditor (Coulson & Monks, 1999).

Studies conducted on the management of environmental risk saw the effect of this risk grow over the past years. Environmental risks are seen as an important component of credit risk and they affect credit risk significantly (Weber, Fenchel & Scholz, 2008; Caouette et al., 2011). A subsequent study found that, when regulators reduced the number of securities linked with contamination and costs associated with the management of environmental disasters, this was the main reason for credit losses as a result of environmental issues (Weber, 2012).

Weber, Scholz and Michalik (2010) investigated credit default predictions and found that, when sustainability variables were added to traditional credit risk indicators, the number of credit default predictions being correct increased significantly. It was found that greater environmental risks and weaker management of environmental concerns are linked with worse credit ratings, which result in a higher cost of debt (Sharfman & Fernando, 2008; Bauer & Hann, 2010; Chava, 2014). These results are evidence of the increased significance of ESG factors such as environmental risks and provide valid reasons for the increased necessity for corporate lenders to manage environmental risks (Weber, 2012). The rapid development of environmental credit risk management is documented by Mengze and Wei (2015), who show that conventional risk assessment is increasingly integrating into the process of rating credit, especially in banks when managing their risk.

3.9 Impact of ESG on Credit Risk

It has now been demonstrated that previous literature shows that a relationship does exist between each individual component of ESG and the cost of debt. This section points out how ESG, as one metric, affects the risk associated with a firm, since risk plays a significant role in the pricing of debt.

A major question remains whether ESG practices affect a firm's credit risk positively, by having an effect on its ability to meet its financial obligations. Barth, Hübel and Scholz (2019) explain two ways in which ESG factors can affect the risk of a firm (Goss & Roberts, 2011). The first way is referred to as the risk mitigation method – which states that firm risk can be reduced while producing increased and more consistent cash flows, if ESG levels are high. Scenarios for risk mitigation include the following: customers of sustainable companies could be open to paying higher prices; suppliers of sustainable firms could have more lenient payment periods; and recruiting new employees could possibly be done at a lower cost (Albuquerque, Koskinen & Zhang, 2019). A further benefit is that sustainable firms are often better equipped

in times of disaster, as they are less exposed to risks and better equipped for changes in regulation (Renneboog, Ter Horst & Zhang, 2008). The second way is where limited resources could be used wastefully if investment in ESG is too high, which could lead to reduced cash flows while increasing risk. This could occur as a result of the agency problem, where leaders in the firm benefit from excessive investment in ESG, at the expense of shareholders (El Ghoul, Guedhami & Kim, 2017). Additionally, firms could feel incentivised to use the good publicity associated with ESG to cover up bad corporate governance or inaccuracies in their reporting (Kim et al., 2014).

The results obtained by Merton (1974) imply that, if ESG is the reason for more reliable and increased cash flows, it should lead to improved asset values, which ultimately lead to lower credit spreads and lower default probabilities. The results of firms with strong ESG practices have shown to protect these firms and provide some sort of protection in times of disasters or other negative events. In other words, looking at the case of fixed income, the returns associated with bonds are very sensitive to downside risk. This statement ties in with Jang et al. (2020) in showing the firm's good intentions by incorporating ESG practices into its operations. Although some studies show higher costs involved, this increases the firm's transparency, which improves investors' perceptions of the firm's default risk.

Most research regarding the effect of ESG on credit risk uses debt that is frequently traded, with figures being provided to explain the relationship (Jiraporn et al., 2014). The alternative is explained using estimations of cost of capital or interest rates on loans obtained from banks, which is an example of non-tradable debt (Goss & Roberts 2011; Chava, 2014). Most of the results obtained from previous literature that analyses corporate bonds in the United States found that ESG reduces firm risk, which is explained by lower spreads on bond yields and by higher credit ratings (Oikonomou et al., 2014; Ge & Liu, 2015).

European studies find contrasting evidence when compared to studies conducted in the United States. They find that the relationship between yield spreads on corporate bonds and ESG ratings is not strong, and the same applies to z-spreads (Stellner et al., 2015). The study of Stellner et al. (2015) used corporate bond data to draw conclusions, but some researchers contend that studying credit default swap (CDS) spreads could provide different results, as they are traded more liquidly (Ederington, Guan & Yang, 2015). Additionally, because they trade more frequently, their information is updated more swiftly (Finnerty, Miller & Chen, 2013).

Comparing bond prices is often difficult as bonds are structured in various ways and often contain embedded options or other bond-specific features – whereas the same standard bonds must be compared for consistency purposes. CDSs are naturally more basic to compare as they are standardised, making it easier to compare in terms of credit scores (Norden & Weber, 2009).

Research conducted on CDS spreads have identified that indicators such as firm leverage and credit ratings have significant links to CDS spreads (Galil et al., 2014). It can be said that these studies should be extended by factoring in ESG when calculating CDS spreads. Goss and Roberts (2011) indicate that ESG helps for risk mitigation and improved ESG variables are linked to decreased firm risk. The studies also find that this risk mitigation as a result of ESG is stronger in Europe than the United States. Other studies complement this statement by finding that a firm's financial benefits from ESG are higher in countries with higher ESG and higher transaction costs (Stellner et al., 2015; El Ghoul et al., 2017; Breuer et al., 2018). If, however, capital is overinvested in ESG, it can destroy firm value and waste limited resources, resulting in higher firm risk. This ties in to the argument that poor ESG would be linked to lower credit risk (Goss & Roberts, 2011).

The flip side is that superior ESG performance leads to improved and more stable cash flows, which implies that these firms will have increased asset values, as well as reduced default probabilities, resulting in decreased credit spreads and risk. Apart from the financial impact, factors such as regulations and reputational influences could cause investors to side with firms showing superior ESG performance (Franklin, 2008). The implications for the firms could include lower credit spreads, an increase in the value of their assets, and a lower cost of capital (Chava, 2014).

On summarising findings from Jang et al. (2020), and assuming that the risk management theory holds up, greater ESG scores will lead to lower default risk and reduced downside risk as a whole. The credit quality of the bond is a product of the default risk associated with the bond and is therefore the determining factor in pricing the bond and the associated return. The results of Jang et al. (2020) showed that firms with greater ESG scores benefit from a lower cost of debt financing. The results also showed that ESG makes up for some of the information inefficiencies for bond investors when calculating a firm's risk and this ultimately adds a

premium to the prices of bonds. Smaller firms which rely on external funding should therefore benefit more from the ESG effect because they experience higher information inefficiencies.

Previous literature has shown that each ESG component is related to a firm's cost of debt in different ways and that ESG as a whole is related to a firm's credit risk. The data and method used in this study is explained in the next section, as this research seeks to find its own results on the topic being investigated.

4. Data and Method

4.1 Data

This study used data collected from the Bloomberg data base. The ESG disclosure scores were obtained from Bloomberg and represented the firms included on the S&P 500. The companies had to have an ESG score assigned to them on the Bloomberg data base, otherwise they were assigned the value of N/A. For a company to be included in the study, it had to have outstanding debt. Bloomberg provided the cost of debt figure for the relevant firms on the S&P 500. Control variables and all other financial metrics that were needed were collected from Bloomberg. The time period used in the sample was from 1 January 2016 to 31 December 2020 as this was the most recent data that could be obtained. Therefore, five years of data were used to analyse the relationship between ESG and cost of debt. The data were obtained from Bloomberg on 25 January 2021. The total sample when the data were extracted was 504 companies. From those companies, the sample was adjusted each year according to the ESG and cost of debt figure. A company had to have both a ESG and cost of debt figure to be included in the sample.

Table 1: Total amount of observations included in the sample for each year

	CoD	**ESG (1)**	**Total (1)**	**Environmental (2)**	**Total (2)**	**Social (3)**	**Total (3)**	**Governance (4)**	**Total (4)**
2016	492	491	*486*	424	*423*	490	*485*	491	*486*
2017	501	494	*492*	451	*449*	494	*492*	494	*492*
2018	499	497	*496*	460	*460*	497	*496*	497	*496*
2019	140	501	*140*	476	*130*	501	*140*	501	*140*
2020	135	412	*133*	390	*126*	412	*133*	412	*133*

* Cost of debt is displayed as CoD

Table 1 shows the sample for each year. The number used in the Total column represents a company that has both an ESG and cost of debt percentage assigned to it. Total (1) refers to

the sample for cost of debt and ESG; total (2) refers to the sample for cost of debt and the environmental score; total (3) refers to the sample for cost of debt and the social score; and total (4) refers to cost of debt and the governance score. The sample sizes for 2016, 2017 and 2018 were very similar, but the sample size in 2019 and 2020 were smaller. This was because, in 2019 and 2020, a large number of companies had undisclosed cost of debt values.

4.1.1 Cost of Debt

Tax rates change over time, therefore, a weighted average after tax cost of debt figure was used, as it was more comparable. The figure was calculated by using government bond rates, a debt adjustment factor, the long-term and short-term debt as a proportion of the total debt, and the company's effective tax rate. The debt adjustment factor represented the average yield above the government bond rates for a given rating class. A higher adjustment factor was assigned to a lower rating. However, the only scenario where the debt adjustment factor was applied was when the company was without a fair market curve (FMC). When a company did not have a credit rating, a rate of 1.38 (the equivalent rate of a BBB+ long-term currency Standard and Poor issuer rating) was assumed as this was seen as a standard of average (Bloomberg L.P., 2021).

The exact debt adjustment factor calculation was a Bloomberg proprietary calculation.

The formula used in calculating cost of debt is as follows:

Cost of Debt = [[(SD/TD) * (CS * AF)] + [(LD/TD) * (CL * AF)]] * [1-TR]

Where SD represents short-term debt, TD represents total debt, CS represents the pre-tax cost of short-term debt, AF represents the debt adjustment factor, LD represents long-term debt, CL represents the pre-tax cost of long-term debt, and TR is the effective tax rate. The cost of debt figure is measured as a percentage (Bloomberg L.P., 2021).

4.1.2 Bloomberg ESG Scores

ESG data was collected from Bloomberg. This data was based on disclosure by the companies themselves. The companies' annual reports, sustainability reports, websites, CSR reports, proprietary surveys by Bloomberg, press releases, and third-party research were some of the ways in which Bloomberg collected this data. Bloomberg also claimed that none of the data were estimations, but rather linked to company reports (Clubb, Takahashi & Tiburzio, 2016).

The proprietary Bloomberg score was based on the extent of a company's disclosure of ESG and its components. Companies that were not covered by the ESG group were shown as N/A and had no score. Companies that did not disclose any information were also shown as N/A. The disclosure score ranged from 0.1 for companies that disclosed the minimum amount of ESG data to 100 for companies that disclosed all the data points collected by Bloomberg. Each data point was weighted in terms of relevance with greater weight being carried by data such as greenhouse gas emissions when compared with other data points. The score was also adjusted according to different industry sectors. By doing this, each company was only evaluated in terms of the data that were relevant to its industry sector. This score measured the amount of ESG data that a company reported publicly, and did not measure a company's performance on any of the other data points (Bloomberg L.P., 2021).

For an ESG score to be developed, Bloomberg tracked c.600 metrics to cover all ESG factors – from shareholder rights to emissions. Environmental components included: renewable energy, pollution, climate change impact, carbon emissions, waste disposal, and resource depletion. Social components included: political contributions, human rights, discrimination, diversity, community relations, and supply chain. Governance components included: shareholders' rights, staggered boards, cumulative voting, independent directors, executive compensation, and takeover defence (Bloomberg L.P., 2021). As mentioned earlier, some metrics carried more weight in the calculation of the ESG score.

Bloomberg's quant model incorporated industry and sustainability frameworks, analysis and research, in order to address size bias, normalise data, and address disclosure gaps (Bloomberg L.P., 2021).

4.1.3 Control Variables

Variables were used to control for the relationship that possibly existed between cost of debt and variables other than ESG and its components.

Table 2: Details of the control variables used

Variable	**Data Collected**	**Data Source**	**Papers That Applied Similar Control Variables**
Measures the ability to pay short-term and current long-term obligations	Current ratio	Bloomberg L.P.	Clubb, Takahashi and Tiburzio (2016)

Provides an approximate timeframe to pay off all debt	Debt to EBITDA	Bloomberg L.P.	Clubb, Takahashi and Tiburzio (2016)
A measure of size of the company	Logarithm of enterprise value	Bloomberg L.P.	Eliwa, Aboud and Saleh (2019); Johnson (2020); Erragragui (2018); Barth, Hübel and Scholz (2019)
A measure of the company's capital structure	Financial leverage	Bloomberg L.P.	Eliwa, Aboud and Saleh (2019); Johnson (2020); Erragragui (2018); Barth, Hübel and Scholz (2019)
Ability to cover the interest portion of the debt obligations	Interest coverage ratio	Bloomberg L.P.	Eliwa, Aboud and Saleh (2019); Erragragui (2018)
A measure of the profitability of the company	Return on assets (ROA)	Bloomberg L.P.	Eliwa, Aboud and Saleh (2019); Erragragui (2018); Barth, Hübel and Scholz (2019)
A measure of growth by the company	Sequential growth in total assets	Bloomberg L.P.	Erragragui (2018)

EBITDA is Earnings before interest, tax, depreciation, and amortisation

The ability of a company to pay short-term and long-term obligations is measured by the current ratio, which is classified as a liquidity ratio. It is calculated by dividing the current assets by the current liabilities. A very high current ratio relative to the industry average indicates the inefficient use of available current assets. However, this ratio is considered acceptable if it is in line with the industry average or slightly higher. A low ratio could indicate a company in distress. This variable is used as it is a good indicator of whether a firm can meet its short-term debt obligations. This is important in the calculation of cost of debt, as a low ratio could lead to a higher pricing of debt, as the firm is already struggling to cover existing short-term debt obligations and could struggle further if more debt is acquired (Bloomberg L.P., 2021).

