**The Price of Responsibility: ESG Performance and Its Effect on Bond Costs and Ratings**

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**ABSTRACT**

This paper examines whether the environmental, social, and governance (ESG) performance impact firm’s cost of det, bond rating and improve market reactions to bond offerings.Using a dataset of 8547 bonds issued by 1250 U.S. firms during the 2004 to 2022 period, the paper investigates how each ESG pillar impacts cost of debt, bond rating and market reaction. This paper suggests that firms with better environmental, social, and governance performance are perceived as lower-risk borrowers by the market . Overall, the paper finds evidence that ESG performance reduces the cost of Debt, improve Bond ratings and lower the adverse market reaction to Bonds issue announcements . Each of the three ESG pillars significantly impacts the cost of Debt.

Keywords: Cost of Debt, Environmental, Social, and Governance (ESG), Bond Offerings (SEO), Corporate Social Responsibility (CSR)

JEL classification: G32; M14, G34

### Introduction

In the last two decades a growing body of literature emerged to examine the impact of corporate social responsibility (CSR) on firm’s financial decisions and performance , Most recently CSR evolved into environmental, social, and governance (ESG) performance measures. CSR have evolved from simple compliance indicators to actual ESG performance measures . As ESG practices become critical for investors, stakeholders, and regulators , Mangers have been increasingly emphasizes the implementation of policies that enhances ESG practices in their firms.

The analysis of this paper contributes to the broader literature on corporate social responsibility and financial markets by providing empirical evidence that ESG performance plays a crucial role in reducing the cost of debt. The research approach is unique in three areas. First, the paper examines whether companies with higher ESG ratings experience lower debt costs, higher Bond ratings, and positive reactions to bond offerings. Second, the paper uses the ESG score adjusted for controversies, a measure that controls for adverse news events. Finally, unlike previous research, the paper explores how ESG components (Environmental, Social, and Governance pillars) affect the cost of a new Bond rating and the investor's reaction to the issue announcement. , providing practical insights for managers, firms, and investors.

Using a comprehensive sample of 8542 U.S. bond offerings from 2004 to 2022 this paper findings show that firms with higher overall ESG, Environmental, Social, and Governance scores experience significantly lower cost of debt, higher bond ratings and lower adverse market reactions to bonds offering . In summary, this paper provides strong empirical evidence that high ESG performance lowers the cost of borrowing because the market perceives ESG-committed firms as lower-risk borrowers .

The rest of this paper proceeds as follows. Section 2 presents the ESG literature and hypotheses development . Section 3 presents the sample and Methodology. Section 4 presents the paper's empirical results. Section 5 concludes the paper.

### ESG literature and hypotheses development

In the last two decades, a growing body of literature emerged to examine the impact of corporate social responsibility (CSR) on firm’s financial decisions and performance . Most recently CSR evolved into environmental, social, and governance (ESG) performance measures. Unlike traditional CSR measures ESG have evolved from simple compliance indicators to actual ESG performance measures .

Several theories explain the potential impact of ESG performance on a firm’s financial decisions. Stakeholder theory (Freeman, 1984) predicts that firms engaged in better ESG practices work on addressing the stakeholders diverse needs and interests , thus reducing Managers Stakeholder conflicts which leads to lower operational risks and credit risk. Oikonomou, Brooks, & Pavelin, 2014 shows that firms with better CRS score may lower their financing costs across different financing instruments. According to signaling theory firms with a better ESG performance signal to the market that they have a better governance, higher transparency, and a better commitment to sustainable practices (Spence, 1973) . Within the Risk mitigation theory (Orlitzky & Benjamin, 2001) frame work, better ESG practices lower firm’s regulations, reputation, and operations risks. On the other hand , Agency theory (Jensen & Meckling, 1976) predicts that strong ESG performance scores reduce agency costs by aligning shareholders and creditors with mangers interests Under this theory, firms with high EGS scores reduce the information asymmetry about the firm’s ability to meet debt obligations.

The literature reveals some mixed results on the impact of ESG on the cost of Debt. Some studies find that better ESG performance reduce the cost of Debt, others suggest that these benefits may vary depending on the industry or other factors. Chava, 2014; Polbennikov et al., 2016 suggested that the creditors perceive firms with high ESG performance as a low credit risk borrower because ESG practices improve operational efficiency, firm’s reputation and align firm with regulatory expectations (Jiang, 2008; Li & Xie, 2014). Ferrell, Liang, & Renneboog, 2016 find that Socially responsible companies may lower it risk by improving employee morale , stakeholder satisfaction, and customers loyalty. Environmental performance impact Debt Costs via appealing to investors who have sustainability preferences. Governance performance found to lowers information asymmetry by reducing agency costs (Du et al., 2015). ESG-conscious investors may perceive firms with better ESG as having lower risk, with stable cash flows thus may react positively (Howton et al., 1998; Shyam-Sunder, 1991) to bond issuance announcements (Apergis et al., 2022; Johnson, 1995). In general these theories predict that strong ESG performance signals the firm’s quality, transparency, better governance, serving the interests of all stakeholders, helps firms gain legitimacy , improve creditworthiness, and reduces investors' risk.

Based on these theoretical predictions, the paper hypothesizes the following:

H 1: Firms with high ESG ,Environmental, Social, and Governance pillars performance are likely to experience lower cost of Debt

H 2: Firms with high ESG ,Environmental, Social, and Governance pillars performanceare likely to experience higher Bond rating

H 3: Bond offering announcement returns are significantly and positively associated with the firm’s ESG ,Environmental, Social, and Governance pillars performance .

By examining each ESG pillar individually, this study provides a granular analysis of the impact of each ESG practices on the cost of debt.

### Sample and Methodology

### 3.1 Sample Construction

To investigate the impact of ESG on the cost of debt, the sample is constructed by combining data from the London Stock Exchange Group (LSEG)’s major database. The LSEG provides an ESG (Environmental, Social, and Governance) dataset, formerly known as Datastream/Refinitiv/Asset 4, covering hundreds of ESG-related variables and ESG scores. The ESG score is based on three primary pillars: Environmental(E), Social(S), and Governance(G). The Environmental(E) pillar has three categories: Resource Use, Emissions, and Environmental Innovation. The Social pillar comprises four categories: Workforce, Human Rights, Community, and Product Responsibility. Finally, The Governance Pillar is based on three categories: Management, Shareholders, and CSR Strategy. In addition, the LSEG ESG dataset provides an overall ESG combined score (see ESGC - Figure 2), which adjusts the ESG score to account for news controversies that significantly impact corporations. All ESG variable definitions are presented in Appendices A and B.

The ESG dataset covers public companies worldwide, with some data from 2003. Overall, it collects and computes more than 630 company-level ESG metrics. A subset of these metrics (186 comparable metrics - Figure 1) is used to reformulate the three pillars - environmental, social, and corporate governance- scores and the final ESG score, which reflects the company’s ESG performance.

The initial sample of U.S. Bonds offerings is from the LSEG deals database. LSEG Datastream provides data on Bonds offerings and market index returns. LSEG World scope database provides financial data for the bond issuer companies.

