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Abstract

Using an up-to-date international sample of firms, we study whether corporate sustainability (proxied by ESG ratings), influences a company's cost of equity and whether Credit Rating Agencies (CRAs) incorporate such an impact in their credit risk assessments. We show that higher ESG performance reduces the cost of equity due to a reduction in ESG risk. This also holds after decomposing the ESG rating into its single-dimensions. Second, we show that CRAs do not incorporate such risk reduction into their credit risk assessments. Our results are robust to endogeneity concerns and the use of two ESG rating providers. They can help guide policies that focus on rating agencies as a potential tool to address ESG concerns

Keywords: Credit rating, ESG rating, Firm risk, Cost of equity
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1 Introduction

How financial performance relates to corporate sustainability, as proxied by an environmental, social, and governance (ESG) rating, has been widely investigated. Although the findings are mixed, the consensus is that better ESG performance reduces risk. One of the main components through which we can observe the risk reduction is the cost of equity (Albuquerque et al., 2019; Goss and Roberts, 2011). Consequently, the firm's credit rating should reflect such a risk reduction (Gillan et al., 2021). However, little attention has been dedicated to the relationship between ESG and credit ratings (Jiraporn et al., 2014; Attig et al., 2013). If ESG is a risk factor and a proxy for some form of hidden systematic risk (e.g., climate change risk), we should expect it to impact firms' cost of equity (Pástor et al., 2021; Becchetti et al., 2018). In such a scenario, credit rating agencies (CRAs) should be able to incorporate such systematic risk exposure into their evaluations. The absence of an impact of ESG on credit ratings may be due to 1) ESG risk being mainly idiosyncratic and, thus, not entering into the credit risk evaluation and possibly being diversified away or 2) CRAs, with their recent acquisitions of ESG rating agencies, have shown their interest in ESG risks but are still facing the challenges with incorporating the different ESG dimensions into their credit risk assessments.[1]

Investigating to what extent credit ratings relate to ESG performance is of primary importance when ESG concerns (climate and social) become more regulated by policymakers. Therefore, we want to verify whether ESG performance influences the cost of equity in the first place and whether CRAs incorporate ESG concerns into their credit risk evaluations. First, we evaluate the impact of the overall ESG rating and the individual environmental, social, and governance pillars on firms' cost of equity and creditworthiness. Second, we verify whether and to what extent credit rating agencies incorporate such a relationship into their creditworthiness evaluations.

Our results show that better ESG practices reduce the cost of equity irrespective of the different ESG dimensions under consideration. ESG ratings proxy for hidden systematic risk components (e.g., climate risk). In our study, one standard deviation increase in the ESG rating reduces firms' equity cost by about 4% per year. Interestingly, after controlling for further endogeneity concerns, addressed in the spirit of Attig et al. (2013) and Liang and Renneboog (2017), it appears that CRAs still do not incorporate such a risk reduction into their creditworthiness evaluations. Our results are consistent across the two ESG rating providers used.

[1] For example, S&P acquired Trucost in 2016, and Moody's acquired Vigeo-Eiris in 2019.

Financial agents such as CRAs are essential for economic dynamics and markets. CRAs are primarily important for an independent assessment of a firm's creditworthiness and inform the investors of the likelihood that an issuer will default on its debt. They may also play a pivotal role in addressing climate change and biodiversity loss, given that they aim at reducing information asymmetries (Scholtens, 2017; Galaz et al., 2018). Both regulatory and market solutions are being offered to gauge the performance of businesses in this regard. The former try to price or mitigate externalities, as in the case of carbon taxes and carbon prices, for example, the European Union's Emission Trading System, or try to specify and define when a particular activity can be regarded as sustainable, for example, the European Union's sustainable finance taxonomy (Regulation (EU) 2020/852).[2] Market solutions include rating agencies that specialize in assessing the ESG performance of businesses (Escrig-Olmedo et al., 2019) and conventional CRAs integrating such performance in their credit rating (Scholtens and Witteveen, 2021).

Finance theory postulates that the financial markets incorporate all the publicly available information that might be relevant for asset (stock) prices (Fama, 1970). This also relates to non-financial information, such as company strikes, environmental hazards, or CEO conduct. All information will be evaluated and used to gauge firm value. The firm's valuation only changes with unexpected information. Risk enters the valuation via discounting: if the perceived risk increases, this will reduce firm value. CRAs primarily assess the solvency of firms and organizations and their sensitivity to shocks (White, 2010). In contrast to stock prices, CRAs traditionally focus on default risk and rely on private information. In the 21st century, credit rating agencies have come to play a crucial role in the assessment of business risk in general (Claessens et al., 2018), whereas they traditionally focused on assessing the default risk of debt (Partnoy, 2002). In addition, specialized rating agencies have emerged that focus on corporate sustainability and its constituents (Escrig-Olmedo et al., 2019). Given the documented risk reduction effect due to better ESG practices, CRAs should incorporate ESG considerations into their ratings to determine how much a firm can meet its financial obligations. Indeed, a few studies have found that ESG performance is positively associated with a firm's credit rating (Chabowski et al., 2019; Jiraporn et al., 2014; Attig et al., 2013, among others).

We provide two insights into this literature using different ESG rating providers. First, we show a negative and significant relation between the overall ESG rating and the cost of equity

[2]For additional details about the European Union taxonomy for a responsible or sustainable activity, please visit: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32020R0852.

proxied by the ESG risk factor betas constructed in the spirit of Fama and French (2012, 2017). More specifically, we show that, on average, better ESG practices reduce the cost of equity by about 4% yearly. After decomposing the overall score into its environmental, social, and governance dimensions, we find that such a negative and significant relation still holds for each ESG dimension even after controlling for endogeneity. Therefore, better ESG practices may reduce the firm's exposure to some hidden ESG systematic risks. Second, we find a positive and significant relationship between ESG and credit ratings, but it completely cancels out after controlling for further endogeneity concerns. Our results still hold when considering different ESG rating providers.

Our analysis complements that of Albuquerque et al. (2019) by showing why firms with high ESG ratings face a lower cost of equity independently from the ESG rating provider. In doing so, we make explicit the mechanism behind the enhanced financial performance of firms with higher ESG ratings previously documented in the literature (Ferrell et al., 2016; Gao and Zhang, 2015; Borghesi et al., 2014). Next, we contribute to the existing literature on the relationship between ESG performance and credit ratings (Jiraporn et al., 2014; Attig et al., 2013). Specifically, in contrast to previous studies, we show that CRAs do not incorporate ESG risk reduction in their credit risk assessment. One possible reason could lie in a mismatch between the methodologies that credit rating agencies use to assess the cash flow-generating capability of a firm in the short term while the consequences of ESG concerns reasonably apply to the long term. This would explain why very few credit ratings have changed due to ESG risk exposures in the last couple of years (Georges et al., 2023). A second possible reason could be the methodology to control for endogeneity when dissecting the relation between ESG and financial performance (Gillan et al., 2021). Finally, a third possible reason may be the additional complexity posed by ESG concerns when evaluating firms' default probabilities (Skreta and Veldkamp, 2009).