The debt to EBITDA (earnings before interest, tax, depreciation and amortisation) ratio is a way to determine the company's ability to pay off the debt it has incurred. The ratio provides the investor with an approximate timeframe needed to pay off all the outstanding debt.
This is an important variable as it is used by credit agencies in determining default probabilities. This could be used to price the cost of debt, as the firms with a higher ratio generally have

higher default probabilities and therefore will have to pay a higher cost of debt (Bloomberg L.P., 2021).

Enterprise value is calculated by taking the sum of a company's market capitalisation, its preferred equity, and the short- and long-term interest-bearing debt, minus the cash and equivalents of the company. This is used as the value of the firm in the event of a takeover. As an alternative to the P/E ratio, enterprise value is often used alongside EBITDA. A size variable is important to use in this analysis, as larger companies generally have more capacity for debt relative to smaller companies. The logarithm is used owing to the size of the number relative to other variables (Bloomberg L.P., 2021).

The financial leverage ratio is used to measure the average assets to average equity. This is calculated by taking the average total assets and dividing it by the average total common equity. The ratio looks at the ability of a company to meet its financial obligations. This ratio is important because most companies use a combination of debt and equity to finance their operations. This ratio is considered when pricing cost of debt as it shows a firm's levels of debt funding used in assets relative to equity funding. Higher debt funding could lead to a higher price for debt, as the firm will become more leveraged (Bloomberg L.P., 2021).

The interest coverage ratio is calculated as a company's operating income before tax or its cash flow, divided by the company's interest obligations for the period in calculation. It shows a company's ability to cover the interest portion of its debt obligations. This is an indicator which shows whether a firm can afford to absorb more debt, because it shows whether the firm will be able to cover additional interest payments related to additional debt being acquired (Bloomberg L.P., 2021).

Return on assets is an indication of the profitability of a company, relative to the total assets of the company. It is calculated by dividing the net income by the total assets. This shows whether the firm is using available capital efficiently. If the firm is inefficient and cannot use additional debt to generate more earnings, it could struggle to meet interest payments that fall due (Bloomberg L.P., 2021).

Sequential growth in total assets measures the current total assets of a company compared to the total assets of the period immediately preceding the current period. This is useful as it shows

by how much the total assets of a company, which are funded mostly through debt or equity, grow from one period to the next. This is a valuable variable in conjunction with others, as it shows the growth in assets and can then be compared with how the additional assets were funded, to determine the change in capital structure (Bloomberg L.P., 2021).

4.2 Method

The year 2020 was considered an outlier year owing to the COVID-19 pandemic, therefore each year, from 2016 to 2020, was analysed in isolation before an analysis was done for the entire sample period. Cost of debt was considered as the dependent variable (Y), as this study was investigating whether ESG scores, considered the independent variable (X), had an effect on cost of debt (Y).

The first step in the analysis was to set up a graph of the core variables, which were cost of debt, and ESG and its components. This was done to see how these variables had changed or moved over the five-year period, and whether they were increasing or decreasing. The graphs were also used to identify clear outliers.

The next step in the analysis was to look at the descriptive statistics of the data. The first thing that was looked for in the descriptive statistics was how close or far apart the median of the variable was from the mean. If the mean and median were close, it would have been an indication that the data were normally distributed. The standard deviation was looked at to see how dispersed the set of data was in relation to the mean. The main reason for looking at descriptive statistics was to get to know the data.

A co-variance analysis was then used where the 1:1 correlation groups of the variables were looked at, focusing on the core variables and their relationship with cost of debt. The relationship of the control variables with cost of debt was then analysed to see whether the movement was what would be expected from the variable. The main purpose of the correlation group was to understand in which direction the variables moved relative to cost of debt and what the size of the movement was. This provided an initial observation of the relationship of each variable relative to cost of debt.

In the next part of the analysis, pairwise granger causality tests were conducted. Firstly, this was done to find out whether any of the core variables caused a change in cost of debt.

Secondly, observations were made to understand whether any of the control variables caused a change in cost of debt. This was because correlation does not mean causation and the changes might be caused by variables other than the core variables, which are also correlated with the core variables. Therefore, it could seem as if the core variables were the reason for changes in cost of debt while it was, in fact, other variables causing the changes.

A test that needed to be done before the regressions were done was the cointegration test. This test was required to ensure that the residuals were stationary, before running a regression on the variables. Finally, before the regression results were analysed, the residuals were plotted on a graph to examine whether there were any unwanted patterns. Plotting the residuals helped to establish whether the regression model was valid and whether the coefficients could be trusted.

The final step in the analysis was to determine the relationship between ESG variables and cost of debt. This was done by running a multiple regression on the variables. Cost of debt was the dependant (Y) variable in every regression, the core variables (ESG, environmental, social and governance) were the independent (X) variables for each regression and then lastly, the control variables were also added.

The formulas used for running the regressions were as follows:

$$1.\ CoD_{it} = \beta_0 + \beta_1 ESG_{it} + \gamma_2 Current\ Ratio_{it} + \gamma_3 Debt\ to\ EBITDA_{it} + \gamma_4 Enterprise\ Value_{it} + \gamma_5 Financial\ Leverage_{it} + \gamma_6 Interest\ Coverage_{it} + \gamma_7 ROA_{it} + \gamma_8 Sequential\ Growth\ in\ Total\ Assets_{it} + (\mu_i + \mu_{2t})$$

$$2.\ CoD_{it} = \beta_0 + \beta_1 Environmental_{it} + \gamma_2 Current\ Ratio_{it} + \gamma_3 Debt\ to\ EBITDA_{it} + \gamma_4 Enterprise\ Value_{it} + \gamma_5 Financial\ Leverage_{it} + \gamma_6 Interest\ Coverage_{it} + \gamma_7 ROA_{it} + \gamma_8 Sequential\ Growth\ in\ Total\ Assets_{it} + (\mu_i + \mu_{2t})$$

$$3.\ CoD_{it} = \beta_0 + \beta_1 Social_{it} + \gamma_2 Current\ Ratio_{it} + \gamma_3 Debt\ to\ EBITDA_{it} + \gamma_4 Enterprise\ Value_{it} + \gamma_5 Financial\ Leverage_{it} + \gamma_6 Interest\ Coverage_{it} + \gamma_7 ROA_{it} + \gamma_8 Sequential\ Growth\ in\ Total\ Assets_{it} + (\mu_i + \mu_{2t})$$

$$4.\ CoD_{it} = \beta_0 + \beta_1 Governance_{it} + \gamma_2 Current\ Ratio_{it} + \gamma_3 Debt\ to\ EBITDA_{it} + \gamma_4 Enterprise\ Value_{it} + \gamma_5 Financial\ Leverage_{it} + \gamma_6 Interest\ Coverage_{it} + \gamma_7 ROA_{it} + \gamma_8 Sequential\ Growth\ in\ Total\ Assets_{it} + (\mu_i + \mu_{2t})$$

CoD is the outcome variable, β_0 is the constant divided by the intercept, β_1 is the coefficient of the variable (ESG and its components) to measure the causal effect on cost of debt, γ_x is the control variables, μ is the constant, i is the notation used for firm, and t is the notation used for time.

After completion of the analysis, it was studied and presented in the following results section.

5. Results

Core Variables Discussion

The core variables were set out in a graph in order to demonstrate how they had changed in recent times. These core variables included cost of debt, ESG disclosure score, environmental disclosure score, social disclosure score, and governance disclosure score.

On looking at cost of debt (Figure A1), it is clear that the mean fell sharply in 2020, along with a narrowing of the standard deviation, which is the most noticeable trend. This is mostly the result of the COVID-19 pandemic, which led to the lowering of interest rates. When the year 2020 (Figure A2) was removed from the sample, the mean cost of debt still seemed to decrease since 2017; however, the standard deviation was larger and the decrease was not as significant.

The trend of the ESG disclosure score (Figure A3) was upwards over recent years, but in 2020 it flattened out somewhat, even decreasing slightly. Therefore 2020 seemed to be an outlier. After removing 2020 (Figure A4) from the sample, it became clear that ESG disclosure scores had been increasing since 2016. The standard deviations remained similar over both periods.

Environmental disclosure scores (Figure A5) look similar to the ESG disclosure scores. Environmental scores had been trending upwards but levelled out during 2020; however, when 2020 was removed (Figure A6), the graph showed an upward trend. The standard deviations remained stable over the period.

The social disclosure scores (Figure A7) increased most consistently over the past few years, while in 2020 the scores decreased slightly. The standard deviations also narrowed in 2020 relative to the previous years. When 2020 was removed (Figure A8) from the sample, the increase in social scores was almost a straight line, which showed how consistent the increases had been.

Governance disclosure scores (Figure A9) have been trending upwards over the past couple of years, with 2020 flattening out slightly. However, when 2020 was removed (Figure A10), the upward trend was much clearer. Standard deviations were relatively stable over both periods.

The year 2020 seemed to be an outlier year for each of the core variables and therefore this was taken into consideration throughout the analysis. It was noticeable from the graphs of the core variables that cost of debt had been trending downwards in recent years, while ESG, environmental, social, and governance scores had all been trending upwards. This implied an inverse relationship between the variables, but it yet needed to be seen how significant this relationship was or whether there were other variables present that were affecting this relationship.

Descriptive Statistics

Looking at the group descriptive statistics in Table 3 the aim is to get to know the data.

Table 3: Descriptive Statistics of the Variables Included in the Cost of Debt and ESG Analysis, 2016–2020

2016-2020	Cost of debt	ESG	Environ-mental	Social	Govern-ance	Current ratio	Debt EBITDA	Enterprise value	Financial leverage	Interest cover	Return on assets	Sequential growth
Mean	2.210	40.323	32.431	36.378	62.412	1.739	5.213	66881.09	4.945	20.270	7.376	11.206
Median	2.157	41.627	34.108	36.842	60.714	1.413	2.368	30459.67	2.701	8.379	6.544	5.449
Maximum	4.741	75.104	78.512	77.193	83.929	16.380	2607.804	2186417	488.924	4323.021	42.829	440.194
Minimum	0.265	12.810	1.550	3.509	46.429	0.169	0.003	508.544	1.207	-40.791	-27.302	-72.879
Std. Dev.	0.781	13.352	17.898	13.617	7.943	1.391	75.385	128546.5	17.170	128.935	6.561	31.951
Skewness	0.251	-0.120	-0.036	0.067	0.312	4.415	34.449	7.658	20.822	31.199	0.691	6.489
Kurtosis	3.198	2.060	2.076	2.287	2.173	34.391	1189.788	94.664	544.602	1038.880	6.555	64.414
Jarque-Bera	14.572	46.906	42.801	26.198	53.505	52991.67	70425101	430405.2	14704190	53667571	724.768	196346.0
Probability	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

If the mean and median have values that are similar, this generally means that the data are normally distributed. All the core variables (cost of debt, ESG and its components) seemed to to be normally distributed. The current ratio is also relatively in line with the terms of the statement above. All the other control variables had mean and median values that were quite far apart and they all had high standard deviations relative to their mean and median values. Additional descriptive statistics were analysed which excluded the data from 2020 (see Appendix B, Table B1). This was done to see whether the output remained similar. The results did not change significantly and the same observations of the mean/median relationship relative to the leverage and size variables remained.

The data were transformed slightly when running some of the regressions in order to solve some issues that were identified. Enterprise value was a significantly larger number than the other variables and therefore the logarithm of enterprise value was used. Any other control variables which seemed to have outliers were windsorised at 2.5%. This ensured that 97.5% of the data was included in the sample, excluding the outliers. This technique was applied to ensure that the results were robust.

Table 4: Correlations Explaining the Univariate Relationship between the Variables, 2016-2020

Correlation												
Probability	**Cost of debt**	**ESG**	**Environ-mental**	**Social**	**Govern-ance**	**Current ratio**	**Debt EBITDA**	**Enterprise value**	**Financial leverage**	**Interest cover**	**Return on assets**	**Sequential growth**
Cost of debt	1.000000											

ESG	-0.045334	1.000000										
	0.1171	-----										
Environmental	-0.049180	0.971978	1.000000									
	0.0891	0.0000	-----									
Social	-0.031981	0.824833	0.693897	1.000000								
	0.2691	0.0000	0.0000	-----								
Governance	-0.036695	0.785000	0.690475	0.648886	1.000000							
	0.2048	0.0000	0.0000	0.0000	-----							
Current ratio	0.014863	-0.122411	-0.095900	-0.122155	-0.184760	1.000000						
	0.6076	0.0000	0.0009	0.0000	0.0000	-----						
Debt EBITDA	0.077394	-0.045461	-0.045736	-0.032668	-0.035227	-0.021942	1.000000					
	0.0074	0.1161	0.1139	0.2589	0.2235	0.4484	-----					
Enterprise value	-0.175102	0.197343	0.234294	0.064515	0.128235	0.001146	-0.004917	1.000000				
	0.0000	0.0000	0.0000	0.0257	0.0000	0.9684	0.8651	-----				
Financial leverage	0.036079	0.010930	-0.000478	0.032688	0.028893	-0.054240	0.004272	-0.004327	1.000000			
	0.2125	0.7057	0.9868	0.2587	0.3181	0.0608	0.8827	0.8812	-----			
Interest cover	-0.042283	-0.057589	-0.046115	-0.072628	-0.054624	0.096299	-0.009141	0.027433	-0.017619	1.000000		
	0.1439	0.0465	0.1109	0.0120	0.0590	0.0009	0.7522	0.3432	0.5427	-----		
Return on assets	-0.026759	0.037954	0.053373	-0.005729	0.007414	0.188337	-0.084604	0.129922	-0.018728	0.144005	1.000000	
	0.3552	0.1896	0.0650	0.8431	0.7978	0.0000	0.0034	0.0000	0.5176	0.0000	-----	
Sequential growth	0.002671	-0.104706	-0.090069	-0.114380	-0.090222	0.029711	0.017391	-0.004682	-0.004879	0.011115	0.014858	1.000000
	0.9265	0.0003	0.0018	0.0001	0.0018	0.3046	0.5479	0.8715	0.8662	0.7010	0.6077	-----

In Table 4 the 1:1 univariate relationship with regard to the correlation group is depicted. This is done to see whether the core variables move in the expected direction. The data include observations for the period 2016–2020.