The sample starts in 2004, which is when the coverage of U.S. firms in the LSEG ESG database became more comprehensive. The initial sample consists of all observations for U.S. Bonds offerings in the SDC Global New Issues database from 2004 to 2021. The sample excludes bonds issued by financial firms, utility firms, and private placements, we include only straight fixed rate corporate bonds . Within straight fixed rate corporate bonds we include bonds with issuance amount more than 100 million and with maturity of at least one year at the time of the issue. Finally, the sample excluded firms with unavailable accounting data in the LSEG Worldscope. After applying the above criteria, the final sample consists of 8,453 bond issues by 1121 unique firms. Table 1 presents the sample characteristics. Among the 8,453 Bonds offerings, 81 percent were Bonds offerings by firms reporting ESG scores. The number of bonds issuers reporting ESG scores varies across the sample period, from a low rate of 42 percent in 2004 to a high rate of 97 percent in 2020. Table 1 Panel A 3 shows that the number of companies reporting ESG scores has increased significantly since 2004. This increase can be attributed to several factors, such as regulatory changes, establishing global standards and frameworks that give companies clear guidelines for ESG reporting, and stakeholder pressure that encourages companies to adopt and report on ESG activities. Table 1 panel B shows the distribution of bonds issue by issuer’s industry. Most bonds issues are in manufacturing (48 percent), next is service industries (16 percent), transportation (15 percent), wholesale /retail trade (12 percent)and construction/mining (10 percent), respectively.

### 3.2 Variable Descriptions

### 3.2.1 Dependent Variables

To examine the impact of ESG on the cost of debt we utilize both direct and indirect measures of the cost of debt. We use the yield spread as proxy for the cost of debt. yield spread is the literature standard measure of bonds risk premium (Apergis et al. (2022),,Chava (2014) , Oikonomou, Brooks, and Pavelin (2014) and Polbennikov et al. (2016) ,Jiang (2008), and Ortiz-Molina (2006)). The yield spread is calculated as the logarithm of difference between the yield of the bond at issuance and that of the Treasury bond with a comparable maturity.

The second dependent variable we employ is the bond rating score (Ge and Liu (2015), Oikonomou, Brooks, and Pavelin (2014), Attig et al. (2013) and Menz (2010) , Goss and Roberts (2011)) , which uses the Moody’s rating of the new issues. We converted Moody’s rating to a ranking scale range between 1 (for the lowest rated bonds) and 21 (for the highest rated bonds). Bonds that are not rated received the value of Zero. Appendix C presents Moody’s Rating System definitions.

The third dependent variable we employ is the cumulative abnormal return around the bond issue announcement (Mikkelson and Partch (1986), Similarly, Eckbo (1986) Chaplinsky and Hansen (1993), Howton, Howton, and Perfect (1998)), we use conventional event study methodology to calculate the 3 days window cumulative abnormal return. The single-factor market model we use is:

where  is the rate of return of common stock for issuer *i* on day ;  is the return on the market portfolio for day  and  is the prediction error. The abnormal return of the *ith* issuer on day  define as:

where, the rate of return of issuer *i* is regressed against the market portfolio return during the period (-260, -11) prior to the Bond issue announcement day to obtain the coefficients and as ordinary least squares estimate of and . The Bond issue announcement date for each announcing firm is designated as event day zero. Over three trading days, beginning with day =-1, and ending with =1, the cumulative abnormal return (CAR) for the ith issuer is:

To control for cross-sectional correlation and event-induced variance, we use [Boehmer, Musumeci, and Poulsen (1991](http://rfs.oxfordjournals.org/content/23/11/3996.abstract?etoc#ref-5)) test statistic that use firm-level clustered standard errors.

Table 2 Panel A shows the descriptive statistics of the dependent variables for the full sample of 8,453 Bond issues, Bonds issued by firms who don’t release ESG performance data and Bonds issued by firms who release ESG performance data, respectively. Bond issues by Firms with ESG performance data tend to be significantly having lower Yield Spread, higher Moody's Rating and positive cumulative abnormal return CAR[-1,+1] . Notably, the market reaction to Bonds issued by firms who don’t release ESG performance data is not different from zero . This result in line with previous work on market reaction to straight debt issues (Dann and Mikkelson (1984) ,Mikkelson and Partch (1986) ,Eckbo (1986),Hansen and Crutchley (1990) ,Shyam-Sunder (1991) ,Chaplinsky and Hansen (1993) ,Johnson (1995) ,Jung, Kim, and Stulz (1996) ,Howton, Howton, and Perfect (1998)) that found no market rection to straight debt issues or at most a very mild negative reaction (Dann and Mikkelson (1984) Howton, Howton, and Perfect (1998)) in stock price.

### 3.2.1 Control variables

**Issuer Characteristics Control variables**

we use several firm level characteristics as explanatory variables. The inclusion of these variables motivated by previous empirical work and based on the existing literature on the cost of Debt. Issuer Size ((Goss & Roberts, 2011; Attig et al., 2013; Oikonomou, Brooks, & Pavelin, 2014) ) measured as The logarithm of the firm’s total assets is used as a proxy for firm size. Larger firms tend to have a lower risk profile, lower levels of information asymmetry and higher reputation effects. We expect that the firm size to be negatively related to yield spread and yield to yield to maturity and positively related to Bond ratings and cumulative abnormal returns.

To control for firm’s risk, we use two traditional risk measures, Leverage and Altman score. Leverage((Goss & Roberts, 2011; Ferrell, Liang, & Renneboog, 2016)) is measured as book value of debt divided by book value of assets, according to the trade-off theory, overleveraged firms may tend to issue equity. Firms with higher Leverage perceived as risker firms, Thus, we expect that Leverage will be positively related to yield spread and yield to yield to maturity and negatively related to Bond ratings and cumulative abnormal returns. Altman Z-score (Altman (1968, Ge & Liu, 2015; Chava, 2014) is measured as:

Altman Z-score is a method of predicting the firm’s state of financial distress . A score range between zero and 1.8 consider a distress zone, 1.8-3.0 range treated as a gray zone and a range of 3.0 – 4.0 consider safe zone. We expect that Altman Z-score will be negatively related to yield spread and yield to yield to maturity and positively related to Bond ratings and cumulative abnormal returns.

To control for firm’s audit quality (Menz (2010) and Oikonomou, Brooks, and Pavelin (2014), we include an indicator variable for auditor reputation. It takes the value of one for Big Four auditors and zero otherwise. We expect that the Big Four indicator variable will be negatively related to yield spread and yield to yield to maturity and positively related to Bond ratings and cumulative abnormal returns. Finally, to control for firm’s profitability and ability to cover interest and debt payment ((Godfrey, 2005; Du et al., 2015; Ferrell et al., 2016)), we include Return on Assets ,defined as net income divided by total assets, in our control variables at the firm level. We expect that profitability will be negatively related to yield spread and yield to yield to maturity and positively related to Bond ratings and cumulative abnormal returns.

Since this paper examines whether the environmental, social, and governance (ESG) performance and its individual pillars impact the Bonds risk premium , we include the combined ESG score (Polbennikov et al. (2016) and Apergis, Filippidis, & Shabani (2022)), ESG score, ESG controversies score and the three primary pillars of the ESG score: Environmental(E), Social(S), and Governance(G) pillars. We predict that the combined ESG score, ESG score, ESG controversies score and ESG three primary pillars to lower Bond market risk premium (Spread) and Yield to maturity and increase Bond rating and announcements cumulative abnormal return.