The results of our study have important implications for policymakers, practitioners, and financial market participants. If CRAs, through new regulations, are to be pivotal in addressing climate change and related issues, they will need to improve their rating methodology to include ESG considerations explicitly when assessing creditworthiness. For example, by explicitly providing two classes of credit ratings, the first class could address the firm's capability to generate cash flows on the short term, and the second class could focus on the long term and aim to disentangle the potential effect of challenges such as climate change. When assessing ESG risks in their portfolios, practitioners and financial market participants should be aware that credit ratings

generally do not consider these risks.[3]

The structure of the remainder of our study is as follows. We first provide more background about the financial and ESG performance nexus and develop our hypotheses. Then, we introduce the models and data and explain the methods employed. Next, we present and discuss our results and report on the robustness of our analysis. The final section concludes this paper.

2 Background

In this section, we discuss the background behind the relationship between ESG and financial performance, focusing on the risk reduction effects that motivate the introducing our first hypothesis. Next, we postulate why credit rating assessment should capture such a risk reduction and motivate our second hypothesis.

CRAs are key economic players in modern economies because they can assess debt issuers' default probability. They became the center of debate among academics, practitioners, and policymakers after the last financial crisis. In the methodologies of credit risk analysis, a firm is assumed to have a simple debt structure consisting of a single liability with a given maturity.[4] The increasing popularity of ESG investing over recent years adds complexity to evaluating the firm's debt features while incorporating ESG risk exposures. In this respect, Ashbaugh-Skaife et al. (2006) and Bhojraj and Sengupta (2003) show that improved corporate governance may increase firms' creditworthiness. In the same spirit, a novel line of literature is aiming to verify whether and to what extent the environmental and social dimensions may impact credit ratings and firm value (Chabowski et al., 2019; Jiraporn et al., 2014; Attig et al., 2013).

The empirical literature on the relationship between financial performance and ESG performance has provided mixed evidence in this regard.[5] Theoretically, the relation between ESG performance and firm value could be positive or negative.[6] On the one hand, ESG performance could increase firm value by increasing cash flows (e.g., by increasing employee productivity or exploiting consumer preference for sustainable products) or by decreasing the discount rate (e.g., by lowering the firm's cost of debt via the perceived risk or improved reputation). On the other hand, to enhance their utility, managers may push the company to increase ESG performance at

[3] European Central Bank, Guide on Climate-Related and Environmental Risks, 2020.

[4] The methodologies of credit risk analysis adopted by the CRAs rely on the Black and Scholes (1973) and Merton (1974) structural models.

[5] For a theoretical treatment of this mechanism, see, e.g., Albuquerque et al. (2019); Fatemi et al. (2015); Benabou and Tirole (2010).

[6] For an empirical review of the topic, see, e.g., Friede et al. (2015).

the expense of the firm's profit (e.g., charitable donations to institutions and causes favored by top management). So far, the literature seems to converge toward the risk reduction effect implied by better ESG performance (Gillan et al., 2021).

A possible channel toward which we can observe the risk reduction effect is the cost of equity. In this respect, Albuquerque et al. (2019) show, theoretically and empirically, that better ESG performance decreases the systematic risk and increases firm value. Similarly, El Ghoul et al. (2011) and Hong and Kacperczyk (2009) empirical studies show that better ESG practices lead to lower cost of equity with investors tilting their portfolios to firms with better ESG performances. At a more granular level, Ng and Rezaee (2015) show that only the environmental and governance dimension of ESG performance reduces the cost of equity, not the social dimension. While Breuer et al. (2018) show that the cost of equity falls (rises) in countries where investor protection is strong (poor). As such, our first hypothesis aims to verify if and to what extent the overall and single ESG dimensions performance does not trigger a reduction in the cost of equity. Similarly, using the implied cost of capital derived from analysts' forecasts, Chava (2014) show that firms subject to environmental concerns register significantly higher expected returns.

$\mathbf{H}_{0,A}$: *The ESG rating does not impact the cost of equity.*

If the ESG rating impacts the cost of equity because it proxies for some source of investment risk (e.g., climate risk), it should also impact firms' creditworthiness. Therefore, with our second hypothesis, we aim to investigate whether and to what extent existing credit rating agencies incorporate ESG performance, measured via the ESG rating, into their credit ratings. So far, little attention has been dedicated to the relationship between ESG and credit risk.

The existing literature has focused on the relationship between credit ratings and corporate governance (Ashbaugh-Skaife et al., 2006; Bhojraj and Sengupta, 2003), and the relation between ESG and credit ratings in the bond market (Chabowski et al., 2019), whilst mainly paying attention to the overall ESG rating rather than its single environmental, social, and governance components (Jiraporn et al., 2014; Attig et al., 2013, among others). Accordingly, our second null hypothesis is the following:

$\mathbf{H}_{0,B}$: *The ESG rating does not impact the credit rating.*

To test our hypotheses, the main challenge we share with the ESG literature is the potential bias in the results due to endogeneity concerns. In this regard, 1) an unobserved variable may

influence both the dependent and the independent variable of interest; 2) better credit ratings may imply lower interest on debt that generates, in turn, higher net revenues that could be invested in ESG activities. Even if using fixed effects partially deals with such a concern, we take a step further by relying on the empirical evidence on the relation between ESG and the country's legal origin and the industry-based methodology provided by Attig et al. (2013). We will adopt a two-stage methodology and construct two instrumental variables. The first is based on the industry to which the firm belongs (Attig et al., 2013), the second is based on the country where the firm is headquartered (Liang and Renneboog, 2017).

3 Models, Data, and Descriptive Statistics

3.1 Models

This section discusses the models used to test our two hypotheses and introduces the data acquired. Next, we provide the descriptive statistics of the sample of firms used in this study.

To investigate whether ESG ratings affect a firm's cost of equity in the first place, we need an appropriate proxy to capture the ESG risk exposure. To pin down such a risk component, we construct an ESG factor along the lines of Pástor et al. (2021), which shows that, in equilibrium, along with the market factor, the ESG factor prices assets. Following the standard risk-factor procedure (Becchetti et al., 2018; Fama and French, 2012, 2017), in June of year t, we sort firms independently based on their market capitalization and the last available overall ESG rating. The *Small*/*Big* firms are those in the bottom/top 10%/90% percentile of the June market capitalization distribution. The *Worst*/*Best* firms in terms of ESG performances are those in the bottom/top 30%/70% percentile of the June overall ESG rating distribution.

We then take the four possible intersections between the *Big*/*Small* firms and the *Worst*/*Best* firms and compose four value-weighted portfolios using the firms in each intersection. For example, the *Small-Worst* portfolio is made by value-weighting firms with a market capitalization lower than the 10% percentile and an overall ESG rating lower than the 30% percentile. The *Worst-minus-Best* (WMB_{esg}) ESG risk factor is the average return on the two *Worst* ESG portfolios minus the average return on the two *Best* ESG portfolios. We repeat the procedure for each E, S, or G dimension to construct the specific risk factors. We then use the 2-factor specification proposed by Pástor et al. (2021) to estimate the ESG risk factor betas used as a proxy for the ESG

risk component of the cost of equity via the following equation:

$$r^e_{i,t} = \alpha_i + \beta_{mk,i} r^e_{mk,t} + \beta_{esg,i} WMB_{esg,t} + \epsilon_{i,t} \tag{1}$$

where $r^e_{i,t}$ is the return of the stock i at time t in excess of the risk-free asset; $r^e_{mk,t}$ is the excess of market return; the $WMB_{esg,t}$ is the ESG risk factor based on the overall ESG rating or the single-dimension score (E, S, or G). $\epsilon_{i,t}$ is the error term. We acknowledge that part of the literature uses cost of equity measures based on accounting variables and/or analysis forecast (see Breuer et al., 2018; Chava, 2014 in this regard). Our approach complements and improves upon them in two regards. First, by pining down the ESG betas, we precisely isolate the component of returns related to the ESG risk. Second, we rely on the ability of stock markets to discount today's risks, whose effects will manifest in the very long run. So far, both approaches have led to similar results at the current state of the art.