ESG, and its components, are negatively correlated to cost of debt – which is the relationship that this study was expecting. However, the correlations are not significant at the 0.05 level. This could mean that the actual coefficient is nil. Even though the correlations are not statistically significant, a relationship is apparent from Table 4 and is discussed. The ESG disclosure score shows a 0.045 move in the opposite direction to cost of debt and this could have an impact on cost of debt if this correlation holds. Additionally, the environmental disclosure score shows a 0.049 negative correlation to cost of debt. This relationship could lead to a consideration for the environmental score when pricing cost of debt. The social and governance disclosure scores show a 0.032 and 0.037 negative correlation to cost of debt, respectively, and are the furthest from being statistically significant. First observations are that the environmental disclosure score has the largest impact on cost of debt and is the nearest to being a statistically significant relationship.

The discussion surrounding the control variables indicates whether the variables move in the expected direction relative to cost of debt. The current ratio is positively correlated to cost of debt. This relationship was expected to be negative, as a company with a better current ratio has more current assets to pay back the current liabilities, which generally makes the company less risky. Debt to EBITDA was positively correlated to cost of debt, which was expected. This relationship is significant at the 0.05 level. Enterprise value was negatively correlated to cost of debt, which makes sense, as larger companies generally have a stronger ability to take on debt. This relationship is also significant at the 0.05 level. Financial leverage was positively correlated to cost of debt, which was expected because it is also a debt ratio. Therefore, as a company increases its debt, the cost of additional debt also increases. Interest cover was negatively correlated to cost of debt which seemed correct as a higher ratio shows a better ability to cover interest expense. This, in turn, shows that the company has capacity to take on more debt. Return on assets was negatively correlated to cost of debt, which shows that an improved performance by the firm results in a lower cost of debt. Sequential growth of total assets showed a positive correlation to cost of debt; however, the correlation was very small and thus insignificant. Out of all the variables, enterprise value had by far the strongest

relationship with cost of debt and this was followed by debt to EBITDA. This showed that cost of debt was mostly correlated to changes in enterprise value and debt to EBITDA.

Removing the 2020 data from the sample being analysed (see Appendix B, Table B2) gave similar results. All the core variables were still negatively correlated to cost of debt; however, the correlations were mostly smaller and the p-values were even larger than before. The control variables retained their signs of being positively or negatively correlated to cost of debt, while the size of the correlations was mixed. Removing the 2020 data therefore contributed to the research by showing rigour to account for the impact of the pandemic, when interpreting the 1:1 correlation.

A scrutiny of the 1:1 relationships of the correlations with the ESG variable revealed that all the remaining core variables, being environmental, social and governance, had strong positive relationships with the ESG variable. This relationship was also significant at the 0.05 level. This was expected as all these individual variables made up the ESG variable. The current ratio had a relatively strong negative correlation which the ESG variable and was statistically significant. Debt to EBITDA was negatively correlated to the ESG variable, which showed that higher ESG results in lower debt to earnings. Enterprise value was positively correlated to ESG and showed by far the strongest relationship with ESG. This indicates that larger companies generally have superior ESG scores. This relationship was also statistically significant. Financial leverage was positively correlated to ESG score, which showed that companies with higher ESG scores are generally more leveraged. Interest cover was negatively correlated to ESG, which means that companies with superior ESG scores generally have a weaker ability to cover their interest payments. This relationship was also statistically significant at the 0.05 level. Return on assets were positively correlated to ESG, which showed that companies with higher ESG scores found that their return on assets increased alongside their ESG scores. Sequential growth of total assets were negatively correlated with a firm's ESG score. This means that when companies grow their total assets relative to the previous year, their ESG score is lower compared to the previous year.

When removing the year 2020 from the sample and only looking at the data from 2016 to 2019, it was found that the core variables, environmental, social and governance relationship with ESG remained very similar – all having positive correlations. All the control variables also

remained very similar after removing the year 2020. Therefore it appeared that 2020 did not make much of a difference to the data for ESG correlations.

ESG and its components were viewed together and a comparison was done to compare how the correlations with other variables contributed to that of ESG. All ESG aspects and their components were strongly and positively correlated with each other, and were also statistically significant.

The current ratio was negatively correlated with environmental, social and governance scores just as they were to the ESG score, while being statistically significant in all cases. The current ratio had the strongest negative relationship with governance, followed by social, and the weakest negative relationship was with the environmental score. Debt to EBITDA was negatively correlated to environmental, social and governance, which was expected, as this was the case with ESG too. The environmental aspect had the strongest negative correlation, followed by governance and then social. However, debt to EBITDA did not have a strong correlation with any of the factors. Enterprise value had by far the strongest correlation with the core variables compared to any of the control variables. The environmental score had the strongest positive correlation, almost double that of governance and the weakest positive correlation was with the social score. This indicates that the size of a firm affects the environmental score more than all the variables. Enterprise value had statistically significant correlations with all the variables. Financial leverage had a negative correlation with the environmental score, but the relationship was very insignificant. Social and governance both had positive correlations with financial leverage, but these relationships were not very strong. Interest cover was negatively correlated with environmental, social and governance. However, interest cover only had a statistically significant relationship with the social disclosure score. Return on assets was positively correlated with both environmental and governance, just as it was with ESG, but it was negatively correlated with the social score. However, return on assets had only a relatively strong relationship with the environmental score. Sequential growth of total assets was negatively correlated with environmental, social and governance showing the most significant relationship with the social score. This showed that a change in the social score would have the largest effect on the sequential growth of total assets.

Removing the year 2020 from the sample, once again, did not change much with regard to the correlations of the variables mentioned above.

By solely considering the 1:1 correlation table, it was clear that ESG, being environment, social and governance, did not have a significant relationship with cost of debt; however, a slight relationship existed. The enterprise value was by far the most significant control variable with its correlation to all the core variables. The final major observation with regard to the correlations was that not much changed when the year 2020 was removed from the sample being analysed.

Granger Causality

Correlation does not necessarily mean causation. Therefore, pairwise granger causality tests were used to find out whether the cost of debt figure was granger caused by any of the core variables.

After running the tests, the null hypothesis that ESG did not granger cause cost of debt could not be rejected. Further tests to view other core variables returned results showing that the null hypothesis that environmental, social or governance did not granger cause cost of debt could not be rejected either. This meant that changes in ESG, being environmental, social or governance, did not cause a change in cost of debt.

From the control variables, the null hypothesis could be rejected for five variables. The hypothesis could be rejected that debt to EBITDA, enterprise value, financial leverage, return on assets, and sequential growth of total assets did not granger cause cost of debt. This meant that these variables did cause changes to cost of debt.

When the year 2020 was removed from the sample, there was one change to the core variables. The null hypothesis that the social disclosure score did not granger cause cost of debt can be rejected. This showed that when the sample data include the years 2016–2019, the social disclosure score does cause changes to cost of debt. However, there were changes to the control variables as well. The null hypothesis could only be rejected for two variables after this change. The hypothesis that enterprise value and sequential growth of total assets does not granger cause cost of debt can be rejected.

Cointegration Test

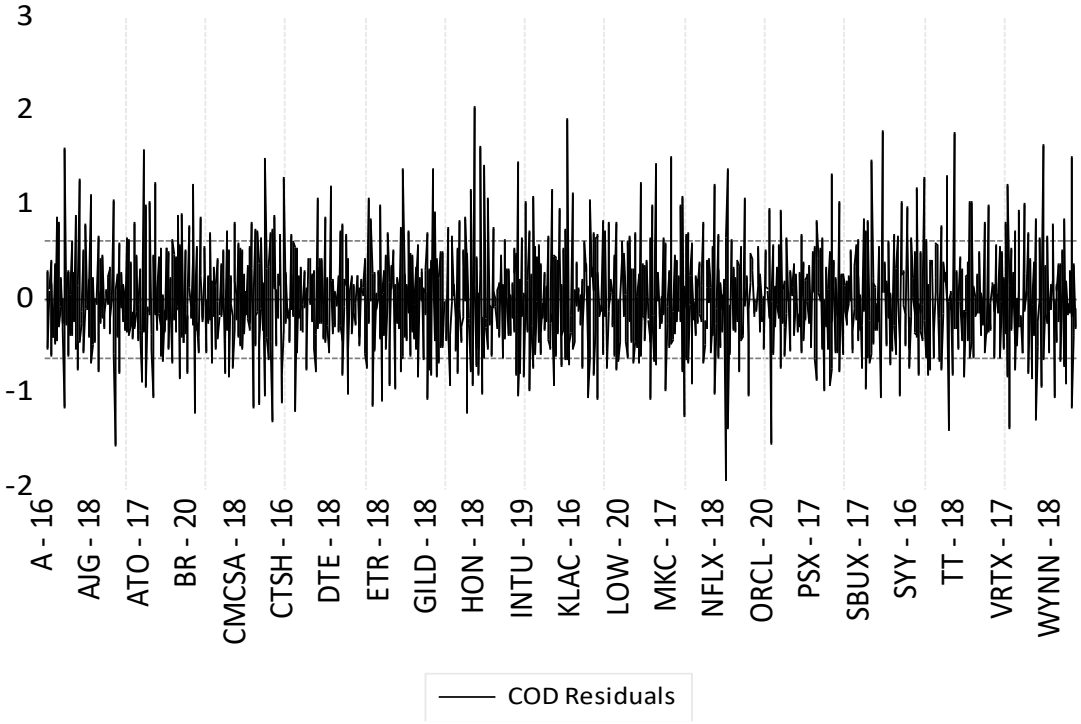
The cointegration test was done to find out whether the residuals of the variables were stationary or not (see Appendix B, Table B3). The null hypothesis of the test was no

cointegration, which means that the residuals are non-stationary. After running the tests for stationarity, the results showed that the null hypothesis of no cointegration can be rejected, which means that the residuals are stationary.

Residuals

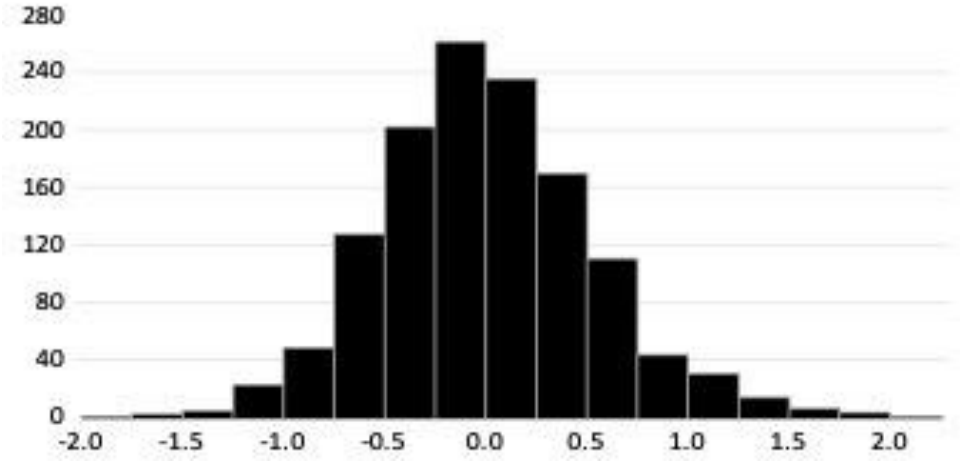
The residuals of the regressions had to be consistent with random errors. This was the reason for looking at the residual plots in Figure 1. The aim was to determine whether the consistent random errors of the residuals remained true. When observing a series of errors, there should be no patterns in the residual plots, otherwise it means that one error can be used to predict another error.

Figure 1: Residuals Obtained by Regressing Cost of Debt on ESG



The data sample used in this study included observations for the period 2016–2020. When viewing the residual plots of the regressions that were run, there was no pattern in the errors and the errors looked random. A good model must show a bounce around the line that is similar in size. Looking at the line that runs through zero, the bounce around this line varied slightly, but there were only a few extreme bounces, with most of the bounces remaining similar in size. When the residuals were obtained by regressing cost of debt on the components of ESG (see Appendix A, Figures A14 – A16), the series of errors remained random and there were few extreme bounces around the line.

Figure 2: Residuals Obtained by Regressing Cost of Debt on ESG



When the residuals were depicted as a histogram in Figure 2, it was observed that the residuals followed a normal distribution. When the residuals of the components of ESG were depicted in a histogram (see Appendix A, Figures A11 – A13), the results showed that the residuals followed a normal distribution.

Regression Analysis

The final and most important test for the relationship between the core variables was to run a regression on the variables. In total 56 regressions were done for this analysis. The first group of regressions were for each individual year. Therefore, a regression was run for 2016, 2017, 2018, 2019 and 2020. This was done to observe and analyse the relationship between the core variables and cost of debt for each individual year. This provided the benefit of depicting the supposed outlier year, 2020, in isolation, without influencing the other years. These results are summarised in Table 5. The second group of regressions was a panel regression from 2016 to 2020, which is the focus of this analysis and is the main discussion point. Additional regressions were run, using winsorisation to remove the top 2.5% and bottom 2.5% of the data, thus eliminating outliers where present. This method was used to check the robustness of the results in resisting the influence of outliers.