All issuer characteristic control variables are lagged by one year to reduce the risk that covariates may lead the dependent variables rather than reflect prior conditions

Table 2 Panel A shows the descriptive statistics of the Issuer Characteristics variables for the full sample of 4,258 firms, Issuer firms who don’t release ESG performance data and issuer firms who release ESG performance data, respectively. Issuer firms reporting ESG performance data tend to be significantly larger firms, carrying less debt, more profitable , have more audit quality, and higher Altman Z-score

**Offer characteristics Control variables**

While focusing on straight debt issues create more homogeneous sample, yet straight debt bonds vary in terms of uncertainty , rating and interest rate risk. To control for uncertainty , We include the bond maturity (Myers & Majluf, 1984; Mikkelson & Partch, 1986) at time of issuance, measured as the log of the numbers of years until the bond matures. Bonds with longer maturity carry greater uncertainty thus we expect the maturity to be positively related to yield spread and yield to maturity. To control for bond’s interest rate risk, we include the bond Duration (Dann & Mikkelson, 1984; Chava, 2014) in our control variables. Bonds with higher durations are sensitive to interest rate changes thus we expect the Duration to be negatively related to yield spread and yield to maturity. Finally, we include the Issue Relative Size measured as the Issue amount divided by total assets. The impact of the Issue Relative Size on yield spread and yield to maturity found to have mixed results (Ortiz-Molina, 2006; Howton et al., 1998).about sign in previous studies. Table 2 Panel B shows the descriptive statistics of the Issuer Characteristics variables for the full sample of 4,258 firms, Issuer firms who don’t release ESG performance data and issuer firms who release ESG performance data, respectively. Issuer firms reporting ESG performance data tend to be significantly larger firms, carrying less debt, more profitable , have more audit quality, and higher Altman Z-score

Table 2 Panel B shows the descriptive statistics of the bond Offer characteristics variables for the full sample of 8,453 offerings. Offers by Issuer firms report ESG performance data tend to significantly have lower Yield Spread, Yield to Maturity, Issue Relative Size, and higher rating, market reaction , Maturity and Duration .

Table 3 Panel A and B shows the correlation among our dependent and independent variables. Notability that all our independent ( both in the full sample of 8543 and subsample 6752) variables have the predicted sign of correlation, but the Big4 that shows a positive relation with yield spread and ESG Controversies score that shows a negative relation with Moody’s rating. The high correlations among some of the i independent variables raise the suspicion of multicollinearity in regression analysis, an issue that we address in the next section.

### 3.3 Estimation models

To test the impact of ESG performance and each ESG pillar impacts on cost of debt, bond rating and the market reaction to Bond announcements, we used the following general model

Estimating the base model for the sub sample of firm that reports ESG performance raises the issues of selection bias . To address this problem, we employ a Heckman (1979) two-stage model to correct for the selection bias. The first stage examines factors affecting the firm’s choice of reports on ESG performance data. The general model setup is as follows:

(1)

(2)

Equation (1) is the selection function of reporting ESG performance or not. Simultaneously, the second stage examines factors that affect the cost of debt, Ratings and cumulative abnormal return, given that the firm decides to report ESG performance measures data.

The error terms and are assumed to be normally distributed. The error terms assumed to be correlated with a correlation coefficient (*ρ* ). The Heckman model utilizes the maximum likelihood estimation (MLE) method to allow the error terms to be correlated across equations. If the MLE of the correlation coefficient *ρ* is significant, then two-stage mode estimation is more efficient than that of one independent regression equation.

In addressing the sample selection problem in equation 2 , In the first step, we estimate equation (1) to obtain the selectivity bias terms (the inverse of Mill’s ratio). In the second step, we incorporate the inverse of Mill's ratio in the regression model to explicitly consider the selection processes that produce unbiased estimates. If the inverse of Mill's ratio is statistically significant, it suggests that selection bias is present, and that the firms reporting ESG metrics differ in unobserved ways from those that do not. Heckman correction will guarantee unbiased estimates of the impact of reporting ESG on Yield Spread, rating and cumulative abnormal return, since it is accounting for the fact that only certain firms choosing to report ESG are included in our sample.

Table 3 shows high correlations among some of the independent variables that raise the suspicion of multicollinearity in regression analysis. Especially the correlation between Z score and the Issue relative size. To detect multicollinearity in our regression analysis we utilized the Variance Inflation Factor (VIF) for each model. We found that Z score has a VIF close to 10, thus we dropped Z score (Kennedy (2008), Gujarati and Porter (2009) from our model in the second stage since we have other good proxies for Firms default risk in the models.

we specify the following Base models:

First-stage

Second stage

Model 1:

Model 2:

Model 3:

The industry-specific intercept ( assists in controlling for unobserved heterogeneity across firms-industry, and the year-specific intercept ( assists in controlling for unobserved heterogeneity across time. For the base model, we included the full Sample of 8562 offers.

### Empirical Results

To evaluate hypothesis 1, the Yield Spread is regressed on ESG performance metrics and various firms and Offer control variables. Table 4 shows that the coefficients for ESG Combined and ESG scores are negative and significant at the 1 percent level, suggesting that higher ESG performance is associated with a lower cost of Debt. This finding aligns with CSR previous studies found that higher CRS reduces financing costs (Oikonomou, Brooks, and Pavelin (2014), Chava (2014), and Ge and Liu (2015) . This indicates that the market responds favorably to firms with better ESG performance, reflecting a discount for firms perceived as more socially responsible. Table 4 yields comparable results when the model includes the pillar components of the ESG score. The Governance Pillar shows a negative significant coefficient, suggesting that effective governance practices such as firm management, shareholder alignment, and a clear ESG strategy negatively influence Yield Spread (Goss and Roberts (2011) and Du et al. (2015)). The coefficient for the Social Pillar is also negative and significant (Ferrell, Liang, and Renneboog (2016) and Apergis, Filippidis, and Shabani (2022)) at the 1 percent level, indicating that more robust performance in social categories like workforce management, human rights, community engagement, and product responsibility is associated with lower Yield Spread. In addition, the coefficient for the Environmental Pillar is negative and statistically significant. This result suggests that environmental performance, as defined by resource use, emissions management, and environmental innovation, does significantly impact the Yield Spread (Chava (2014).

The coefficients for Firm Size, Return on Assets are negative and significant(Menz (2010) and Attig et al. (2013), indicating that larger and profitable firms tend to experience lower cost of Debt. Firms with higher Leverage experience higher cost of Deb, due to the increase of default probability. Leverage has a negative coefficient, yet it is not statistically significant. The offer characteristics also impact the cost of debt. The coefficients for Moody's Rating and Duration are negative and significant, and the coefficient for Maturity is positive as predicted. similar to the f Howton et al. (1998) and Ferrell et al. (2016) results ,the coefficient for Issue Relative Size and Big4 are not statistically significant. Overall, the results in Table 4 indicate that firms with a better ESG performance realized lower cost of Debt.