Next, to test our first hypothesis ($H_{0,A}$), we then estimate the following general specification:

$$\hat{\beta}_{esg,i,t} = \theta_0 + \theta_1 ESG_{i,t} + B' X_{i,t} + \nu_{i,t} \tag{2}$$

where $\hat{\beta}_{esg,i,t}$ is our proxy for the firm's cost of equity capturing the specific exposure to the ESG risk (e.g., climate risk). It is estimated using one year of daily returns in the model (1). $ESG_{i,t}$ is the score, ranging from 0 for the worst to 100 for the best firms in ESG practices. Depending on the estimated model, the ESG variable equals the overall ESG rating or the single dimension score (E, S, or G). Our parameter of interest is θ_1. More specifically, θ_1 will be negative and statistically significant if best ESG practices reduce the firm's exposure to some specific form of systematic risk and, with it, the firm's cost of equity. $X_{i,t}$ is a set of explanatory variables commonly used in the credit rating literature (Chabowski et al., 2019; Ashbaugh-Skaife et al., 2006 among others). $\nu_{i,t}$ is the error term.

Subsequently, we test our second hypothesis ($H_{0,B}$) to verify whether the firm's creditworthiness mirrors the relation between ESG ratings and the cost of equity. Due to the ordinal nature of the credit ratings, we follow a methodology of Liang and Renneboog (2017) and Attig et al. (2013) and estimate the probability that higher ESG rating lead to higher credit ratings using the

following general specification for an ordered probit model:

$$y^*_{i,t} = \lambda_0 + \lambda_1 ESG_{i,t} + B'X_{i,t} + \eta_{i,t} \tag{3}$$

where $y^*_{i,t}$ is an unobserved latent variable measuring the firm's default probability. We use credit ratings to link unobserved default probabilities to the ESG ratings. More specifically, $y^*_{i,t}$ is the credit rating assigned by a CRA that is converted to an ordinal scale. Moreover, in line with Liang and Renneboog (2017) and Attig et al. (2013) and their ordered probit models, $y^*_{i,t}$ is linked to the observed ordinal response categories $y_{i,t}$:

$$y_{i,t} = \begin{cases} 1 & \text{if } y^*_{i,t} \leqslant \mu_1 \\ 2 & \text{if } \mu_1 < y^*_{i,t} \leqslant \mu_2 \\ \vdots & \vdots \qquad \vdots \\ 7 & \text{if } \mu_6 < y^*_{i,t} \leqslant \mu_7 \\ 8 & \text{if } \mu_7 < y^*_{i,t} \leqslant \mu_8 \end{cases} \tag{4}$$

The μ's represent thresholds to be estimated (along with the coefficients β) using maximum likelihood estimation, subject to the constraint that $\mu_1 < \mu_2 < \cdots < \mu_7 < \mu_8$. $\eta_{i,t}$ is the error term. In equation (3), our parameter of interest is instead λ_1. If, via better ESG practices, firms reduce their cost of equity, we should observe a positive and significant λ_1.

Both models (2) and (3) may suffer from potential endogeneity issues: 1) an unobserved variable may influence both the dependent and the independent variable of interest; 2) better credit ratings may imply lower interest on debt that generates, in turn, higher net revenues that could be invested in ESG activities. To cope with the endogeneity concerns in points 1) and 2), we first include industry-, time-, and country-fixed effects to control for unobserved effects at the industry, time, and country levels. Next, we implement a two-step procedure using two instruments. For the first instrument, we follow Attig et al. (2013) and use the average overall and single-dimension ESG ratings by time and industry. Firms within the same industry may share similar characteristics and face similar challenges in improving their ESG performance. As such, an industry's average ESG ratings can create more homogeneous groups, reducing the potential endogeneity arising from unobservable heterogeneity across firms. It is important to emphasize that using the average ESG ratings within an industry as an instrument alleviates but does not completely eliminate endogeneity concerns.

To strengthen the analysis, we compute a second instrument based on empirical evidence provided by Liang and Renneboog (2017) showing that the country's legal origin is related to the ESG rating of the firm depending on where the firm is headquartered. We make this instrument by taking the average of the overall ESG rating and its single dimensions by time and the country's legal origin where the company is headquartered.

In summary, by using industry-, time-, and country-fixed effects, the average ESG ratings across firms in the same industry and the country's legal origin help mitigate the endogeneity concerns and strengthen the robustness of our results.

3.2 Data and Descriptive Statistics

We collect data from different sources. First, the yearly credit rating data is provided by Standard & Poor's (S&P) at the firm level and ranges between *AAA* (assigned to firms with the highest creditworthiness) to *D* (given to firms in default). Next, in line with Attig et al. (2013), we assign firms into the notched categories to the main class category. For example, firms entering into the AA^+ and AA^- categories are assigned to the primary *AA* category because these firms have roughly similar default probabilities. The categorical credit ratings are then converted to an ordinal scale from 8 (*AAA*) for the firm with the lowest default probability to 1 (CC) with the highest default probability.

The overall ESG rating and the single E, S, and G dimension scores are retrieved from Refinitiv. For the Refinitiv dataset, the overall ESG rating is given by the weighted average of the firm's scores in each category within the single E, S, and G dimensions.[7] We additionally retrieve the ESG rating by Sustainalytics based on core and industry-specific indicators.[8] Our use of two ESG rating providers is motivated by the recent evidence from the literature on the divergence of ESG ratings across different rating agencies due to the different methodologies and weighting schemes applied (see Berg et al., 2022). Using two ESG rating providers mitigates concerns that the interpretation of our results might change due to the use of different ESG ratings.

Additionally, to isolate the effects of the firm's ESG rating on its creditworthiness, we retrieve a set of variables commonly used in the credit rating literature (Chabowski et al., 2019; Attig et al., 2013; Ashbaugh-Skaife et al., 2006, among others). Accordingly, from Refinitiv, we retrieve

[7]For an in-depth overview of the universe and the methodology used to assess the ESG rating of a firm visit https://www.refinitiv.com/en/sustainable-finance/esg-scores.