Table 5: Single Year Core Variable Regressions

	ESG		**Environmental**		**Social**		**Governance**	
	Coefficient	**Prob.**	**Coefficient**	**Prob.**	**Coefficient**	**Prob.**	**Coefficient**	**Prob.**
2016	0.00077	0.7556	0.003058	0.1293	0.000339	0.8865	0.00568	0.2186
2017	-0.007256	0.0121	-0.004299	0.063	-0.004124	0.1509	-0.008903	0.0801
2018	-0.000998	0.7112	0.000185	0.9338	-0.002542	0.3287	0.002547	0.5831

2019	0.005173	0.2224	-0.000563	0.8588	0.008061	0.0483	-0.00033	0.9631
2020	0.00377	0.3502	0.002358	0.4456	0.000972	0.8137	0.000962	0.8864

Prob. refers to probability

The summary of the regression results enabled the analysis of the relationship between the ESG variables and cost of debt.

The ESG disclosure score revealed that only 2017 had a statistically significant relationship. Attention was however more sharply focused on the coefficients than on the p-values. Only two of the five years showed the expected negative relationship with cost of debt. In the two years, 2017 and 2018, only 2017 had a somewhat material effect on cost of debt.

When analysing the environmental disclosure score, it was again only 2017 which had a somewhat significant relationship. It was 2017 that had the highest coefficient, which could have a slight material effect on cost of debt, but it was very low. The relationship was negative, as was to be expected; however, three of the five years had a positive coefficient, which was not expected.

The social disclosure score showed one year with a statistically significant relationship, which was 2019. The coefficient in 2019 was relatively high compared to ESG and environmental scores; however, the coefficient was positive, which was not expected. Once again, three of the five years had positive coefficients.

With the governance disclosure score, 2017 had a somewhat significant relationship, with the highest negative coefficient. Therefore, it seems that the governance score had the most material effect on cost of debt. Three of the five years had a positive coefficient, like all the other core variables.

When looking at all the core variable regressions for one year, it can be said that ESG and its components did not seem to affect cost of debt in a material way. Additionally, in most years, there was a positive coefficient where it was previously thought that negative relationships would exist. A disclaimer is that most of the statistically significant coefficients were negative. Relationships are further analysed in the next group of regressions.

Table 6: Regression Results of Cost of Debt and ESG Models for the Period 2016–2020

	Model 1 (ESG)		Model 1 (Environmental)		Model 1 (Social)		Model 1 (Governance)	
Regressor	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**	**Coefficient**	**Std. Error**
C	0.487736	1.081788	0.008623	1.147723	0.665346	1.062272	-0.268004	1.1399
ESG	0.001101	0.005518	NA	NA	NA	NA	NA	NA
Environmental	NA	NA	0.00175	0.00435	NA	NA	NA	NA
Social	NA	NA	NA	NA	-0.0044	0.003891	NA	NA
Governance	NA	NA	NA	NA	NA	NA	0.012514	0.006751*
Current ratio	0.087475	0.032570***	0.075915	0.034891**	0.088895	0.032474***	0.085381	0.032445***
Debt EBITDA	0.000425	0.000296	0.000465	0.000345	0.000431	0.000296	0.000427	0.000296
Log(Enterprise value)	0.129916	0.101578	0.173877	0.108297	0.131106	0.101542	0.132673	0.101374
Financial leverage	0.001808	0.001504	0.001768	0.001522	0.001734	0.001504	0.002014	0.001505
Interest cover	-0.00019	0.000182	-0.00018	0.000187	-0.00019	0.000182	-0.000185	0.000182
ROA	0.025487	0.004834***	0.026494	0.005067***	0.025938	0.004834***	0.02543	0.004817***
Sequential growth	9.59E-05	0.000473	-0.00046	0.000688	8.88E-05	0.000476	0.000108	0.000471
Fixed effects	Yes (cross-sectional and period)		Yes (cross-sectional and period)		Yes (cross-sectional and period)		Yes (cross-sectional and period)	
R-sq	0.548309		0.541097		0.54893		0.549997	
adj. R-sq	0.357651		0.342458		0.358323		0.360052	

** statistical significance <10%; ** statistical significance <5%; *** statistical significance <1%*

ESG

It can clearly be seen that ESG did not have a statistically significant relationship with cost of debt. Additionally, it is observed that the coefficient of ESG was very low and it was positive. For every 1% of change in cost of debt, ESG showed a positive 0.001 shift. The regression results in Table 6 show that the control variables had a larger impact on cost of debt than ESG.

The only two variables that showed a statistically significant relationship with cost of debt were the current ratio and ROA. The coefficient of the current ratio was relatively high and was positive, which is what was observed in the correlation in Table 4. The coefficient of ROA was slightly lower, meaning that its effect on cost of debt was not as large. The coefficient of ROA had however changed from negative in the correlation table to positive when running the regression. The logarithm of enterprise value was the variable with the largest coefficient, which shows that this had the largest impact on cost of debt for this regression.

On viewing the regression of ESG and control variables on cost of debt, it can clearly be seen that the control variables affected cost of debt more so than ESG did. The data were possibly affected by some outliers, because when winsorisation was applied to remove the top and bottom 2.5%, the coefficient of the ESG variable became negative. It can be seen that the regressions, ESG and cost of debt were not materially related.

Environmental

First observations revealed that the environmental disclosure score had a positive coefficient and that the relationship with cost of debt was not statistically significant. The coefficient was negative previously in the correlation table and now showed to be positive when running the regression. The coefficient showed that for every 1% change in cost of debt, the environmental score made a positive 0.002 shift. The current ratio and ROA were two notable variables that showed a statistically significant relationship with cost of debt, which clearly had a larger impact than the environmental score did. Both variables had positive coefficients with the current ratio having the higher of the two. The logarithm of enterprise value did however seem to have the largest impact on cost of debt, as the coefficient was significantly higher than all the other variables. The only two variables with negative coefficients were interest cover and sequential growth, but the impact thereof was minimum.

From this regression, it became clear that the control variables had a more significant impact on cost of debt than the environmental score did. When winsorisation was applied to remove the top 2.5% and bottom 2.5% of outliers, no significant changes were observed with the environmental score. However, some changes were seen regarding the control variables. This regression showed that the environmental score did not have a significant effect on cost of debt, but rather the control variables were related to cost of debt.

Social

The first observation made when looking at the regression was that the social disclosure score had a negative coefficient. This means that when cost of debt changes by 1%, the social disclosure score shifts by 0.004 in the opposite direction. Although this relationship was not statistically significant, the size of this shift was larger than the previous variables. Identical to the previous two regressions, only the current ratio and ROA had statistically significant relationships with cost of debt. The current ratio had a far larger positive coefficient than ROA, which means that it had a larger impact on cost of debt. The logarithm of enterprise value variable had the most material effect on cost of debt, as its coefficient was significantly larger than the other variables. Other than the social score, the only variable that moved in the opposite direction to cost of debt was the interest cover variable, but the effect thereof was minimal.

This regression showed the relationship that was expected between the social score and cost of debt, on viewing the correlation table. However, the impact that the control variables had were far more significant than the impact of the social score. After using winsorisation to remove the bottom 2.5% and top 2.5% of the data, the coefficient of the social disclosure score became slightly larger, while remaining negative. More changes were observed, with the control variables clearly showing that, by altering the data slightly, the results did change. This regression showed that the social score was slightly related to cost of debt, but that control variables had a larger impact on cost of debt.

Governance

On looking at the regression, it is seen that the governance disclosure score had the highest coefficient of all the core variables and had some statistical significance. The coefficient was however positive, which was different to what was observed earlier in the correlation table. This means that, for every 1% change in cost of debt, the governance score shifted with a coefficient of 0.013, which could have a significant impact on cost of debt. The current ratio and ROA were once again showing the most statistically significant relationship with cost of debt, with the current ratio having the larger coefficient of the two. The logarithm of enterprise value had the largest coefficient, which showed that it had the greatest effect on cost. The only negative coefficient in this instance was the interest cover coefficient; however, the coefficient was small and had no material impact on cost of debt.

After applying winsorisation to the data to remove the top and bottom 2.5% of the data, the statistical significance of the governance disclosure score worsened and the coefficient became smaller. Changes to the control variables also occurred, therefore it seems as though altering the data did change the results slightly.

Summary

After observing the regressions conducted, it can be said that ESG and cost of debt are not related in a material way. The only core variable that showed a slightly material relationship with cost of debt was the governance disclosure score. Neither ESG, environmental nor social disclosure scores showed a material relationship with cost of debt. After applying winsorisation, these core variables remained immaterial in relation to cost of debt. Therefore, it can be said that ESG and its components did not have a material impact on cost of debt. There are however a few methods that could be applied differently in future research.

The control variables that showed a statistically significant relationship with cost of debt remained consistent throughout all four regressions. The current ratio and ROA had a statistically significant relationship with cost of debt for all the core variables. The logarithm of enterprise value had the largest coefficient throughout. The significance of the control variables did however change when winsorisation was applied to the data. This is an indication that the data were not necessarily robust, which could be due to outliers, among others.

All in all, cost of debt was affected most by the size of a firm (logarithm of enterprise value), its short-term liquidity (current ratio) and the firm's performance (ROA). Of all the core variables which are all measured as a percentage, the governance score showed the largest impact on cost of debt.

Relation to Existing Literature

The results of this study tie in with only a small portion of existing literature previously mentioned in this research. The main findings were that ESG variables do not have a significant effect on the cost of debt of companies. These results agree with D'Antonio et al. (1997), who found that CSR does not relate to yield differences, while adjusting for risk. It was shown that no strong relationship exists between yield spreads on corporate bonds and ESG ratings, with Stellner et al. (2015) showing that the same applies for z-spreads.

A large portion of the previous literature shows a negative correlation between ESG ratings and interest rates. Chava (2014) found mostly lower interest rates for companies with little to no environmental risks. Findings by Oikonomou et al. (2014) showed higher CSR performance related to higher credit ratings and a lower cost of debt. Another study obtained results showing the gain of financial benefits as a result of improved ESG activities. A lower cost of debt when issuing bonds was one of these benefits (Jang et al., 2020). Isa (2019) found similar benefits when companies reported their ESG risks. Evidence was provided by Sun and Cui (2014), showing that firms which practise superior ESG with effective risk management experience a lower associated cost of debt. It was found that high-quality corporate governance practices with high-quality disclosure are associated with lower interest rates when pricing bonds (Sengupta, 1998; Bhoiraj & Sengupta, 2003; Anderson et al., 2004). Another study found benefits when investing in bonds, if a firm has superior corporate governance practices (Bhoiraj & Sengupta, 2003; Klock et al., 2005; Chava et al., 2009). A study conducted in Australia by Aldamen and Duncan (2012) showed that better corporate governance led to a lower cost of debt.

A portion of the literature makes a link between improved ESG and lower risk. Weber (2012) found results showing that ESG factors do affect total credit risk. Goss and Roberts (2011) found that ESG helps for risk mitigation and is linked to a decrease in a firm's risk. When issuing bonds, Attig et al. (2013) found that a company with superior CSR performance has a better credit rating. Most of the results from existing literature that analyse corporate bonds in the United States found that ESG reduces firm risk (Oikonomou et al., 2014; Ge & Liu, 2015). This was explained by bond yields having a lower spread and by higher credit ratings. The results in this study are therefore mostly contradictory when compared to the existing literature, as this research found no real effect of ESG factors on cost of debt.

Limitations of the Research

Before concluding, a few limitations of this research should be mentioned. Companies could fall out of the S&P 500 therefore the first limitation is that survivorship bias could be present in the data. The other limitation is that a test for heteroskedasticity and serial correlation could not be run for the regressions. Therefore, the residuals of the regressions were plotted on a graph as an alternative test.

Conclusion

COVID-19 sent the world into a recession, causing many businesses to close. It was established that debt levels were rising and that the focus on ESG was increasing. In that context, the aim of the study was to find out whether superior ESG was rewarded through a lower cost of debt. To do that, the research objective was to find out whether a relationship existed between cost of debt and ESG disclosure scores. The research explored whether ESG and its components had a relationship with cost of debt. The final objective was to tie the results into existing literature and make recommendations for future research.

After studying existing literature on the topic, it was found that ESG is related to cost of debt in some capacity and that it mostly affects a company's credit risk. In a couple of instances superior ESG resulted in a lower cost of debt for firms. On examining the descriptive statistics, a slight negative correlation between ESG variables and cost of debt was observed, which related to most of the previous research. However, further tests found that none of the ESG variables granger caused cost of debt. When the regressions were analysed, it was found that only governance had a slightly material relationship with cost of debt. It was mainly the size variable (logarithm of enterprise value) that affected cost of debt. After robustness checks were run using winsorisation to remove outliers, it was found that the significance of the control variables changed in relation to cost of debt. More research has been done on the relationship between equity and ESG scores. This is because ESG is more relevant to equity than it is to debt. The reason for this is that debt holders are paid before equity holders and are not perpetual holders, as is the case with equities. Therefore, debt holders are paid whether the stock price does well or struggles, meaning ESG factors affecting the stock price has an effect on equity but not necessarily on debt. Therefore, if ESG makes even the slightest impact on debt, it means that ESG has come a long way. The results of this study do however show that ESG is not fully mainstream yet.