Table 5 shows the regression results examining the relationship between Bond Ratings and the explanatory and control variables. Both the ESG combined and ESG scores show a significant positive relation (Attig et al. (2013) and Oikonomou et al. (2014). This confirms hypothesis 2 that better ESG performance is associated with higher Bond Ratings. The coefficients for Firm Size, Return on Assets and Big4 are positive and significant (Menz (2010) and Goss and Roberts (2011)), indicating that larger ,profitable, better quality audit firms tend to have higher Bond rating. Firms with higher Leverage experience lower Bond rating(Chava (2014) and Ge and Liu (2015)), due to the increase of default probability. None of the offer characteristics shows a significant impact of bond rating . This is possibly because those variables are measured at the time of the issue. These results affirm that Bond rating is driven by the issuer characteristics.

To evaluate hypothesis 3, the CAR (-1, 1) is regressed on ESG performance metrics and various control variables. Table 5 shows that the coefficients for ESG Combined and ESG scores are positive and significant (Howton et al. (1998) and Apergis et al. (2022)) at the 1 percent level, suggesting that higher ESG performance is associated with a positive reaction to Bond offerings. This indicates that the market responds favorably to firms with better ESG performance. The coefficients for Firm Size and Big Four audit are positive and significant (Mikkelson and Partch (1986) and Ge & Liu (2015)), indicating that larger and well-audited firms tend to experience higher cumulative announcement returns. Leverage has a significantly negative coefficient (Menz (2010) and Attig et al. (2013)). None of the offer characteristics shows a significant impact of bond rating, affirming that market reaction is driven by the issuer characteristics.

Table 5 yields comparable results when the model includes the pillar components of the ESG score. The Governance Pillar shows a positive significant coefficient, suggesting that effective governance practices such as firm management, shareholder alignment, and a clear CSR strategy positively influence cumulative announcement returns. The coefficient for the Social Pillar is also positive and significant at the 1 percent level, indicating that more robust performance in social categories like workforce management, human rights, community engagement, and product responsibility is associated with higher cumulative announcement returns. The coefficient for the Environmental Pillar is positive and statistically significant. This result suggests that environmental performance, as defined by resource use, emissions management, and environmental innovation, does significantly impact the Bond announcement returns.

Overall, the paper documents compelling evidence that firms with higher ESG performance experience significantly lower Cost of Debt, higher Ratings and more positive cumulative abnormal returns .

### Conclusion

This paper examines the impact of a firm’s ESG performance and the ESG component pillars on the cost of Debt using a comprehensive sample of U.S. corporate bond issuances spanning from 2004 to 2022. The findings indicate that firms with higher ESG scores experience significantly lower cost of Debt, higher Bond ratings and more postive cumulative abnormal returns around the bond announcements. The results support the theoretical predictions that the market weighs environmental practices, governance practices, and social responsibility when evaluating bond offerings. Specifically, the Environmental , Social and Governance pillars of ESG positively influence market reactions . Further, the results from the Yield Spread and Bond rating models show that the financial market is willing to accept lower yields on Bonds from firms with high ESG practices, suggesting that the market views firms with higher ESG as lower-risk borrowers. Accordingly, the results support a number of theories, namely, the signaling theory (Spence, 1973), stakeholder theory (Freeman, 1984), risk mitigation theory (Orlitzky & Benjamin, 2001), and Agency Theory (Jensen & Meckling, 1976). This study contributes to the growing literature on ESG and its impact on firms' financial performance by providing empirical evidence on the importance of the Environmental, Social, and Governance pillars in reducing a firm’s cost of debt.

**Figure 1**

**A diagram of a circular chart

Description automatically generated with medium confidence**

***Source:*** [***LSEG ESG***](https://www.lseg.com/content/dam/data-analytics/en_us/documents/methodology/lseg-esg-scores-methodology.pdf)

**Figure 2**

A diagram of esg score

Description automatically generated

***Source:*** [***LSEG ESG***](https://www.lseg.com/content/dam/data-analytics/en_us/documents/methodology/lseg-esg-scores-methodology.pdf)

**Table 1: The Sample**

**Panel A**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Year | Total Number of Bonds Issued | Issues without ESG | Issues with ESG | Total Number of Issuer Firms | Total Number of Issuer without ESG | Total Number of Issuer with ESG |
| 2004 | 259 | 149 | 110 | 177 | 111 | 66 |
| 2005 | 214 | 83 | 131 | 150 | 66 | 84 |
| 2006 | 236 | 78 | 158 | 155 | 62 | 93 |
| 2007 | 287 | 78 | 209 | 160 | 54 | 106 |
| 2008 | 257 | 52 | 205 | 136 | 30 | 106 |
| 2009 | 407 | 72 | 335 | 247 | 61 | 186 |
| 2010 | 419 | 120 | 299 | 276 | 97 | 179 |
| 2011 | 415 | 96 | 319 | 232 | 78 | 154 |
| 2012 | 542 | 105 | 437 | 304 | 83 | 221 |
| 2013 | 509 | 130 | 379 | 273 | 96 | 177 |
| 2014 | 550 | 114 | 436 | 269 | 86 | 183 |
| 2015 | 636 | 61 | 575 | 262 | 47 | 215 |
| 2016 | 543 | 30 | 513 | 228 | 21 | 207 |
| 2017 | 585 | 53 | 532 | 258 | 31 | 227 |
| 2018 | 396 | 34 | 362 | 171 | 15 | 156 |
| 2019 | 498 | 25 | 473 | 221 | 20 | 201 |
| 2020 | 851 | 24 | 827 | 335 | 15 | 320 |
| 2021 | 553 | 87 | 466 | 281 | 56 | 225 |
| 2022 | 296 | 92 | 204 | 123 | 36 | 87 |
| **Total** | **8,453** | **1,483** | **6,970** | **4,258** | **1,065** | **3,193** |
| **Panel B** |  |  |  |  |  |  |
| Construction/Mining | 826 | 272 | 554 | 540 | 216 | 324 |
| Manufacturing | 4,075 | 501 | 3,574 | 1,980 | 353 | 1,627 |
| Transportation | 1,227 | 263 | 964 | 515 | 176 | 339 |
| Wholesale /Retail Trade | 1,012 | 160 | 852 | 509 | 116 | 393 |
| Services | 1,313 | 287 | 1,026 | 714 | 204 | 510 |
| **Total** | **8,453** | **1,483** | **6,970** | **4,258** | **1,065** | **3,193** |