[8]Notice that by the end of 2020, Sustainalytics has changed the methodology used to assess the ESG level of a firm, but we use the scores up to 2022 computed using the old method. For additional details, visit https://www.sustainalytics.com/esg-data.

the following firm-level data on an annual basis: total assets; net sales or revenues; earnings before interest and taxes; operating income; long-term debt; property, plant, and equipment; Global Industry Classification Standard (GICS) classification; and the country where the firm is headquartered. Following Attig et al. (2013), size is defined as the logarithm of the total assets in USD million ($Size$), coverage is defined as the earnings before interest and taxes plus interest expense divided by interest expense (Cov), margin is defined as the ratio of operating income to sales (Mar), leverage is defined as the ratio of long term debt to total assets (Lev), and the ratio of property plant and equipment to total assets (Cap). Furthermore, we collect the daily returns index together with the daily excess return of the market (Mkt) and the one-month T-bill rate (Rf) from the Fama and French (2012, 2017) global risk-factor database.[9,10]

Following Fama and French (2012, 2017), we filter out ADRs (American Depository Receipts), units, preferred shares, stapled securities, and financials. As a result, we end up with a sample of 1,717 unique firms between 2002 and 2022. Table 1 reports the descriptive statistics for the firm-specific characteristics of the Refinitiv sample. Looking at this sample, the average firm has an overall ESG rating of 50.25 on a theoretical scale from 0 to 100. Breaking down the overall ESG rating into its single-dimension components, the average firm achieves the highest score in the governance dimension (55.84, G) and the lowest in the environmental dimension (42.95, E). In addition, the average firm has a credit rating of 4.77, corresponding almost to the BBB (5.00) category. Concerning the credit rating, profitability, and leverage, the characteristics of our sample appear to align with those of Attig et al. (2013). The only substantial difference appears to be on the size variable, where our sample is characterized by smaller firms, probably because it is not exclusively composed of US firms. Moreover, if we look at the median, half of the sample is below investment grade. Looking at the ESG factor betas, firms rated by Refinitiv appear, on average, to have positive risk exposure to the overall ESG risk ($\hat{\beta}_{esg}$, column 11), which appears to be driven by the environmental risk exposure ($\hat{\beta}_{e}$, column 12) and mitigated by the social and governance dimensions ($\hat{\beta}_{s}$ and $\hat{\beta}_{g}$, columns 13 to 14).

Table A-1 in the Appendix shows the sample breakdown by the Country (Panel A) and Industry (Panel C) following the GICS classification. At the country level, half of the dataset covers firms

[9]The data types of the variables retrieved are as follows: $WC02999$ (total assets), $WC01001$ (net sales or revenues), $WC18191$ (earnings before interest and taxes), $WC01250$ (operative income), $WC03251$ (long-term debt), $WC02501$ (property, plant, and equipment), $TR.GICSIndustry$ (GICS Industry Classification), $TR.ExchangeCountry$ (Country of Exchange), and Return Index (RI).

[10]Fama/French web page: http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html.

from the United States, followed by Canada and the United Kingdom (Panel A). As such, Table A-1 shows that our dataset appears to be tilted towards firms in the US (Panel A); at the same time, it appears to be scattered across the different industries (Panel B). We will use the country- and industry-fixed effect to control for any possible bias that might arise from the relation between the ESG level of the firm and the country or industry to which it belongs.

Table 1. Descriptive Statistics

The table reports the distributions for the time series averages of the yearly firm characteristics. The firm characteristics are the overall ESG rating (ESG), the environmental dimension score (E), the social dimension score (S), and the governance dimension score (G) provided by Refinitiv; the credit rating assigned by Standard & Poor's ($S\&P$), the logarithm of total assets in USD million ($Size$), earnings before interest and taxes plus interest expense divided by interest expense (Cov), the ratio of operating income to sales (Mar), the ratio of long-term debt to total assets (Lev), the ratio of property plant and equipment to total assets (Cap), the ESG risk factor betas are estimated over one year of daily data ($\hat{\beta}_{esg}$, $\hat{\beta}_{e}$, $\hat{\beta}_{s}$, and $\hat{\beta}_{g}$) by using equation (1). The sample consists of 1,717 unique firms from the 2002 to 2022 period.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	ESG	E	S	G	$S\&P$	$Size$	Cov	Mar	Lev	Cap	$\hat{\beta}_{esg}$	$\hat{\beta}_{e}$	$\hat{\beta}_{s}$	$\hat{\beta}_{g}$
$Avg.$	50.25	42.95	51.11	55.84	4.77	1.74	16.97	0.14	0.28	0.37	0.01	0.14	-0.12	-0.12
Med	50.86	44.93	50.89	58.02	5.00	1.74	5.67	0.11	0.26	0.31	-0.01	0.09	-0.16	-0.08
$Std.$	21.35	29.63	23.75	22.50	1.10	1.58	58.39	0.23	0.18	0.28	0.48	0.61	0.55	0.78

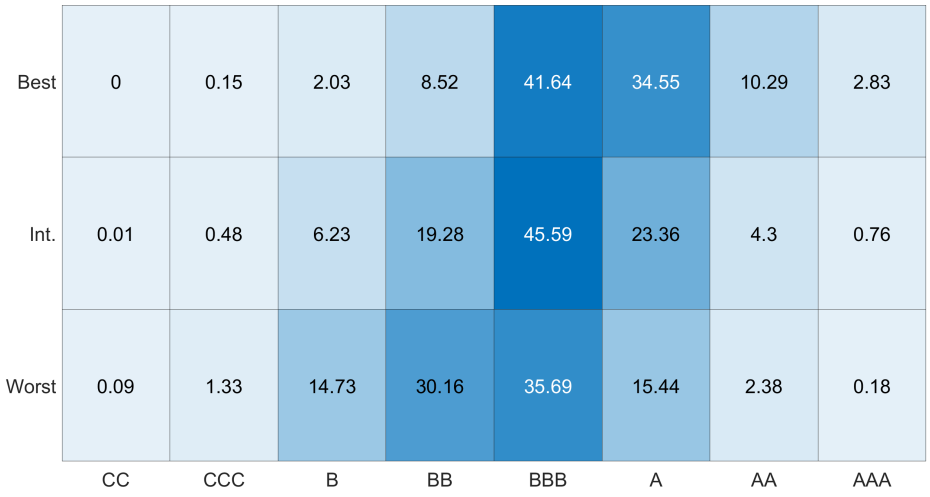
To gauge any existing relation between ESG ratings and credit ratings, similar to the ESG risk factor construction, we first group the firms into three groups based on their overall ESG rating at time t. $Worst$ is the group of firms with an ESG rating lower than or equal to the $30th$ percentile of the overall ESG rating distribution; $Intermediate$ ($Int.$) is the group of firms with a score between the $30th$ and the $70th$ percentile; and $Best$ is the group of firms with a score greater than the $70th$ percentile. Next, for every year t, we compute the frequency of firms in each possible credit ratings category (from CC to AAA), conditioning on the ESG group they belong to. We can interpret such frequencies as the probability that a firm in our sample enters into a specific credit rating category given the ESG group it belongs to. Finally, we average out such probabilities across time.

Figure 1 reports the resultant descriptive evidence for Refinitiv using the overall ESG rating. The figure shows that the probability of firms ending up in a higher credit rating category increases monotonically as firms move from $Worst$ to $Best$, but only for firms with a rating above category A. The opposite reasoning holds for firms with a credit rating below BBB. These firms are more likely to end up in a lower credit rating category as they move from $Best$ to $Worst$. Similar descriptive evidence holds for the single-dimension ESG groups and the credit rating categories

reported in Figures A-1. Such descriptive evidence indicates that best ESG practices improve the firm's creditworthiness, but only for those in the top three credit rating categories. The effect may even be counterproductive for the other rating categories, with firms having a higher probability of ending up in lower credit rating categories when they invest in better ESG practices.