The first suggestion for future research is to use a before-tax cost of debt figure instead of an after-tax figure. This is because an after-tax figure brings more variability into the cost of debt figure, as companies all have different tax policies. A before-tax figure should eliminate some variability from the cost of debt figure. The second suggestion is to focus on crisis years: 2020 was identified as an outlier year early on in the analysis and, when removing the outliers by

using winsorisation, the results did change slightly. Therefore, only focusing on crisis years to see whether ESG plays a larger role could bring some useful results.

References

Albuquerque, R., Koskinen, Y. & Zhang, C. 2019. Corporate social responsibility and firm risk: theory and empirical evidence. *Management Science*. 65(10):4451-4469.

Aldamen, H. & Duncan, K. 2012. Does adopting good corporate governance impact the cost of intermediated and non-intermediated debt? *Accounting & Finance*. 52:49-76.

Altman, E.I., Gande, A. & Saunders, A. 2010. Bank debt versus bond debt: evidence from secondary market prices. *Journal of Money, Credit and Banking*. 42(4):755-767.

Altman, E.I. & Hotchkiss, E. 2010. *Corporate financial distress and bankruptcy: predict and avoid bankruptcy, analyze and invest in distressed debt*. 3rd ed. New Jersey: John Wiley & Sons.

Aman, H. & Nguyen, P. 2013. Does good governance matter to debtholders? Evidence from the credit ratings of Japanese firms. *Research in International Business and Finance*. 29:14-34.

An, X. & Pivo, G. 2020. Green buildings in commercial mortgage-backed securities: the effects of LEED and energy star certification on default risk and loan terms. *Real Estate Economics*. 48(1):7-42.

Anderson, R.C., Mansi, S.A. & Reeb, D.M. 2004. Board characteristics, accounting report integrity, and the cost of debt. *Journal of Accounting and Economics*. 37(3):315-342.

Andrade, S.C., Bernile, G. & Hood III, F.M. 2014. SOX, corporate transparency, and the cost of debt. *Journal of Banking & Finance*. 38:145-165.

Antea Group. 2021. *ESG vs. CSR: Key distinctions & what businesses need to know*. August 2021. Available: https://us.anteagroup.com/news-events/blog/esg-csr-definitions-differences-sustainability [2021, September 26].

Attig, N., El Ghoul, S., Guedhami, O. & Suh, J. 2013. Corporate social responsibility and credit ratings. *Journal of Business Ethics*. 117(4):679-694.

Barnea, A. & Rubin, A. 2010. Corporate social responsibility as a conflict between shareholders. *Journal of Business Ethics*. 97(1):71-86.

Barth, F., Hübel, B. & Scholz, H. 2019. *ESG and corporate credit spreads*. Available: http://dx.doi.org/10.2139/ssrn.3179468 [2020, October 17].

Bauer, R. & Hann, D. 2010. *Corporate environmental management and credit risk*. Available: http://dx.doi.org/10.2139/ssrn.1660470 [2020, October 15].

Bavoso, V. 2014. *Explaining financial scandals: corporate governance, structured finance and the enlightened sovereign control paradigm*. Newcastle: Cambridge Scholars Publishing.

Bedard, J.C. & Johnstone, K.M. 2004. Earnings manipulation risk, corporate governance risk, and auditors' planning and pricing decisions. *The Accounting Review*. *79(*2):277-304.

Bhoiraj, S. & Sengupta, P. 2003. Effect of corporate governance on bond ratings and yields: the role of institutional investors and outside directors. *The Journal of Business*. 76(3):455-475.

Birindelli, G., Ferretti, P., Intonti, M. & Iannuzzi, A.P. 2015. On the drivers of corporate social responsibility in banks: evidence from an ethical rating model. *Journal of Management & Governance*. 19(2):303-340.

Bloomberg. n.d. *Global environmental, social & governance – ESG data content and data*. Available: https://www.bloomberg.com/professional/dataset/global-environmental-social-governance-data/ [2020, April 20].

Bloomberg L.P. 2021. *Cost of debt from the S&P 500.* Avaliable: Bloomberg database [2021, January 25]

Bloomberg L.P. 2021. *ESG disclosure scores from the S&P 500.* Avaliable: Bloomberg database [2021, January 25]

Bouslah, K., Kryzanowski, L. & M'zali, B. 2013. The impact of the dimensions of social performance on firm risk. *Journal of Banking & Finance*. 37(4):1258-1273.

Breuer, W., Müller, T., Rosenbach, D. & Salzmann, A. 2018. Corporate social responsibility, investor protection, and cost of equity: a cross-country comparison. *Journal of Banking & Finance*. 96:34-55.

Bruntland, G. 1987. *World Commission on Environment and Development: Our Common Future.* Oxford: Oxford University Press. 45-65.

Callen, J.L. & Fang, X. 2015. Religion and stock price crash risk. *Journal of Financial and Quantitative Analysis*. 50(1-2):169-195.

Cantino, V., Devalle, A. & Fiandrino, S. 2017. ESG sustainability and financial capital structure: where they stand nowadays. *International Journal of Business and Social Science.* 8(5):116-126.

Caouette, J.B., Altman, E.I., Narayanan, P. & Nimmo, R. 2011. *Managing credit risk: the great challenge for global financial markets*. 2nd ed. New Jersey: John Wiley & Sons.

Chava, S. 2014. Environmental externalities and cost of capital. *Management Science*. 60(9):2223-2247.

Chava, S., Livdan, D. & Purnanandam, A. 2009. Do shareholder rights affect the cost of bank loans? *The Review of Financial Studies*. 22(8):2973-3004.

Cheng, B., Ioannou, I. & Serafeim, G. 2014. Corporate social responsibility and access to finance. *Strategic Management Journal*. 35(1):1-23.

Choi, H. & Moon, D. 2016. Perceptions of corporate social responsibility in the capital market. *Journal of Applied Business Research*. 32(5):1507-1518.

Clubb, R., Takahashi, Y. & Tiburzio, P. 2016. *Evaluating the relationship between ESG and corporate fixed income*. Management Sloan School. Cambridge, Massachusetts.

Coulson, A.B. & Monks, V. 1999. Corporate environmental performance considerations within bank lending decisions. *Eco-Management and Auditing: The Journal of Corporate Environmental Management*. 6(1):1-10.

D'Antonio, L., Johnsen, T. & Hutton, R.B. 1997. Expanding socially screened portfolios: an attribution analysis of bond performance. *The Journal of Investing*. 6(4):79-86.

Derwall, J., Koedijk, K. & Ter Horst, J. 2011. A tale of values-driven and profit-seeking social investors. *Journal of Banking & Finance*. 35(8):2137-2147.

Devalle, A., Fiandrino, S. & Cantino, V. 2017. The linkage between ESG performance and credit ratings: a firm-level perspective analysis. *International Journal of Business and Management.* 12(9):53-65.

Ederington, L., Guan, W. & Yang, L.Z. 2015. Bond market event study methods. *Journal of Banking & Finance*. 58:281-293.

Edmans, A. 2011. Does the stock market fully value intangibles? Employee satisfaction and equity prices. *Journal of Financial economics*. 101(3):621-640.

El Ghoul, S., Guedhami, O. & Kim, Y. 2017. Country-level institutions, firm value, and the role of corporate social responsibility initiatives. *Journal of International Business Studies*. 48(3):360-385.

El Ghoul, S., Guedhami, O., Kwok, C.C. & Mishra, D.R. 2011. Does corporate social responsibility affect the cost of capital? *Journal of Banking & Finance*. 35(9):2388-2406.

Eliwa, Y., Aboud, A. & Saleh, A. 2019. ESG practices and the cost of debt: Evidence from EU countries. *Critical Perspectives on Accounting*. 79(102097). https://doi.org/10.1016/j.cpa.2019.102097.

Erragragui, E. 2018. Do creditors price firms' environmental, social and governance risks? *Research in International Business and Finance*. 45:197-207. https://doi.org/10.1016/j.ribaf.2017.07.151.

Fich, E.M. & Slezak, S.L. 2008. Can corporate governance save distressed firms from bankruptcy? An empirical analysis. *Review of Quantitative Finance and Accounting*. 30(2):225-251.

Finnerty, J.D., Miller, C.D. & Chen, R.R. 2013. The impact of credit rating announcements on credit default swap spreads. *Journal of Banking & Finance*. 37(6):2011-2030.

Fitch ratings named most transparent credit rating agency for ESG for second year. 2020. *Fitch Ratings*. 05 July. Available: https://www.fitchratings.com/research/fund-asset-managers/fitch-ratings-named-most-transparent-credit-rating-agency-for-esg-for-second-year-05-07-2020 [2020, October 10].

Flammer, C. 2015. Does corporate social responsibility lead to superior financial performance? A regression discontinuity approach. *Management Science*. 61(11):2549-2568.

Franklin, D. 2008. Just good business: a special report on corporate social responsibility. *Economist Newspaper*. 19 January. Avaliable: http://www.yooyahcloud.com/MOSSCOMMUNICATIONS/RQ93b/Just_good_business_ECONOMIST.pdf [2020, October 5].

Freeman, R.E., Harrison, J.S., Wicks, A.C., Parmar, B.L. & De Colle, S. 2010. *Stakeholder theory: the state of the art*. New York: Cambridge University Press.

Galil, K., Shapir, O.M., Amiram, D. & Ben-Zion, U. 2014. The determinants of CDS spreads. *Journal of Banking & Finance*. 41:271-282.

Ge, W. & Liu, M. 2015. Corporate social responsibility and the cost of corporate bonds. *Journal of Accounting and Public Policy*. 34(6):597-624.

Godfrey, P.C., Merrill, C.B. & Hansen, J.M. 2009. The relationship between corporate social responsibility and shareholder value: an empirical test of the risk management hypothesis. *Strategic Management Journal*. 30(4):425-445.

Goss, A. 2009. Corporate social responsibility and financial distress. *Proceedings of the Administrative Sciences Association of Canada*. 30 July 2009. Ontario. 1-18.

Goss, A. & Roberts, G.S. 2011. The impact of corporate social responsibility on the cost of bank loans. *Journal of Banking & Finance*. 35(7):1794-1810.

Harrison, J.S. & Wicks, A.C. 2013. Stakeholder theory, value, and firm performance. *Business Ethics Quarterly*. 23(1)97-124.

Hemingway, C.A. & Maclagan, P.W. 2004. Managers' personal values as drivers of corporate social responsibility. *Journal of Business Ethics*. 50(1):33-44.

Hester, J. 2020. *Credit agencies take ESG into consideration.* Available: https://www.theimpactivate.com/credit-agencies-take-esg-into-consideration/ [2021, September 26].

Ho, P. 2019. *Rating agencies boost ESG risk analysis.* Available: https://www.reuters.com/article/rating-agencies-boost-esg-risk-analysis-idUSL8N27Y2DE [2021, September 26].

Hoepner, A., Oikonomou, I., Scholtens, B. & Schröder, M. 2016. The effects of corporate and country sustainability characteristics on the cost of debt: an international investigation. *Journal of Business Finance & Accounting*. 43(1-2):158-190.

Isa, M. 2019. Ignore sustainable investment at your own peril. *Finweek.* 7 November. Avaliable: https://hdl.handle.net/10520/EJC-192cca834f [2020, September 20]

Jang, G.Y., Kang, H.G., Lee, J.Y. & Bae, K. 2020. ESG scores and the credit market. *Sustainability*. 12(8):3456.

Jiraporn, P., Jiraporn, N., Boeprasert, A. & Chang, K. 2014. Does corporate social responsibility (CSR) improve credit ratings? Evidence from geographic identification. *Financial Management*. 43(3):505-531.

Johnson, R. 2020. The link between environmental, social and corporate governance disclosure and the cost of capital in South Africa. *Journal of Economic and Financial Sciences*. 13(1)12.

Kim, Y., Li, H. & Li, S. 2014. Corporate social responsibility and stock price crash risk. *Journal of Banking & Finance*. 43:1-13.

Klock, M.S., Mansi, S.A. & Maxwell, W.F. 2005. Does corporate governance matter to bondholders? *Journal of Financial and Quantitative Analysis*. 40(4):693-719.

Kocmanová, A. & Dočekalová, M. 2013. Construction of the economic indicators of performance in relation to environmental, social and corporate governance (ESG) factors. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis*. 60(4):195-206.

Koh, P.S., Qian, C. & Wang, H. 2014. Firm litigation risk and the insurance value of corporate social performance. *Strategic Management Journal*. 35(10):1464-1482.

Kölbel, J.F. & Busch, T. 2013. *The effect of bad news on credit risk: a media based view of the pricing of corporate social responsibility*. Swiss Federal Institute of Technology: Zurich.

Krueger, P. 2015. Corporate goodness and shareholder wealth. *Journal of Financial Economics*. 115(2):304-329.

Kuh, T. 2020. *Viewpoint: ESG after COVID-19: Will it be different this time*? Available: https://www.ipe.com/viewpoint-esg-after-covid-19-will-it-be-different-this-time/10046023.article [2020, October 14].

Levitt, T. 1958. The dangers of social-responsibility. *Harvard Business Review*. 36(5):41-50.

Mans-Kemp, N. & Viviers, S. 2015. Responsible investment in South Africa. *The Routledge handbook of responsible investment*. London: Routledge. 99-114.

Margolis, J.D., Elfenbein, H.A. & Walsh, J.P. 2007. Does it pay to be good? A meta-analysis and redirection of research on the relationship between corporate social and financial performance. *Social Science Research Network*. 1001(48109-1234):1-68.

Mengze, H. & Wei, L. 2015. A comparative study on environment credit risk management of commercial banks in the Asia-Pacific region. *Business Strategy and the Environment*. 24(3):159-174.

Merton, R.C. 1974. On the pricing of corporate debt: the risk structure of interest rates. *The Journal of Finance*. 29(2):449-470.