**Table 2: Descriptive Statistics**

**Panel A:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variables | Bonds Issues | Issuers without ESG | Issuers with ESG | Diff |
| **Issuer characteristics** |  |  |  |  |
| Issuer Size | 15.945 | 14.847 | 16.312 | 1.465\*\* |
| Leverage | 38.237 | 45.683 | 35.754 | -9.929\*\* |
| Big4 | 0.228 | 0.165 | 0.249 | 0.084\*\* |
| Return on Assets | 4.454 | 1.343 | 5.491 | 4.148\*\* |
| Z-score | 1.884 | 1.235 | 2.101 | 0.865\*\* |
| ESG Combined | 35.332 |  | 47.116 |  |
| ESG Controversies \* | 58.926 |  | 78.580 |  |
| ESG | 38.804 |  | 51.747 |  |
| - Environment Pillar | 32.587 |  | 43.456 |  |
| - Social Pillar | 39.994 |  | 53.333 |  |
| - Governance Pillar | 42.391 |  | 56.530 |  |
| **N** | **4,258** | **1,065** | **3,193** | **4,258** |
| **Offer characteristics** |  |  |  |  |
| Yield Spread | 0.447 | 0.831 | 0.365 | -0.467\*\* |
| Moody's Rating | 10.991 | 9.292 | 11.352 | 5.686\*\* |
| CAR[-1,+1] | 0.658\*\* | -0.207 | 0.842\*\* | 0.694\*\* |
| Maturity | 2.222 | 2.156 | 2.236 | 0.079\* |
| Duration | 7.906 | 7.230 | 8.050 | 0.820\*\* |
| Issue Relative Size | 0.046 | 0.096 | 0.036 | -0.061\*\* |
| **N** | **8,453** | **1,483** | **6,970** | **8,453** |

\*, \*\* indicate significance at 5%, and 1% level, respectively

\*Each ESG measure has a polarity indicating whether a higher value is positive or negative. Companies with no controversies get a score of 100.

**Table 3: Correlation Matrix**

**Full Sample**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | Issuer Size | Leverage | Big4 | Return on Assets | Z-score | ESG Combined | ESG Controversies \* | ESG | Environment | Social | Governance | Yield Spread | Moody's Rating | CAR[-1,+1] | Maturity | Duration | Relative Size |
| Issuer Size | 1 | -.261\*\* | 0.013 | .150\*\* | .031\*\* | .421\*\* | -.122\*\* | .605\*\* | .610\*\* | .596\*\* | .457\*\* | -.389\*\* | .372\*\* | .090\*\* | .137\*\* | .179\*\* | -.056\*\* |
| Leverage | -.261\*\* | 1 | -.169\*\* | -.170\*\* | -.173\*\* | -.155\*\* | -.069\*\* | -.182\*\* | -.164\*\* | -.163\*\* | -.182\*\* | .261\*\* | -.122\*\* | -.077\*\* | -.055\*\* | -.064\*\* | -.030\*\* |
| Big4 | 0.013 | -.169\*\* | 1 | .035\*\* | .021\* | -.040\*\* | .035\*\* | -.049\*\* | -.042\*\* | -.050\*\* | -.031\*\* | .046\*\* | .097\*\* | .034\*\* | .028\*\* | -.026\* | -0.001 |
| Return on Assets | .150\*\* | -.170\*\* | .035\*\* | 1 | .231\*\* | .196\*\* | .080\*\* | .202\*\* | .175\*\* | .207\*\* | .168\*\* | -.298\*\* | .144\*\* | .042\*\* | .103\*\* | .111\*\* | -.053\*\* |
| Z-score | .031\*\* | -.173\*\* | .021\* | .231\*\* | 1 | .088\*\* | .051\*\* | .087\*\* | .071\*\* | .082\*\* | .083\*\* | -.109\*\* | .065\*\* | 0.004 | 0.010 | .037\*\* | .761\*\* |
| ESG Combined | .421\*\* | -.155\*\* | -.040\*\* | .196\*\* | .088\*\* | 1 | .564\*\* | .912\*\* | .809\*\* | .870\*\* | .819\*\* | -.291\*\* | .187\*\* | .093\*\* | .053\*\* | .095\*\* | -.025\* |
| ESG Controversies \* | -.122\*\* | -.069\*\* | .035\*\* | .080\*\* | .051\*\* | .564\*\* | 1 | .274\*\* | .123\*\* | .251\*\* | .385\*\* | -.033\*\* | -.113\*\* | 0.002 | -0.014 | -0.008 | -0.008 |
| ESG | .605\*\* | -.182\*\* | -.049\*\* | .202\*\* | .087\*\* | .912\*\* | .274\*\* | 1 | .915\*\* | .960\*\* | .862\*\* | -.342\*\* | .291\*\* | .111\*\* | .075\*\* | .126\*\* | -.031\*\* |
| Environment Pillar | .610\*\* | -.164\*\* | -.042\*\* | .175\*\* | .071\*\* | .809\*\* | .123\*\* | .915\*\* | 1 | .867\*\* | .669\*\* | -.326\*\* | .325\*\* | .107\*\* | .091\*\* | .139\*\* | -.030\*\* |
| Social Pillar | .596\*\* | -.163\*\* | -.050\*\* | .207\*\* | .082\*\* | .870\*\* | .251\*\* | .960\*\* | .867\*\* | 1 | .741\*\* | -.343\*\* | .290\*\* | .094\*\* | .076\*\* | .127\*\* | -.031\*\* |
| Governance Pillar | .457\*\* | -.182\*\* | -.031\*\* | .168\*\* | .083\*\* | .819\*\* | .385\*\* | .862\*\* | .669\*\* | .741\*\* | 1 | -.269\*\* | .188\*\* | .107\*\* | .038\*\* | .077\*\* | -.027\* |
| Yield Spread | -.389\*\* | .261\*\* | .046\*\* | -.298\*\* | -.109\*\* | -.291\*\* | -.033\*\* | -.342\*\* | -.326\*\* | -.343\*\* | -.269\*\* | 1 | -.199\*\* | -.059\*\* | .102\*\* | -.133\*\* | 0.016 |
| Moody's Rating | .372\*\* | -.122\*\* | .097\*\* | .144\*\* | .065\*\* | .187\*\* | -.113\*\* | .291\*\* | .325\*\* | .290\*\* | .188\*\* | -.199\*\* | 1 | .034\*\* | .033\*\* | .055\*\* | -0.009 |
| CAR[-1,+1] | .090\*\* | -.077\*\* | .034\*\* | .042\*\* | 0.004 | .093\*\* | 0.002 | .111\*\* | .107\*\* | .094\*\* | .107\*\* | -.059\*\* | .034\*\* | 1 | 0.008 | 0.017 | 0.006 |
| Maturity | .137\*\* | -.055\*\* | .028\*\* | .103\*\* | 0.010 | .053\*\* | -0.014 | .075\*\* | .091\*\* | .076\*\* | .038\*\* | .102\*\* | .033\*\* | 0.008 | 1 | .208\*\* | -0.009 |
| Duration | .179\*\* | -.064\*\* | -.026\* | .111\*\* | .037\*\* | .095\*\* | -0.008 | .126\*\* | .139\*\* | .127\*\* | .077\*\* | -.133\*\* | .055\*\* | 0.017 | .208\*\* | 1 | -0.002 |
| Issue Relative Size | -.056\*\* | -.030\*\* | -0.001 | -.053\*\* | .761\*\* | -.025\* | -0.008 | -.031\*\* | -.030\*\* | -.031\*\* | -.027\* | 0.016 | -0.009 | 0.006 | -0.009 | -0.002 | 1 |

\*, \*\* indicate significance at 5%, and 1% level, respectively

\*Each ESG measure has a polarity indicating whether a higher value is positive or negative. Companies with no controversies get a score of 100.