Figure 1. Overall ESG rating and Credit Ratings Categories

The figure reports the probability of ending up in each of the credit rating categories under consideration, conditioning on the ESG group it to which belongs: $Worst$, $Intermediate$, and $Best$. $Worst$ is the group of firms with an ESG rating lower or equal than the $30th$ percentile of the overall ESG rating distribution; $Intermediate$ ($Int.$) is the group of firms with a score between the $30th$ and the $70th$ percentile; and $Best$ is the group of firms with a score greater than the $70th$ percentile.



4 Results

In this section, we are going to formally test our two hypotheses. We first verify whether and to what extent better ESG practices impact a company's exposure to ESG risk. Next, we verify if credit ratings incorporate such additional sources of risk. In addition, we are going to further address endogeneity concerns by implementing a two-stage procedure that relies on the methodology provided by Attig et al. (2013) and the existing relation between ESG and the country's legal origins where the firm is headquartered (Liang and Renneboog, 2017).

4.1 ESG Performance as Proxy for ESG Risk

To understand whether and to what extent better ESG performance reduces the cost of equity and is incorporated into credit ratings, we start our analysis by estimating model (2) using the ESG

factor beta as a proxy for the cost of equity and the overall and single-dimension ESG ratings provided by Refinitiv. Table 2 reports the overall and single-dimension ESG ratings over the market beta. In line with Albuquerque et al. (2019) and El Ghoul et al. (2011), the results show that investing in better ESG practices reduces the cost of equity with a negative and statistically significant parameter for the overall ESG rating (ESG, column 1). Specifically, one standard deviation increase in the ESG rating reduces the cost of equity by 4.27% ($21.35 * 0.002 * 100$) per year.

It is worth noting, however, that using the overall ESG rating makes it difficult to disentangle how the three dimensions influence the firm's cost of equity. More specifically, the different E, S, and G dimensions might have contrasting effects on firms' cost of equity. On the one hand, improving the environmental and social performance of the firm might be seen as a misuse of resources and might consequently increase the cost of equity. On the other hand, following the best practices in corporate governance can increase a debtor's trustworthiness and reduce the cost of equity accordingly. Alternatively, improving the E, S, or G performance may be seen as an attempt by the firm to mitigate specific investment risks (e.g., climate risk). Under such a view, better ESG performance should reduce the cost of equity no matter which dimension is under consideration. In addition, the methodologies adopted by different rating agencies may mitigate or exacerbate our results with confounding effects that could arise from how they measure or weigh the ESG performance of firms (Berg et al., 2022).

The results in Table 2 for the single E (column 2), S (column 3), and G (column 4) dimensions show that, in these cases, the estimated parameters are negative and statistically significant. Our results are, therefore, partially aligned with those of Ng and Rezaee (2015), who show a significant and negative relation between the cost of equity and the ESG performance of the firm only in the environmental and governance dimensions. A possible explanation for the difference in the results with Ng and Rezaee (2015) could be the use of a different ESG rating provider, KLD. Looking at the remaining explanatory variables, our results are consistent with those provided by the literature (Albuquerque et al., 2019). In particular, bigger ($Size$) and highly leveraged (Lev) firms face a lower and higher cost of equity, respectively.

Since ESG ratings impact the cost of equity because they proxy for a hidden source of systematic risk (e.g., climate risk), this should also be reflected in firms' creditworthiness. In line with Liang and Renneboog (2017), and motivated by the ordinal nature of our dependent variable ($S\&P$ credit rating), we estimate the ordered probit model in equation (3) using the overall and

Table 2. Effect of Overall and Single-dimension ESG rating on Cost of Equity

The table presents the results of the equation in model (2) of the overall (ESG) or the single (E, S, or G) scores. ESG risk factor betas are estimated over one year of daily data ($\hat{\beta}_{esg}$, column 1; $\hat{\beta}_{e}$, column 2; $\hat{\beta}_{s}$, column 3; and $\hat{\beta}_{g}$, column 4) by using equation (1) as a proxy for the cost of equity. The controls include the logarithm of total assets in USD million ($Size$), earnings before interest and taxes plus interest expense divided by interest expense (Cov), the ratio of operating income to sales (Mar), the ratio of long-term debt to total assets (Lev), the ratio of property plant and equipment to total assets (Cap). Each model specification controls for time-, industry-, and country-fixed effects. Robust standard errors are clustered at a firm level and reported in parentheses. ***,**, and * denote 1%, 5%, and 10% significance, respectively. The sample comprises 1,717 unique firms over the 2002–2022 period.

	(1)	(2)	(3)	(4)
ESG	-0.002***			
	(0.000)			
E		-0.003***		
		(0.000)		
S			-0.002***	
			(0.000)	
G				-0.002***
				(0.000)
$Size$	-0.033***	-0.016***	-0.037***	-0.011*
	(0.004)	(0.005)	(0.005)	(0.006)
Cov	-0.000**	-0.000	-0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Mar	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Lev	0.091***	-0.007	0.174***	0.027
	(0.030)	(0.034)	(0.039)	(0.044)
Cap	-0.016	-0.026	0.093***	-0.234***
	(0.027)	(0.029)	(0.034)	(0.036)
Time FE	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y
Country FE	Y	Y	Y	Y
N	19691	19691	19691	19691

single-dimension ESG ratings provided by Refinitiv, and report the results in Table 3. The results show that the overall ESG rating determines the firm's creditworthiness since the coefficient is positive and strongly significant (ESG, column 1). We re-estimate our ordered probit model in equation (3) using the single E (column 2), S (column 3), or G (column 4) dimensions. The results confirm, by and large, those for the overall ESG rating.

More specifically, in Table 3, the coefficient for the environmental dimension (E, column 2) is positive and significant. Therefore, in line with Seltzer et al. (2022), investing in better environmental practices seems to pay off in terms of improved creditworthiness. Moreover, improving the social and governance practices (S and G, columns 3 and 4) positively and significantly impacts the credit rating. In line with Ashbaugh-Skaife et al. (2006), improved governance practices may pay off in terms of higher credit rating and consequently lower the cost of equity. Additionally, our results indicate that the value creation resulting from better product quality, recognized by consumers (Cao et al., 2019) or higher employee satisfaction (El Ghoul et al., 2011) impacts the

default probability of firms as approximated by credit ratings. The remaining control variables' results align with those of Attig et al. (2013) and those presented in Table 2.

Looking at the control variables commonly used in studies on credit ratings, the results of our study appear to align with prior research (Table 3, columns 1 to 4). In particular, the estimated coefficient for $Size$, Mar, and Cap are positively and significantly related to firms' credit ratings (Alali et al., 2012; Ashbaugh-Skaife et al., 2006; Bhojraj and Sengupta, 2003). Larger firms with higher profitability and a greater portion of long-term assets are less likely to default on their debt. By contrast, leverage (Lev) significantly and negatively impacts firms' credit ratings. Our results, based on an international sample of firms, confirm that better ESG practices lead to higher credit ratings (Jiraporn et al., 2014; Attig et al., 2013).