MSCI (Morgan Stanley Capital International). 2020. *Who will regulate ESG?* Available: https://www.msci.com/who-will-regulate-esg [2020, October 7].

Mutezo, A. 2014. Socially responsible investment and financial performance: evidence from the Johannesburg Securities Exchange. *Banks and Bank Systems*. 9(3):120-128.

Mutua, D.C. & Poh, J. 2019. *These agencies want to check who's naughty and who's nice*. Available: https://www.bloomberg.com/news/articles/2019-11-22/moody-s-s-p-race-into-esg-rating-business-in-acquisitionbinge [2020, October 7].

The Nielsen Company. 2014. *Global corporate social responsibility report. June 2014.* Available: https://www.nielsen.com/wp-content/uploads/sites/3/2019/04/global-corporate-social-responsibility-report-june-2014.pdf [2020, October 15].

Nooteboom, B., Berger, H. & Noorderhaven, N.G. 1997. Effects of trust and governance on relational risk. *Academy of Management Journal*. 40(2):308-338.

Norden, L. & Weber, M. 2009. The co-movement of credit default swap, bond and stock markets: an empirical analysis. *European Financial Management*. 15(3):529-562.

Oikonomou, I., Brooks, C. & Pavelin, S. 2014. The effects of corporate social performance on the cost of corporate debt and credit ratings. *Financial Review*. 49(1):49-75.

Orlitzky, M. & Benjamin, J.D. 2001. Corporate social performance and firm risk: a meta-analytic review. *Business & Society*. 40(4):369-396.

Pinner, D., Rogers, M. & Samandari, H. 2020. *Addressing climate change in a post-pandemic world.* Available: https://www.mckinsey.com/business-functions/sustainability/our-insights/addressing-climate-change-in-a-post-pandemic-world [2021, September 25].

Renneboog, L., Ter Horst, J. & Zhang, C. 2008. Socially responsible investments: institutional aspects, performance, and investor behavior. *Journal of Banking & Finance*. 32(9):1723-1742.

Scholtens, B. 2006. Finance as a driver of corporate social responsibility. *Journal of Business Ethics*. 68(1):19-33.

Scholtens, B. 2009. Corporate social responsibility in the international banking industry. *Journal of Business Ethics*. 86(2):159-175.

Scholtens, B. & Zhou, Y. 2008. Stakeholder relations and financial performance. *Sustainable Development*. 16(3):213-232.

Schuler, D., Rasche, A., Etzion, D. & Newton, L. 2017. Guest editors' introduction: corporate sustainability management and environmental ethics. *Business Ethics Quarterly*. 27(2):213-237.

Semenova, N. & Hassel, L. 2019. The performance of investor engagement dialogues to manage sustainability risks. *The Nordic Journal of Business*. 68:5-22.

Sengupta, P. 1998. Corporate disclosure quality and the cost of debt. *Accounting Review*. 73(4):459-474.

Sharfman, M.P. & Fernando, C.S. 2008. Environmental risk management and the cost of capital. *Strategic Management Journal*. 29(6):569-592.

spglobal. 2020. Credit trends: global corporate, debt market: state of play in 2020. June. Available: https://www.spglobal.com/ratings/en/research/articles/200625-credit-trends-global-corporate-debt-market-state-of-play-in-2020-11546901 [2020, October 17].

Stellner, C., Klein, C. & Zwergel, B. 2015. Corporate social responsibility and Eurozone corporate bonds: the moderating role of country sustainability. *Journal of Banking & Finance*. 59:538-549.

Sun, W. & Cui, K. 2014. Linking corporate social responsibility to firm default risk. *European Management Journal*. 32(2):275-287.

Sustainable Returns for Pensions and Society. 2013. *Responsible investment and ownership: a guide for pension funds in South Africa*. Available: https://rioguide.batseta.org.za/?from_sustainable_returns [2020, October 16].

Thompson, P. & Cowton, C.J. 2004. Bringing the environment into bank lending: implications for environmental reporting. *The British Accounting Review*. 36(2):197-218.

Viviers, S. & Els, G. 2017. Responsible investing in South Africa: Past, present and future. *African Review of Economics and Finance*. *9*(1):122-155.

Weber, O. 2012. Environmental credit risk management in banks and financial service institutions. *Business Strategy and the Environment*. 21(4):248-263.

Weber, O., Fenchel, M. & Scholz, R.W. 2008. Empirical analysis of the integration of environmental risks into the credit risk management process of European banks. *Business Strategy and the Environment*. 17(3):149-159.

Weber, O., Scholz, R.W. & Michalik, G. 2010. Incorporating sustainability criteria into credit risk management. *Business Strategy and the Environment*. 19(1):39-50.

Zeidan, R., Boechat, C. & Fleury, A. 2015. Developing a sustainability credit score system. *Journal of Business Ethics*. 127(2):283-296.

Appendix A: Figures

Figure A1: Mean of Cost of Debt (COD) with Standard Deviations (S.D.), 2016–2020

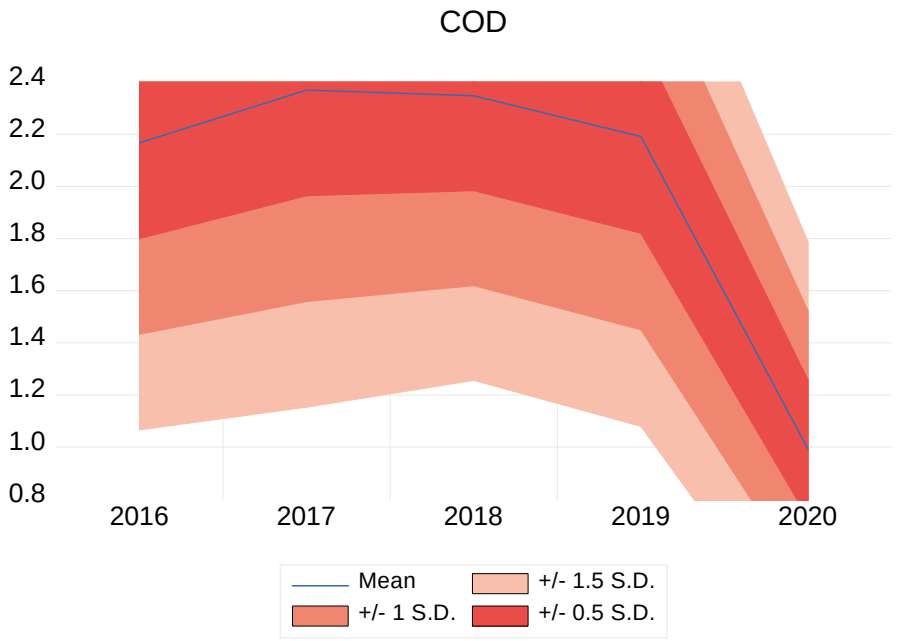


Figure A2: Mean of Cost of Debt (COD) with Standard Deviations (S.D.), 2016–2019

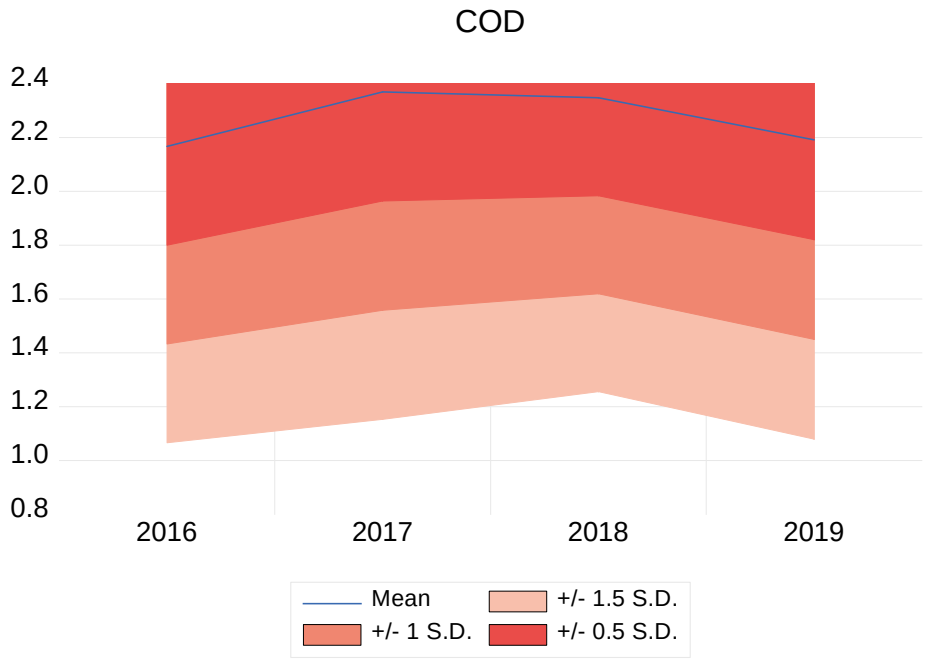


Figure A3: Mean of ESG Score with Standard Deviations (S.D.), 2016–2020

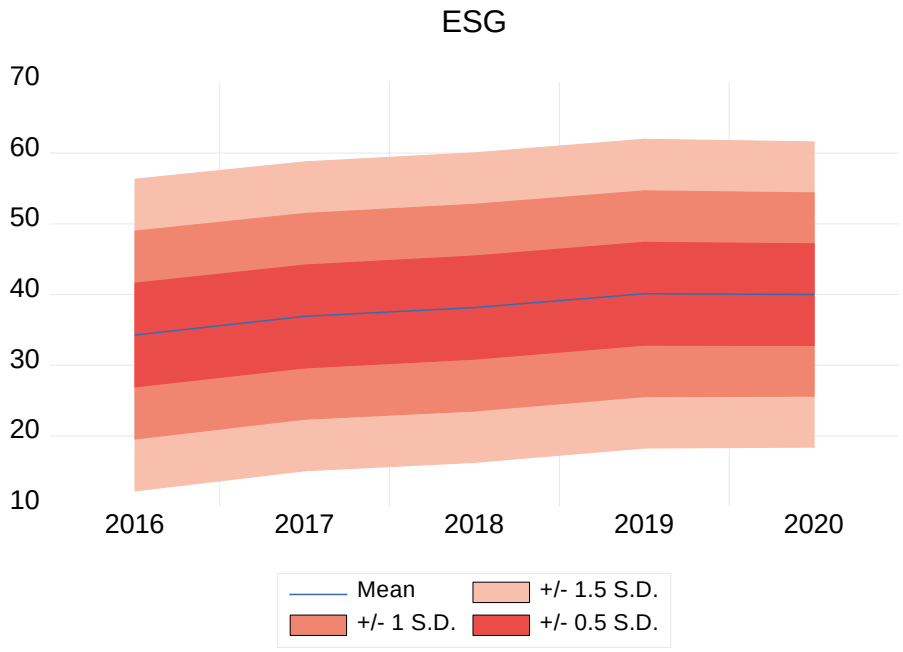


Figure A4: Mean of ESG Score with Standard Deviations (S.D.), 2016–2019

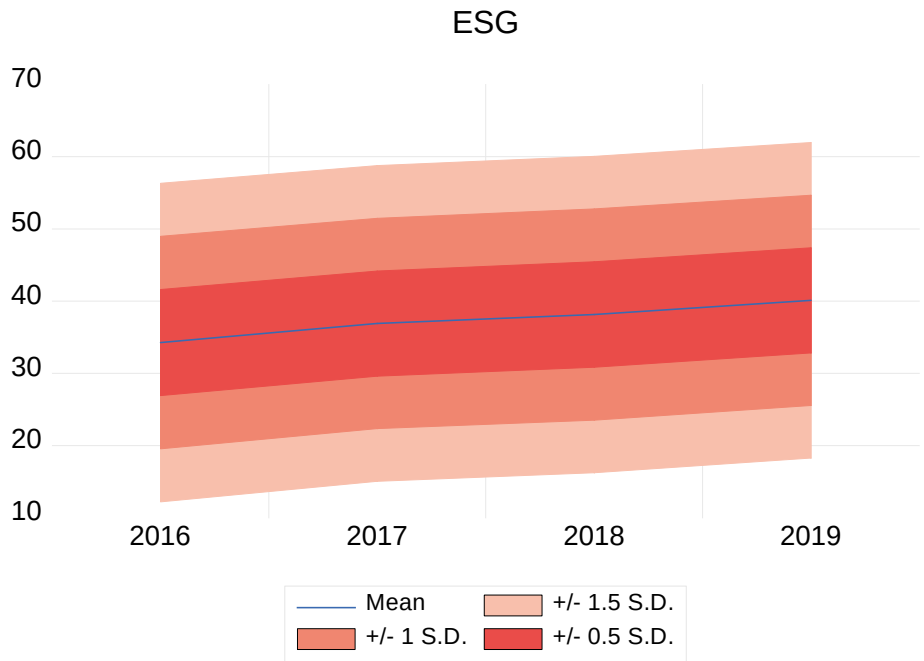


Figure A5: Mean of Environmental Score with Standard Deviations (S.D.), 2016–2020