**Sub Sample**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | Issuer Size | Leverage | Big4 | Return on Assets | Z-score | ESG Combined | ESG Controversies \* | ESG | Environment | Social | Governance | Yield Spread | Moody's Rating | CAR[-1,+1] | Maturity | Duration | Relative Size |
| Issuer Size | 1.00 | -.206\*\* | -.031\* | .039\*\* | -0.01 | .205\*\* | -.600\*\* | .549\*\* | .556\*\* | .530\*\* | .270\*\* | -.344\*\* | .378\*\* | .085\*\* | .116\*\* | .143\*\* | -.036\*\* |
| Leverage | -.206\*\* | 1.00 | -.185\*\* | -.047\*\* | -.141\*\* | -.028\* | .072\*\* | -.076\*\* | -.080\*\* | -.048\*\* | -.076\*\* | .233\*\* | -.145\*\* | -.072\*\* | -.041\*\* | -.040\*\* | -.079\*\* |
| Big4 | -.031\* | -.185\*\* | 1.00 | 0.02 | 0.02 | -.111\*\* | 0.02 | -.126\*\* | -.085\*\* | -.122\*\* | -.096\*\* | .082\*\* | .094\*\* | .039\*\* | 0.01 | -.040\*\* | 0.01 |
| Return on Assets | .039\*\* | -.047\*\* | 0.02 | 1.00 | .197\*\* | .150\*\* | -.032\*\* | .162\*\* | .129\*\* | .171\*\* | .094\*\* | -.328\*\* | .162\*\* | .040\*\* | .095\*\* | .098\*\* | 0.01 |
| Z-score | -0.01 | -.141\*\* | 0.02 | .197\*\* | 1.00 | .059\*\* | 0.01 | .057\*\* | .040\*\* | .049\*\* | .048\*\* | -.128\*\* | .081\*\* | 0.00 | 0.01 | .037\*\* | .915\*\* |
| ESG Combined | .205\*\* | -.028\* | -.111\*\* | .150\*\* | .059\*\* | 1.00 | .181\*\* | .794\*\* | .684\*\* | .711\*\* | .579\*\* | -.221\*\* | .140\*\* | .074\*\* | .027\* | .066\*\* | 0.00 |
| ESG Controversies \* | -.600\*\* | .072\*\* | 0.02 | -.032\*\* | 0.01 | .181\*\* | 1.00 | -.394\*\* | -.396\*\* | -.388\*\* | -.176\*\* | .169\*\* | -.277\*\* | -.057\*\* | -.059\*\* | -.074\*\* | .039\*\* |
| ESG | .549\*\* | -.076\*\* | -.126\*\* | .162\*\* | .057\*\* | .794\*\* | -.394\*\* | 1.00 | .886\*\* | .912\*\* | .675\*\* | -.316\*\* | .313\*\* | .104\*\* | .063\*\* | .117\*\* | -0.02 |
| Environment Pillar | .556\*\* | -.080\*\* | -.085\*\* | .129\*\* | .040\*\* | .684\*\* | -.396\*\* | .886\*\* | 1.00 | .789\*\* | .417\*\* | -.288\*\* | .330\*\* | .094\*\* | .081\*\* | .127\*\* | -.030\* |
| Social Pillar | .530\*\* | -.048\*\* | -.122\*\* | .171\*\* | .049\*\* | .711\*\* | -.388\*\* | .912\*\* | .789\*\* | 1.00 | .420\*\* | -.315\*\* | .304\*\* | .075\*\* | .063\*\* | .116\*\* | -0.02 |
| Governance Pillar | .270\*\* | -.076\*\* | -.096\*\* | .094\*\* | .048\*\* | .579\*\* | -.176\*\* | .675\*\* | .417\*\* | .420\*\* | 1.00 | -.181\*\* | .141\*\* | .098\*\* | 0.00 | .036\*\* | -0.01 |
| Yield Spread | -.344\*\* | .233\*\* | .082\*\* | -.328\*\* | -.128\*\* | -.221\*\* | .169\*\* | -.316\*\* | -.288\*\* | -.315\*\* | -.181\*\* | 1.00 | -.256\*\* | -.049\*\* | .160\*\* | -.106\*\* | -0.01 |
| Moody's Rating | .378\*\* | -.145\*\* | .094\*\* | .162\*\* | .081\*\* | .140\*\* | -.277\*\* | .313\*\* | .330\*\* | .304\*\* | .141\*\* | -.256\*\* | 1.00 | .024\* | .026\* | .044\*\* | 0.01 |
| CAR[-1,+1] | .085\*\* | -.072\*\* | .039\*\* | .040\*\* | 0.00 | .074\*\* | -.057\*\* | .104\*\* | .094\*\* | .075\*\* | .098\*\* | -.049\*\* | .024\* | 1.00 | 0.00 | 0.01 | 0.00 |
| Maturity | .116\*\* | -.041\*\* | 0.01 | .095\*\* | 0.01 | .027\* | -.059\*\* | .063\*\* | .081\*\* | .063\*\* | 0.00 | .160\*\* | .026\* | 0.00 | 1.00 | .187\*\* | -0.01 |
| Duration | .143\*\* | -.040\*\* | -.040\*\* | .098\*\* | .037\*\* | .066\*\* | -.074\*\* | .117\*\* | .127\*\* | .116\*\* | .036\*\* | -.106\*\* | .044\*\* | 0.01 | .187\*\* | 1.00 | 0.02 |
| Issue Relative Size | -.036\*\* | -.079\*\* | 0.01 | 0.01 | .915\*\* | 0.00 | .039\*\* | -0.02 | -.030\* | -0.02 | -0.01 | -0.01 | 0.01 | 0.00 | -0.01 | 0.02 | 1.00 |

\*, \*\* indicate significance at 5%, and 1% level, respectively

\*Each ESG measure has a polarity indicating whether a higher value is positive or negative. Companies with no controversies get a score of 100.

**Table 4: Bond Spread and ESG Performance**

**Heckman selection**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Heckman selection | Coef. | Coef. | Coef. | Coef. | Coef. | Coef. |
| Variables | First-stage | Second stage | Second stage | Second stage | Second stage | Second stage | Second stage |
| Issuer Size | 0.435\*\* | -0.157\*\* | -0.156\*\* | -0.12\*\* | -0.127\*\* | -0.122\*\* | -0.145\*\* |
| Leverage | -0.005\*\* | 0.007\*\* | 0.006\*\* | 0.007\*\* | 0.007\*\* | 0.007\*\* | 0.006\*\* |
| AltimaZ | 0.013\*\* |  |  |  |  |  |  |
| Return on Assets | 0.017\*\* | -0.023\*\* | -0.023\*\* | -0.022\*\* | -0.023\*\* | -0.022\*\* | -0.023\*\* |
| Big4 | 0.379\*\* | 0.023 | 0.024 | 0.029 | 0.024 | 0.018 | 0.029 |
| ESG Combined \* |  | -0.004\*\* |  |  |  |  |  |
| ESG Controversies |  |  | 0 |  |  |  |  |
| ESG |  |  |  | -0.005\*\* |  |  |  |
| - Environment Pillar |  |  |  |  | -0.003\*\* |  |  |
| - Social Pillar |  |  |  |  |  | -0.005\*\* |  |
| - Governance Pillar |  |  |  |  |  |  | -0.001\*\* |
| Moody's Rating |  | -0.011\*\* | -0.011\*\* | -0.009\*\* | -0.009\*\* | -0.009\*\* | -0.011\*\* |
| Duration |  | -0.01\*\* | -0.01\*\* | -0.01\*\* | -0.01\*\* | -0.01\*\* | -0.01\*\* |
| Maturity |  | 0.26\*\* | 0.26\*\* | 0.26\*\* | 0.262\*\* | 0.259\*\* | 0.259\*\* |
| Issue Relative Size |  | 0.009 | 0.01 | 0.008 | 0.006 | 0.008 | 0.01 |
| Milles Ratio |  | -0.104 | 0.016 | -0.03 | -0.046 | -0.051 | 0.033 |
| Industry Effect |  | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect |  | Yes | Yes | Yes | Yes | Yes | Yes |
| Pseudo R2 | 0.309 | 0.44 | 0.431 | 0.443 | 0.44 | 0.446 | 0.433 |
| N | 8,453 | 6,970 | 6,970 | 6,970 | 6,970 | 6,970 | 6,970 |