All in all, our results show that credit ratings incorporate the information the ESG ratings provide. Moreover, a better ESG performance by a firm appears to be rewarded in terms of lower cost of equity. However, the results may change when endogeneity concerns are further considered (Liang and Renneboog, 2017; Attig et al., 2013) and ESG ratings from a different provider are used (Berg et al., 2022).

4.2 Further Addressing Endogeneity Concerns

Our estimates might suffer from potential endogeneity issues such as 1) an unobserved variable might influence both the dependent and the independent variables of interest, or 2) high credit ratings might imply a lower cost of equity that generates, in turn, higher net revenues that could be invested in ESG activities. To further mitigate such concerns, we implement a two-stage procedure in the spirit of Attig et al. (2013) and Liang and Renneboog (2017).

We instrument our overall and single-dimension ESG rating with 1) the average of the overall and single-dimension ESG rating across time and industries (ESG_{IV1}), in line with Attig et al. (2013), and 2) the average of the overall and single-dimension ESG rating across time and country's legal origin (ESG_{IV2}), following the empirical evidence provided by Liang and Renneboog (2017). The two-stage procedure and fixed effects further address the potential challenges endogeneity poses.

Table A-2 reports the results for the first stage of the Refinitiv database (Panel A). The results show that both instruments are relevant, with estimated positive and strongly significant parameters independently from the ESG dimension under consideration (columns 1 to 4, Panel A). In addition, in line with Udayasankar (2008), the firm's size strongly predicts current ESG ratings.

Table 3. Order Probit Model for Effect of Overall and Single-dimension ESG rating on Credit Rating

The table presents the results of the equation in the model (3) for the overall and single-dimension ESG ratings on firms' credit rating ($S\&P$). The controls include the logarithm of total assets in USD million ($Size$), earnings before interest and taxes plus interest expense divided by interest expense (Cov), the ratio of operating income to sales (Mar), the ratio of long-term debt to total assets (Lev), and the ratio of property plant and equipment to total assets (Cap). The $S\&P$ credit ratings are converted to an ordinal scale that goes from 8 (*AAA*) for the firm with the lowest default probability to 1 (CC) for the firm with the highest default probability. Each model specification controls for time-, industry-, and country-fixed effects. Robust standard errors are clustered at the firm level and reported in parentheses. ***,**, and * denote 1%, 5%, and 10% significance, respectively. The sample comprises 1,717 unique firms over the 2002–2022 period.

	(1)	(2)	(3)	(4)
ESG	0.014***			
	(0.002)			
E		0.008***		
		(0.002)		
S			0.010***	
			(0.002)	
G				0.004***
				(0.001)
$Size$	0.945***	0.949***	0.970***	1.001***
	(0.074)	(0.074)	(0.073)	(0.073)
Cov	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Mar	0.003***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Lev	-2.987***	-2.993***	-2.993***	-2.997***
	(0.342)	(0.342)	(0.346)	(0.347)
$Capint$	1.495***	1.484***	1.505***	1.509***
	(0.336)	(0.336)	(0.336)	(0.340)
Time FE	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y
Country FE	Y	Y	Y	Y
N	16243	16243	16243	16243

Larger firms appear to achieve better ESG performance across all dimensions. Given the relevance of our instruments in explaining the overall and the single-dimension ESG ratings, we then use our instrumented ESG ratings ($\widehat{ESG}$, $\widehat{E}$, $\widehat{S}$, and $\widehat{G}$) in models (2) and (3).

Table 4 reports the cost of equity (Panel A) and credit rating (Panel B) results. Looking at the cost of equity (Panel A), independently from the dimension under consideration, the ESG ratings negatively and significantly impact the firms' cost of equity. Regarding the credit ratings (Panel B), the impact of the ESG ratings on credit ratings is positive but insignificant. This indicates that, by and large, ESG ratings proxy for some concealed form of systematic ESG risk, but the CRAs do not consider such ESG risk. In line with Skreta and Veldkamp (2009), a possible explanation could be the additional complexity or the lack of expertise credit rating agencies face when evaluating firms from financial and non-financial perspectives. Alternatively, as pointed out by Georges et al. (2023), the absence of any impact of ESG performance on credit ratings may be due to a growing gap between policy pledges and the tangible effects of regulations.

Table 4. Effect of Instrumented Overall and Single-dimension ESG rating on Cost of Equity and Credit Rating

The table presents the results of the equation in models (2) and (3) for instrumented overall and single-dimension ESG ratings over the ESG factor betas (Panel A) and credit ratings (Panel B). ESG risk factor betas are estimated over one year of daily data ($\hat{\beta}_{esg}$, column 1; $\hat{\beta}_{e}$, column 2; $\hat{\beta}_{s}$, column 3; and $\hat{\beta}_{g}$, column 4) by using equation (1) as a proxy for the cost of equity. The $S\&P$ credit ratings are converted to an ordinal scale that goes from 8 (AAA) for the firm with the lowest default probability to 1 (CC) for the firm with the highest default probability. The instrumented ESG ratings are computed using the first-stage results reported in Table A-2. Controls and the dependent variables are defined in Table 3. Robust standard errors are clustered at the firm level and reported in parentheses. ***,**, and * denote 1%, 5%, and 10% significance, respectively. The sample comprises 1,717 unique firms from 2002 to 2022 period.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A				**Panel B**			
$\widehat{ESG}$	-0.018***				0.007			
	(0.003)				(0.016)			
$\widehat{E}$		-0.027***				0.007		
		(0.002)				(0.008)		
$\widehat{S}$			-0.019***				0.004	
			(0.003)				(0.013)	
$\widehat{G}$				-0.008***				0.005
				(0.002)				(0.009)
$Size$	0.089***	0.234***	0.099***	0.019*	0.971***	0.948***	0.993***	0.993***
	(0.021)	(0.027)	(0.022)	(0.011)	(0.125)	(0.108)	(0.112)	(0.082)
Cov	-0.000	0.000	-0.000	-0.000	0.003***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Mar	-0.000	-0.001	-0.001*	-0.000	0.003***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lev	-0.002	-0.183***	0.112**	-0.012	-2.976***	-2.969***	-2.989***	-2.985***
	(0.038)	(0.062)	(0.048)	(0.046)	(0.355)	(0.349)	(0.354)	(0.350)
Cap	0.019	0.064	0.126**	-0.213***	1.502***	1.487***	1.510***	1.499***
	(0.040)	(0.068)	(0.051)	(0.039)	(0.342)	(0.343)	(0.340)	(0.341)
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
N	19691	19691	19691	19691	16243	16243	16243	16243

5 Robustness Checks

Overall, our main results show that 1) ESG risk matters for the cost of equity reduction and 2) that credit rating agencies do not incorporate such information into their credit risk assessments. In the next subsections, we will test the robustness of these results. Motivated by Berg et al. (2022), we first proceed to verify whether and to what extent the methodologies used by ESG rating agencies confound our results. We rely on the Sustainalytics database to perform the test, which provides the overall and single-dimension ESG rating. Next, given the ad-hoc measure we are using to pin down a proxy for the cost of equity related to the ESG risk, we will use the market beta as a proxy for the cost of equity to challenge our results on the cost of equity part only. Finally, we will check whether CRAs incorporated ESG risk into their credit risk evaluation starting from when they manifested their interest in ESG concerns via recent acquisitions of ESG rating agencies.