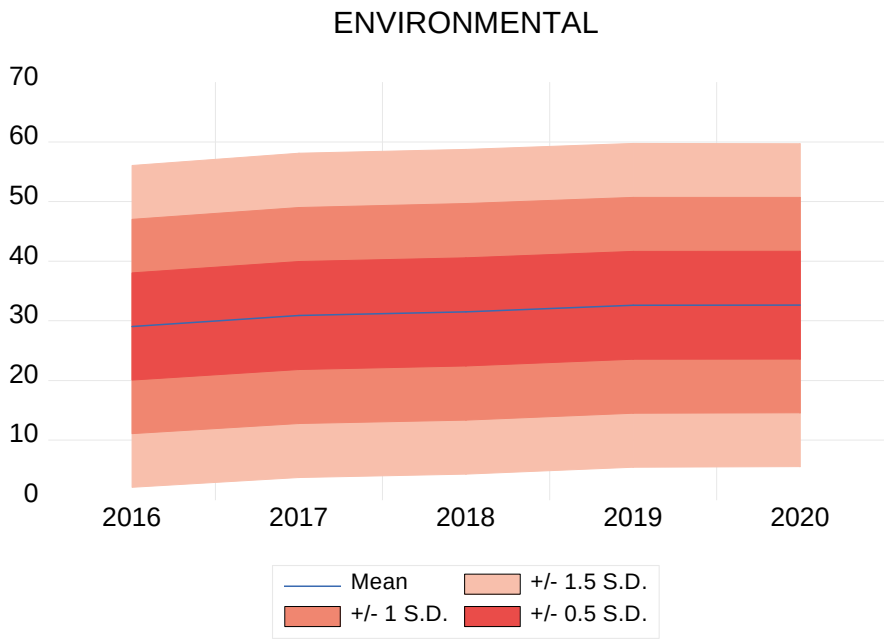


Figure A6: Mean of Environmental Score with Standard Deviations (S.D.), 2016–2019

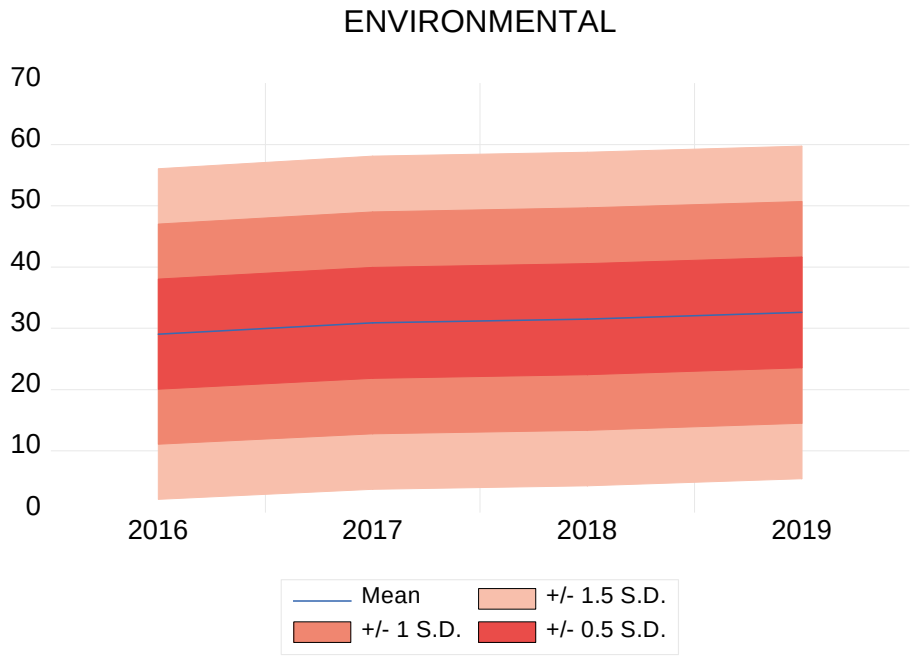


Figure A7: Mean of Social Score with Standard Deviations (S.D.), 2016–2020

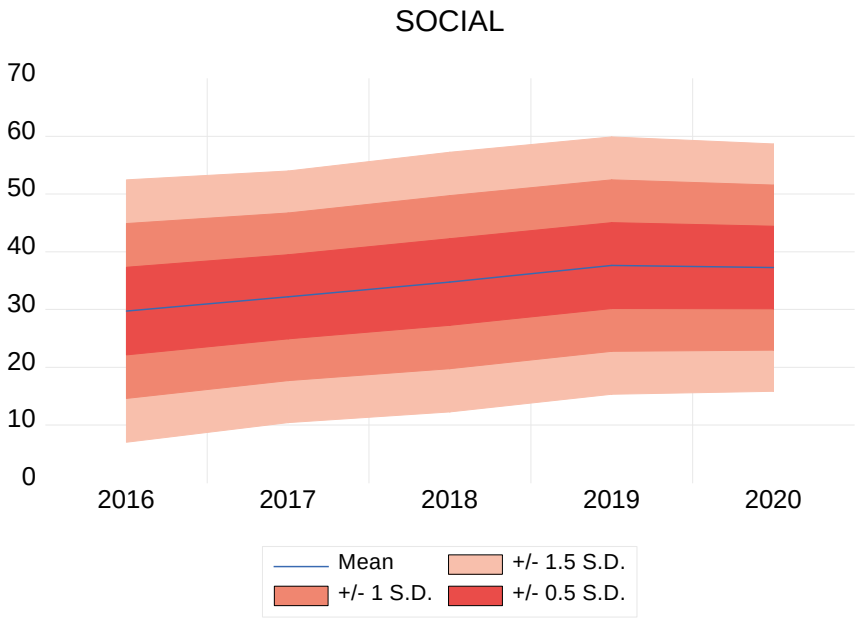


Figure A8: Mean of Social Score with Standard Deviations (S.D.), 2016–2019

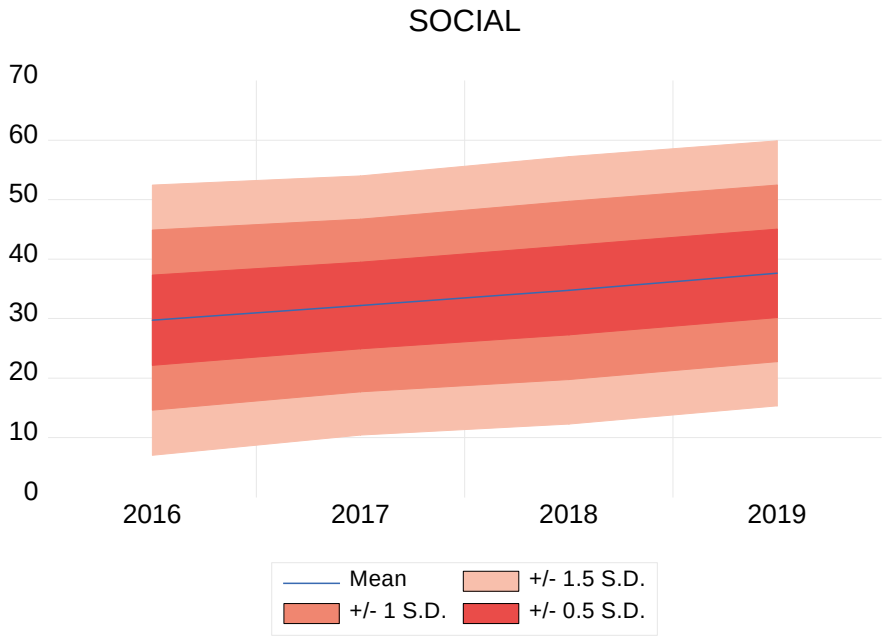


Figure A9: Mean of Governance Score with Standard Deviations (S.D.), 2016–2020

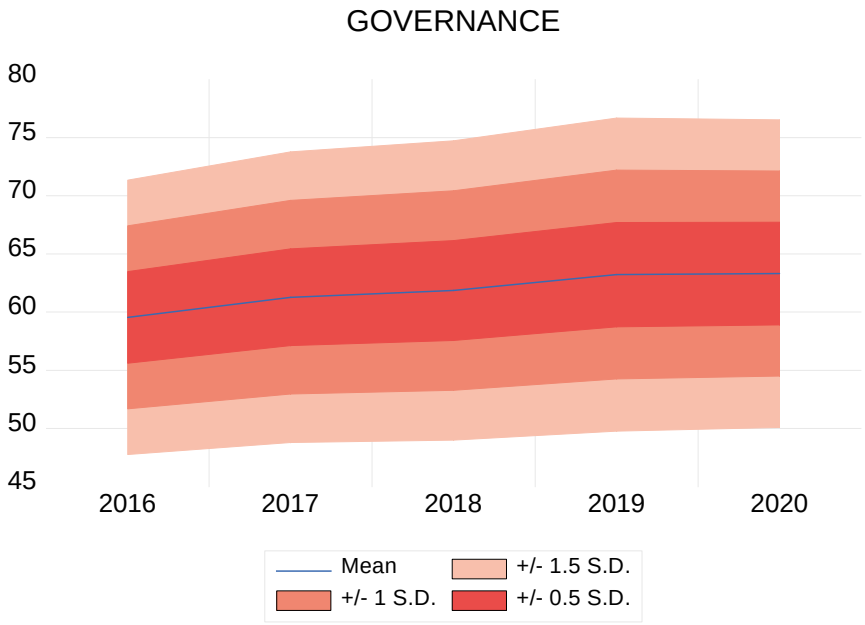


Figure A10: Mean of Governance Score with Standard Deviations (S.D.), 2016–2019

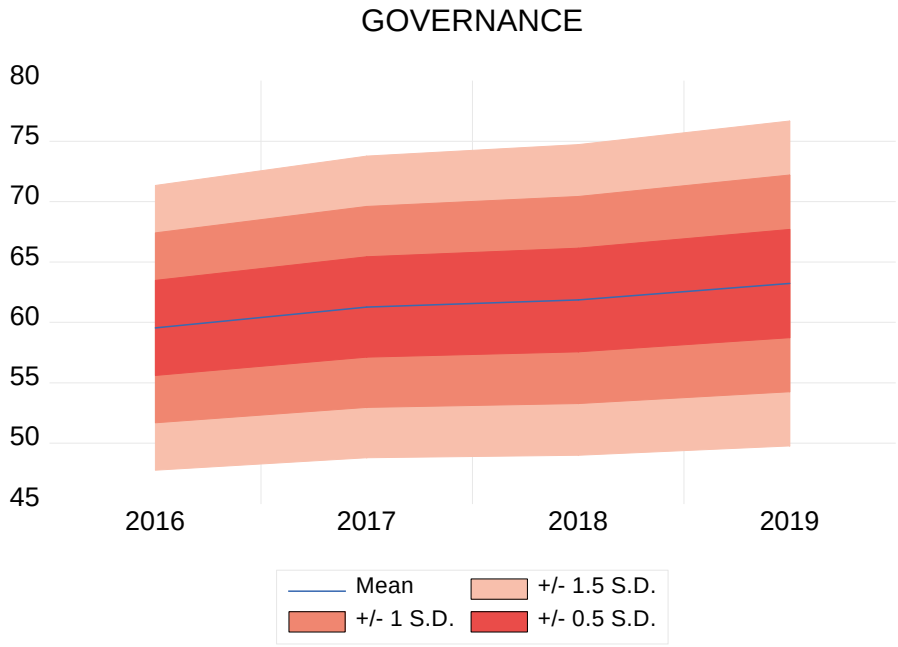
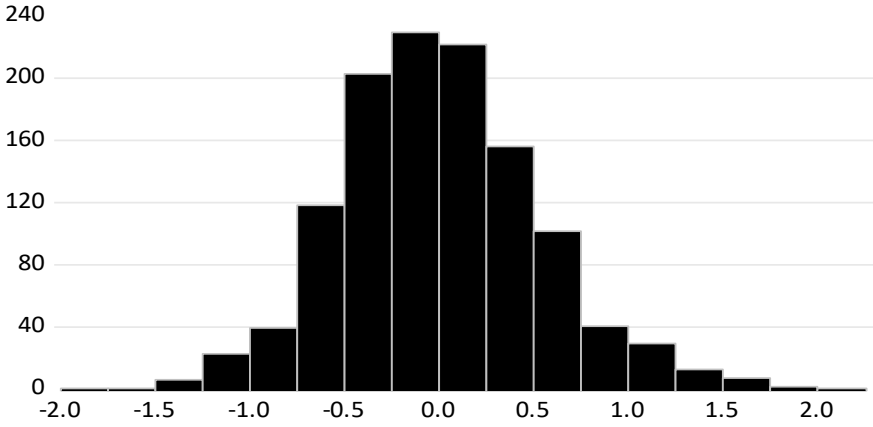
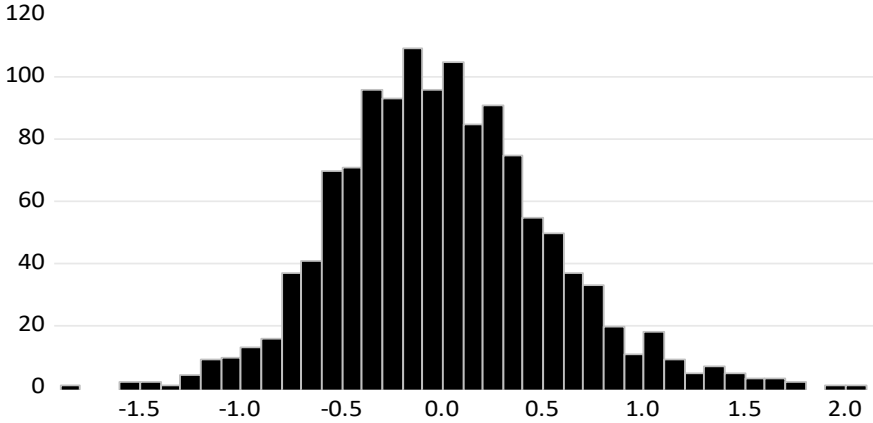