\*, \*\* indicate significance at 5%, and 1% level, respectively

\*Each ESG measure has a polarity indicating whether a higher value is positive or negative. Companies with no controversies get a score of 100.

**Table 5: Bond Rating and ESG Performance**

**Heckman selection**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Heckman selection | Coef. | Coef. | Coef. | Coef. | Coef. | Coef. |
| Variables | First-stage | Second stage | Second stage | Second stage | Second stage | Second stage | Second stage |
| Issuer Size | 0.435\*\*\* | 2.267\*\*\* | 2.01\*\*\* | 1.983\*\*\* | 1.94\*\*\* | 2.01\*\*\* | 2.242\*\*\* |
| Leverage | -0.005\*\*\* | -0.014\*\*\* | -0.014\*\*\* | -0.015\*\*\* | -0.016\*\*\* | -0.016\*\*\* | -0.013\*\*\* |
| AltimaZ | 0.013\*\*\* |  |  |  |  |  |  |
| Return on Assets | 0.017\*\*\* | 0.131\*\*\* | 0.128\*\*\* | 0.122\*\*\* | 0.126\*\*\* | 0.122\*\*\* | 0.131\*\*\* |
| Big4 | 0.379\*\*\* | 2.268\*\*\* | 2.278\*\*\* | 2.202\*\*\* | 2.223\*\*\* | 2.277\*\*\* | 2.262\*\*\* |
| ESG Combined \* |  | 0.018\*\*\* |  |  |  |  |  |
| ESG Controversies |  |  | -0.012\*\*\* |  |  |  |  |
| ESG |  |  |  | 0.041\*\*\* |  |  |  |
| - Environment Pillar |  |  |  |  | 0.035\*\*\* |  |  |
| - Social Pillar |  |  |  |  |  | 0.035\*\*\* |  |
| - Governance Pillar |  |  |  |  |  |  | 0.002 |
| Moody's Rating |  |  |  |  |  |  |  |
| Duration |  | -0.01 | -0.009 | -0.013 | -0.016 | -0.013 | -0.01 |
| Maturity |  | -0.15 | -0.148 | -0.144 | -0.165\* | -0.142 | -0.15 |
| Issue Relative Size |  | 0.317 | 0.329\* | 0.322\* | 0.349\* | 0.327\* | 0.318 |
| Milles Ratio |  | 5.883\*\*\* | 4.842\*\*\* | 5.723\*\*\* | 6.048\*\*\* | 5.846\*\*\* | 5.357\*\*\* |
| Industry Effect |  | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect |  | Yes | Yes | Yes | Yes | Yes | Yes |
| Pseudo R2 | 0.309 | 0.226 | 0.227 | 0.235 | 0.241 | 0.236 | 0.224 |
| N | 8,453 | 6,970 | 6,970 | 6,970 | 6,970 | 6,970 | 6,970 |

\*, \*\* indicate significance at 5%, and 1% level, respectively

\*Each ESG measure has a polarity indicating whether a higher value is positive or negative. Companies with no controversies get a score of 100.

**Table 6: Market Reaction Bond Issue Announcement and ESG Performance**

**Heckman selection**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Heckman selection | Coef. | Coef. | Coef. | Coef. | Coef. | Coef. |
| Variables | First-stage | Second stage | Second stage | Second stage | Second stage | Second stage | Second stage |
| Issuer Size | 0.435\*\*\* | 0.737\*\*\* | 0.686\*\*\* | 0.582\*\*\* | 0.607\*\*\* | 0.663\*\*\* | 0.642\*\*\* |
| Leverage | -0.005\*\*\* | -0.018\*\*\* | -0.017\*\*\* | -0.018\*\*\* | -0.018\*\*\* | -0.018\*\*\* | -0.016\*\*\* |
| AltimaZ | 0.013\*\*\* |  |  |  |  |  |  |
| Return on Assets | 0.017\*\*\* |  |  |  |  |  |  |
| Big4 | 0.379\*\*\* | 0.974\*\*\* | 0.968\*\*\* | 0.967\*\*\* | 0.971\*\*\* | 0.985\*\*\* | 0.911\*\*\* |
| ESG Combined \* |  | 0.019\*\*\* |  |  |  |  |  |
| ESG Controversies |  |  | 0.001 |  |  |  |  |
| ESG |  |  |  | 0.024\*\*\* |  |  |  |
| - Environment Pillar |  |  |  |  | 0.014\*\*\* |  |  |
| - Social Pillar |  |  |  |  |  | 0.009\*\* |  |
| - Governance Pillar |  |  |  |  |  |  | 0.019\*\*\* |
| Moody's Rating |  | -0.177 | -0.151 | -0.205\* | -0.198\* | -0.173 | -0.16 |
| Duration |  | 0.007 | 0.008 | 0.006 | 0.005 | 0.007 | 0.009 |
| Maturity |  | 0.032 | 0.031 | 0.031 | 0.023 | 0.031 | 0.041 |
| Issue Relative Size |  | -0.04 | -0.038 | -0.036 | -0.026 | -0.036 | -0.043 |
| Milles Ratio |  | 3.02\*\*\* | 2.398\*\*\* | 2.812\*\*\* | 2.775\*\*\* | 2.643\*\*\* | 2.472\*\*\* |
| Industry Effect |  | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Effect |  | Yes | Yes | Yes | Yes | Yes | Yes |
| Pseudo R2 | 0.309 | 0.032 | 0.03 | 0.033 | 0.032 | 0.031 | 0.034 |
| N | 8,453 | 6,970 | 6,970 | 6,970 | 6,970 | 6,970 | 6,970 |

\*, \*\* indicate significance at 5%, and 1% level, respectively

\*Each ESG measure has a polarity indicating whether a higher value is positive or negative. Companies with no controversies get a score of 100.