5.1 Alternative ESG Rating

Concerning our first set of robustness checks, we provide the descriptive statistics for the Sustainalytics sample in Table 5. Looking at the ESG ratings (columns 1 to 4), firms are awarded higher ESG ratings in all dimensions when compared with those of the Refinitiv sample (Table 1), with the highest average score in the governance dimension (66.40, G) and the lowest in the environmental and social dimensions. Firms show similar average credit ratings; half of the sample is below investment grade. The average firm has a positive risk exposure towards the environmental risk factor ($\hat{\beta}_e$, column 12), which is compensated by the social and governance risk factor betas ($\hat{\beta}_s$ and $\hat{\beta}_g$, columns 13 to 14). By contrast, and differently from the Refinitiv sample, the exposure to the overall ESG risk appears to be negative. Moreover, Figure 2 shows that the probability of firms ending up in a lower credit rating category decreases monotonically when moving from *Worst* to *Best*, but only for firms with a rating lower than BBB. Similar descriptive evidence holds for the single-dimension ESG groups and the credit rating categories reported in Figures A-2.

Overall, also for the Sustainalytics sample, the descriptive evidence provided by Table 5 and Figure 2 indicates that firms with better ESG practices have, on average, a lower ESG risk exposure and, consequently, they should experience a reduction in their cost of equity and better credit ratings.

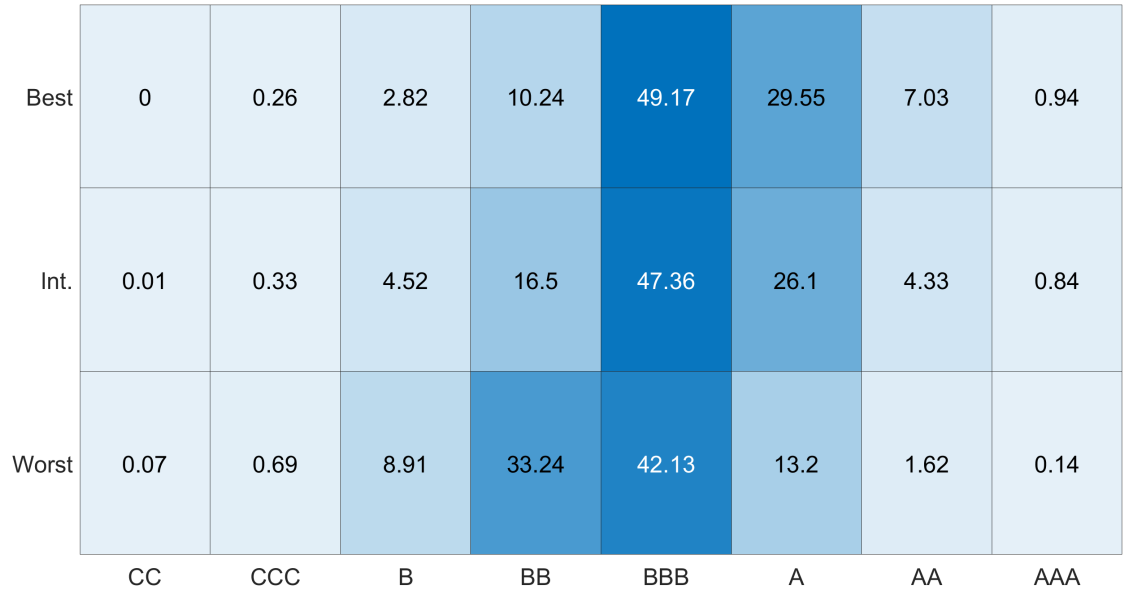
Table 5. Descriptive Statistics – Sustainalytics

The table reports the distributions for the time series averages of the yearly firm characteristics. The firm characteristics are the overall ESG rating (ESG), the environmental dimension score (E), the social dimension score (S), and the governance dimension score (G); the credit rating assigned by Standard & Poor's ($S\&P$), logarithm of the total assets in USD million ($Size$), earnings before interest and taxes plus interest expense divided by interest expense (Cov), the ratio of operating income to sales (Mar), the ratio of long-term debt to total assets (Lev), the ratio of property plant and equipment to total assets (Cap), the ESG risk factor betas are estimated over one year of daily data ($\hat{\beta}_{esg}$, $\hat{\beta}_e$, $\hat{\beta}_s$, and $\hat{\beta}_g$) by using equation (1). The sample consists of 1,273 firms for the 2009 and 2022 period.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	ESG	E	S	G	$S\&P$	$Size$	Cov	Mar	Lev	Cap	$\hat{\beta}_{esg}$	$\hat{\beta}_e$	$\hat{\beta}_s$	$\hat{\beta}_g$
$Avg.$	60.28	58.88	58.96	66.40	4.92	2.35	17.20	0.15	0.28	0.36	-0.17	0.04	-0.16	-0.30
Med	60.00	58.63	58.00	66.00	5.00	2.29	6.40	0.12	0.26	0.30	-0.16	0.01	-0.13	-0.39
$Std.$	10.33	14.01	12.14	10.03	0.98	1.32	55.04	0.21	0.17	0.27	0.63	0.70	0.70	0.68

Figure 2. Overall ESG rating and Credit Ratings Categories – Sustainalytics

The figure reports the probability of ending up in each of the credit rating categories under consideration, conditioning on the ESG group it to which belongs: $Worst$, $Intermediate$, and $Best$. $Worst$ is the group of firms with an ESG rating lower or equal than the $30th$ percentile of the overall ESG rating distribution; $Intermediate$ ($Int.$) is the group of firms with a score between the $30th$ and the $70th$ percentile; and $Best$ is the group of firms with a score greater than the $70th$ percentile.



Next, we instrument the overall and single-dimension ESG rating with 1) the average of the overall and single-dimension ESG rating across time and industries (ESG_{IV1}), in line with Attig et al. (2013), and 2) the average of the overall and single-dimension ESG rating across time and country's legal origin (ESG_{IV2}), following the empirical evidence provided by Liang and Renneboog (2017). The instrumented ESG ratings are then used to estimate our models in equations (2) and (3). The results for the first-stage are reported in Table A-2 (Panel B) and are, by and large, in line with those of Refinitiv (Table A-2, Panel A). More specifically, the results show that both instruments are relevant, with positive and strongly significant parameters independently from the ESG dimension under consideration (columns 1 to 4, Panel B). In addition, larger firms appear to achieve better scores across all ESG dimensions.

The second-stage results are reported in Table 6. Looking at the cost of equity (Panel A), the results are consistent with those in Table 2. In line with Albuquerque et al. (2019) and El Ghoul et al. (2011), investing in better ESG practices reduces the cost of equity independently from the ESG dimension considered (columns 1 to 4). Concerning the remaining explanatory variables, the results confirm, by and large, those presented in Table 2.