Figure A11: Cost of Debt and Environmental Residuals Distribution



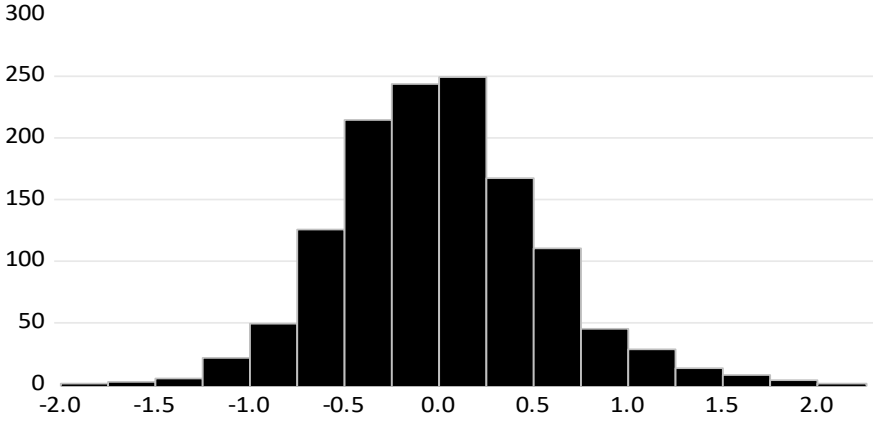
Series: Standardized Residuals	
Sample 2016 2020	
Observations 1196	
Mean	1.86e-17
Median	-0.025186
Maximum	2.027749
Minimum	-1.926970
Std. Dev.	0.528837
Skewness	0.352219
Kurtosis	3.630953
Jarque-Bera	44.56768
Probability	0.000000

Figure A12: Cost of Debt and Social Residuals Distribution



Series: Standardized Residuals	
Sample 2016 2020	
Observations 1287	
Mean	1.45e-17
Median	-0.026333
Maximum	2.021575
Minimum	-1.888493
Std. Dev.	0.524597
Skewness	0.350533
Kurtosis	3.630435
Jarque-Bera	47.66941
Probability	0.000000

Figure A13: Cost of Debt and Governance Residuals Distribution



Series: Standardized Residuals	
Sample 2016 2020	
Observations 1288	
Mean	-3.50e-17
Median	-0.021845
Maximum	2.050573
Minimum	-1.936944
Std. Dev.	0.523867
Skewness	0.345617
Kurtosis	3.632143
Jarque-Bera	47.08757
Probability	0.000000

Figure A14: Cost of Debt and Environmental Residuals Plotted

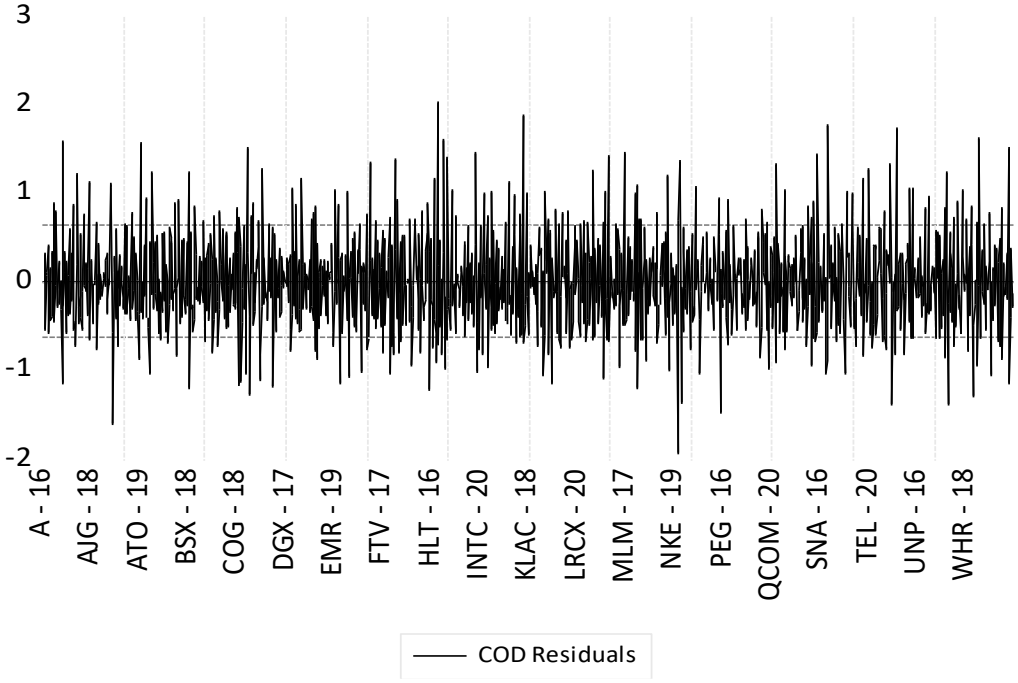


Figure A15: Cost of Debt and Social Residuals Plotted

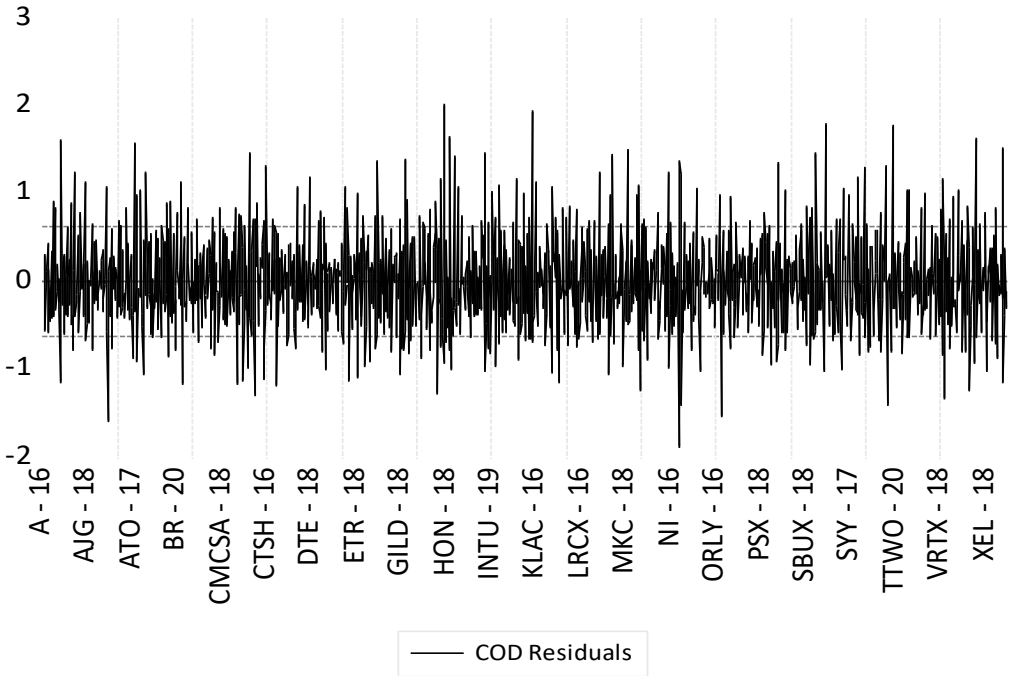
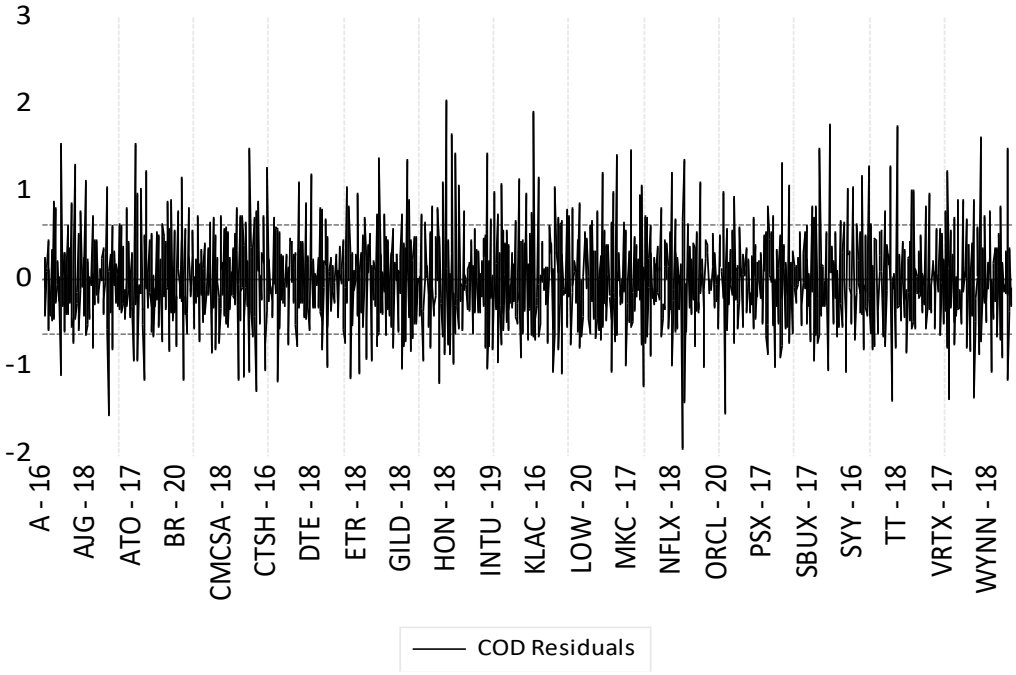


Figure A16: Cost of Debt and Governance Residuals Plotted



Appendix B: Tables

Table B1: Descriptive Statistics of the Variables Included in the Cost of Debt and ESG Analysis, 2016–2019

2016-2019	Cost of debt	ESG	Environ-mental	Social	Govern-ance	Current ratio	Debt EBITDA	Enterprise value	Financial leverage	Interest cover	Return on assets	Sequential growth
Mean	2.333	40.194	32.314	36.205	62.268	1.727	5.415	62081.91	5.029	20.095	7.244	10.893
Median	2.227	41.509	34.109	36.842	60.714	1.406	2.384	29948.55	2.722	8.202	6.501	5.263
Maximum	4.742	75.104	78.512	77.193	83.929	16.380	2607.804	1206914.	488.924	4323.021	42.829	440.194
Minimum	0.864	12.810	1.550	3.509	46.429	0.169	0.003	508.544	1.207	-40.791	-27.302	-72.880
Std. Dev.	0.692	13.399	17.947	13.747	7.945	1.384	79.064	103476.0	17.928	134.702	6.363	32.880
Skewness	0.649	-0.120	-0.039	0.076	0.329	4.445	32.852	4.941	20.102	30.104	0.700	6.543
Kurtosis	3.319	2.064	2.074	2.283	2.169	35.419	1081.799	38.111	503.876	959.820	6.650	63.360
Jarque-Bera	80.828	42.293	39.070	24.300	50.933	51180.10	52906248	60255.79	11435850	41628939	692.233	172767.5
Probability	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table B2: Correlations Explaining the Univariate Relationship between the Variables, 2016–2019

Correlation												
Probability	**Cost of debt**	**ESG**	**Environ-mental**	**Social**	**Govern-ance**	**Current ratio**	**Debt EBITDA**	**Enterprise value**	**Financial leverage**	**Interest cover**	**Return on assets**	**Sequential growth**
Cost of debt	1.000000											

ESG	-0.037824	1.000000										
	0.2127	-----										
Environmental	-0.049237	0.973105	1.000000									
	0.1047	0.0000	-----									
Social	-0.012956	0.826206	0.694171	1.000000								
	0.6696	0.0000	0.0000	-----								
Governance	-0.005016	0.787275	0.693467	0.653245	1.000000							
	0.8688	0.0000	0.0000	0.0000	-----							
Current ratio	0.028589	-0.129356	-0.099583	-0.136200	-0.193668	1.000000						
	0.3464	0.0000	0.0010	0.0000	0.0000	-----						
Debt EBITDA	0.086974	-0.047703	-0.047865	-0.034369	-0.036798	-0.022229	1.000000					
	0.0041	0.1160	0.1148	0.2576	0.2254	0.4641	-----					
Enterprise value	-0.158367	0.206779	0.239241	0.086149	0.131471	-0.003286	-0.003764	1.000000				
	0.0000	0.0000	0.0000	0.0045	0.0000	0.9138	0.9014	-----				
Financial leverage	0.035126	0.011321	-0.000952	0.035847	0.027140	-0.052585	0.004098	-0.000893	1.000000			
	0.2472	0.7093	0.9750	0.2376	0.3714	0.0831	0.8926	0.9765	-----			
Interest cover	-0.047712	-0.057514	-0.046117	-0.071726	-0.055187	0.094363	-0.008767	0.032681	-0.015965	1.000000		
	0.1159	0.0580	0.1286	0.0180	0.0689	0.0018	0.7728	0.2817	0.5990	-----		
Return on assets	0.001356	0.042943	0.056627	-0.004795	0.007716	0.182564	-0.088212	0.115874	-0.014727	0.142728	1.000000	
	0.9644	0.1571	0.0620	0.8745	0.7994	0.0000	0.0036	0.0001	0.6277	0.0000	-----	
Sequential growth	0.016595	-0.112805	-0.097408	-0.119905	-0.095861	0.032850	0.018084	-0.000313	-0.005495	0.006269	0.008108	1.000000
	0.5847	0.0002	0.0013	0.0001	0.0016	0.2792	0.5515	0.9918	0.8564	0.8364	0.7895	-----

Table B3: Cointegration Test, 2016–2020

Kao Residual Cointegration Test

Series: COD ESG ENVIRONMENTAL SOCIAL GOVERNANCE CURR_RATIO DEBT_EBITDA ENTER_VALUE FIN_LEV INT_COVER ROA SEQ_GROWTH

Null Hypothesis: No cointegration

	t-Statistic	Prob.
ADF	-6.740032	0.0000
Residual variance	1.295912	

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(RESID)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-1.272102	0.038088	-33.39920	0.0000

R-squared	0.559055	Mean dependent var	-0.156066
Adjusted R-squared	0.559055	S.D. dependent var	1.013573