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | Yield Spread | Yield to Maturity | Moody's Rating |
| **Offer characteristics** |  |  |  |
| Moody's Rating | - | - |  |
| Maturity | + | + | - |
| Duration | - | + | - |
| Issue Relative Size | ؟ | ؟ | ؟ |
| Issuer Size | - | - | + |
| Leverage | + | + | - |
| Big4 | - | - | + |
| Return on Assets | - | - | + |
| Z-score | - | - | + |
| ESG Combined |  | - | + |
| ESG Controversies \* | - | - | + |
| ESG | - | - | + |
| - Environment Pillar | - | - | + |
| - Social Pillar | - | - | + |
| - Governance Pillar | - | - | + |

**Appendix A: ESG Definitions**

|  |  |
| --- | --- |
| **Measure** | **Definition** |
| **ESG score** | LSEG captures and calculates over 630 company-level ESG measures, of which a subset of 186 (details in the ESG glossary, available on request) of the most comparable and material per industry, power the overall company assessment and scoring process.  These are grouped into ten categories that reformulate the three pillar scores and the final ESG score, which reflects the company’s ESG performance, commitment, and effectiveness based on publicly reported information.  The category scores are rolled up into three pillar scores – environmental, social, and corporate governance. The ESG pillar score is a relative sum of the category weights, which vary per industry for the environmental and social categories. For governance, the weights remain the same across all industries. The pillar weights are normalized to percentages ranging between 0 and 100 (for further details, refer to Appendix C on page 19 of  this document). |
| **ESG Combined Score** | ESGC scores provide a rounded and comprehensive score of a company’s ESG performance based on the reported information pertaining to the ESG pillars, with the ESG controversies overlay captured from global media sources. The main objective of this score is to discount the ESG performance score based on negative media stories. It does this by incorporating the impact of significant, material ESG controversies in the overall ESGC score. |
| **ESG Controversies** | The ESG controversies score is calculated based on 23 ESG controversy topics. During the year, if a scandal occurs, the company involved is penalized, affecting their overall ESGC score and grading. The impact of the event may still be seen in the following year if there are new developments related to the negative event, for example, lawsuits, ongoing legislation disputes or fines. All new media materials are captured as the controversy progresses. The controversies score also addresses the market cap bias from which large-cap companies suffer, as they attract more media attention than smaller-cap companies. |

***Source:*** [***LSEG ESG***](https://www.lseg.com/content/dam/data-analytics/en_us/documents/methodology/lseg-esg-scores-methodology.pdf)

**Appendix B: ESG Pillars Definitions**

|  |  |
| --- | --- |
| **Pillars** | **Definition** |
| **Environmental** | The score is calculated using around **68 key performance indicators (KPIs)** based on three major categories:   * LSEG ESG resource use score (20 indicators) reflects a company’s performance and capacity to reduce the use of materials, energy, or water and to find more eco-efficient solutions by improving supply chain management. * LSEG ESG emissions reduction score (28 indicators) measures a company’s commitment and effectiveness towards reducing environmental emissions in its production and operational processes. * LSEG ESG innovation score (20 indicators) reflects a company’s capacity to reduce environmental costs and burdens for its customers, thereby creating new market opportunities through new environmental technologies and processes or eco-designed products. |
| **Social** | This pillar is evaluated based on 62 KPIs based on three major categories:   * LSEG ESG workforce score (30 indicators) measures a company’s effectiveness in providing job satisfaction, a healthy and safe workplace, maintaining diversity and equal opportunities, and developing opportunities for its workforce. * LSEG ESG human rights score (8 indicators) measures a company’s effectiveness in terms of respecting fundamental human rights conventions. * LSEG ESG community score (14 indicators) measures the company’s commitment to being a good citizen, protecting public health, and respecting business ethics. * LSEG ESG product responsibility score (10 indicators) The product responsibility score reflects a company’s capacity to produce quality goods and services, integrating the customer’s health and safety, integrity, and data privacy. |
| **Governance** | The governance score is derived from **56 KPIs** based on three major categories:   * LSEG ESG management score (35 indicators) measures a company’s commitment and effectiveness towards following best practice corporate governance principles. * LSEG ESG shareholders score (12 indicators) measures a company’s effectiveness towards equal treatment of shareholders and the use of anti-takeover devices. * LSEG ESG CSR strategy score (9 indicators) reflects a company’s practices to communicate that it integrates economic (financial), social and environmental dimensions into its day-to-day decision- making processes. |

***Source:*** [***LSEG ESG***](https://www.lseg.com/content/dam/data-analytics/en_us/documents/methodology/lseg-esg-scores-methodology.pdf)

**Appendix A: Moody’s Rating System**

|  |  |  |  |
| --- | --- | --- | --- |
| Rating symbols | Comments | Rating notches | Ranking scale |
| Investment | | | |
| Aaa | Highest quality, subject to the lowest level of credit risk | Aaa | 21 |
| Aa | High quality, subject to very low credit risk | Aa1 | 20 |
| Aa2 | 19 |
| Aa3 | 18 |
| A | Upper-medium grade, subject to low credit risk | A1 | 17 |
| A2 | 16 |
| A3 | 15 |
| Baa | Medium-grade, subject to moderate credit risk and may possess certain speculative characteristics | Baa1 | 14 |
| Baa2 | 13 |
| Baa3 | 12 |
| Speculative | | | |
| Ba | Judged to be speculative, subject to substantial credit risk | Ba1 | 11 |
| Ba2 | 10 |
| Ba3 | 9 |
| B | Considered speculative, subject to high credit risk | B1 | 8 |
| B2 | 7 |
| B3 | 6 |
| Caa | Speculative of poor standing and subject to very high credit risk | Caa1 | 5 |
| Caa2 | 4 |
| Caa3 | 3 |
| Ca | Speculative and likely in, or very near, default, with some prospect of recovery of principal and interest | Ca | 2 |
| C | The lowest rated and typically in default, with little prospect for recovery of principal or interest | C | 1 |
| Not Rated | Not Rated | NR | 0 |

**Appendix C: Variable Definitions**

|  |  |
| --- | --- |
| CAR | Cumulative abnormal stock return for the time interval (−1, 0, 1) around the SEO announcement for firm i . |
| Underpricing | The closing market price on the offer day minus the offer price, divided by the offer price for firm i . |
| Firm Size | This is measured as the natural logarithm of the book value of total assets for firm i in the year before the SEO announcement. |
| Market-to-Book Value | Calculated as the market value of equity divided by the book value of equity for firm *i* in the year prior to the SEO announcement. |
| Leverage | Defined as the ratio of the book value of long-term debt to the book value of total assets for firm *i* in the year before the SEO announcement. |
| Relative Offer Size | The ratio of the number of shares offered to the total shares outstanding for firm *i* in the year prior to the SEO announcement. |
| Stock Price Runup | Stock returns over the one hundred trading days preceding the SEO announcement for firm *i*. |
| Market Runup | Market returns over the one hundred trading days preceding the SEO announcement for firm *i*. |
| Slack | This is measured as cash and short-term investments divided by total assets for firm *i* in the year before the SEO announcement. |
| Secondary Shares | The percentage of SEO shares sold by existing shareholders relative to the total SEO shares offered for firm *i* in the year of the SEO announcement. |
| Information asymmetry | The standard deviation of the market model residuals is calculated using daily returns from the previous year for firm i . |
| Number of analysts | the total number of analysts following the issuer in the year before the SEO deal. |
| Lagged Price | Log of the closing price on the day before the offer date. |
| Industry Effect | Dummy variables control for unobserved heterogeneity across industries. |
| Year Effect | Dummy variables control for unobserved heterogeneity across time. |

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