Looking at the credit ratings, the results in Table 6 (Panel B) report the estimates for the equation in model (3) with S&P's credit rating as the dependent variable. In line with Attig et al. (2013) and Seltzer et al. (2022), the results show that the parameters for the overall and the single-dimension ESG rating appear positive but not significant (columns 5 to 8). Therefore, when analyzing the credit ratings results, the main difference between the two datasets arises in the governance dimension only. Concerning the remaining control variables, the results largely align with those in Table 3. More specifically, large and profitable firms with a greater portion of long-term assets are less likely to default on their debt, while, in contrast, leveraged firms have a higher probability of defaulting on their debt (Attig et al., 2013).

All in all, the results suggest that, when using an alternative ESG rating provider applying a different rating methodology, this generally does not impact our results (concerning the cost of equity and the credit rating).

Table 6. Effect of Instrumented Overall and Single-dimension ESG rating on Cost of Equity and Credit Rating – Sustainalytics

The table presents the results of the equation in models (2) and (3) for instrumented overall and single-dimension ESG ratings over the ESG factor betas (Panel A) and credit ratings (Panel B). ESG risk factor betas are estimated over one year of daily data ($\hat{\beta}_{esg}$, column 1; $\hat{\beta}_{e}$, column 2; $\hat{\beta}_{s}$, column 3; and $\hat{\beta}_{g}$, column 4) by using equation (1) as a proxy for the cost of equity. The $S\&P$ credit ratings are converted to an ordinal scale that goes from 8 (AAA) for the firm with the lowest default probability to 1 (CC) for the firm with the highest default probability. The instrumented ESG ratings are computed using the first-stage results reported in Table A-2. Controls and the dependent variables are defined in Table 3. Robust standard errors are clustered at the firm level and reported in parentheses. ***,**, and * denote 1%, 5%, and 10% significance, respectively. The sample comprises 1,273 unique firms over the 2009–2022 period.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A				**Panel B**			
$\widehat{ESG}$	-0.031***				0.038			
	(0.004)				(0.026)			
$\widehat{E}$		-0.011***				0.014		
		(0.004)				(0.021)		
$\widehat{S}$			-0.024***				0.021	
			(0.003)				(0.017)	
$\widehat{G}$				-0.050***				0.020
				(0.005)				(0.024)
$Size$	0.111***	-0.003	0.068***	0.132***	1.078***	1.126***	1.141***	1.158***
	(0.013)	(0.016)	(0.012)	(0.013)	(0.107)	(0.112)	(0.104)	(0.102)
Cov	0.000	-0.000	0.000**	0.000	0.003***	0.004***	0.004***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Mar	-0.001	0.001*	-0.004	-0.002	-0.000	-0.002	-0.004	-0.003
	(0.003)	(0.001)	(0.004)	(0.002)	(0.007)	(0.006)	(0.006)	(0.006)
Lev	-0.097*	-0.105**	0.012	-0.214**	-3.343***	-3.442***	-3.391***	-3.389***
	(0.056)	(0.051)	(0.054)	(0.084)	(0.532)	(0.582)	(0.579)	(0.584)
Cap	-0.103*	0.001	-0.103*	0.046	1.437***	1.550***	1.529***	1.494***
	(0.056)	(0.046)	(0.053)	(0.068)	(0.422)	(0.425)	(0.427)	(0.425)
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
N	12878	12174	12174	12174	11577	10957	10957	10957

5.2 *Different Cost of Equity Measure*

The results in Tables 1 and 3 show that ESG ratings proxy for some hidden source of systematic risk. However, the ESG factor betas comply with the standard Fama and French (2012, 2017) approach. In their main appraisal of this approach, Lewellen et al. (2010) point out that the method chosen for the factor portfolio grouping can dramatically impact the results. Additionally, Ferson et al. (1999) show that the portfolio construction methodology creates a mechanical relation between the factor betas and the sorting variable used for the factor's construction. To address both these concerns, we rely on the methodology proposed by Albuquerque et al. (2019), in which the cost of equity is proxied by the market beta only. Table 7 reports the results for the estimates of model (2) using the market beta as a proxy for the cost of equity. In line with the results in Tables 2 and 4, these results show that investing in better ESG practices reduces the cost of equity irrespective of the single-dimension ESG rating under consideration or the ESG rating provider (Panels A and B). The only substantial difference is in the environmental dimension when looking at Sustainalytics (column 6, Panel B).

All in all, our second robustness check confirms our main findings. Better ESG practices decrease the firms' cost of equity by reducing the exposure to a hidden systematic risk component.

Table 7. Effect of Overall and Single-dimension ESG rating on a Different Cost of Equity Proxy

The table presents the results of the equation in model (2) using the instrumented overall and single-dimension ESG ratings provided by Refinitiv (Panel A) and Sustainalytics (Panel B). The instrumented ESG ratings are computed using the first-stage results reported in Table A-2. The market betas are estimated over one year of daily data and used as an alternative proxy for the cost of equity. Controls and the dependent variables are defined in Table 3. Each model specification controls for time-, industry-, and country-fixed effects. Robust standard errors are clustered at a firm level and reported in parentheses. ***,**, and * denote 1%, 5%, and 10% significance, respectively. The sample comprises 1,717 unique firms (Refinitiv) from 2002 to 2022 and 1,273 unique firms (Sustainalytics) over the 2009–2022 period.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A				**Panel B**			
$\widehat{ESG}$	-0.017***				-0.008**			
	(0.003)				(0.003)			
$\widehat{E}$		-0.007**			-0.004*			
		(0.003)				(0.003)		
$\widehat{S}$			-0.008*				-0.004**	
			(0.005)			(0.002)		
$\widehat{G}$				-0.008*				-0.011***
				(0.004)				(0.003)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
N	19724	19724	19724	19724	13428	12710	12710	12710

5.3 Increasing Attention Paid to ESG Risks Over Time

Table 4 shows that CRAs do not incorporate ESG risk into their creditworthiness evaluations. A possible explanation for this result could be the lack of expertise in evaluating the non-financial performance of firms. Starting in 2016, Standard and Poor's and other major CRAs began acquiring ESG rating providers, such as Trucost (2016) and RobecoSAM (2019). These acquisitions could mark the starting point for incorporating ESG considerations into credit risk evaluations. At the very least, they indicate a willingness to obtain the know-how for the assessment of the non-financial performance of a firm, as well as increasing attention paid to ESG concerns. To verify whether this recent increasing awareness of the ESG performance of firms would justify the results in Table 4, we introduce a dummy variable taking value one after 2016 and zero otherwise ($D16$). Next, we interact with the instrumented ESG ratings from Table A-2. The results are reported in Table 8 and confirm, by and large, those of Table 4. More specifically, the instrumented ESG ratings and the interaction terms are not statistically significant for both ESG rating providers, confirming that credit rating agencies do not incorporate the ESG investment risk reduction into their creditworthiness assessments, even after acquiring ESG rating knowledge and experience.

Table 8. Order Probit Model for the Effect of Overall and Single-dimension ESG rating on Credit Rating Post-2016

The table presents the results of the equation in model (3) using overall and single-dimension ESG ratings provided by Refinitiv (Panel A) and Sustainalytics (Panel B). $D16$ is a dummy variable taking value one after 2016, zero otherwise. The results for the first stage for both ESG rating providers are reported in Table A-2. Controls and the dependent variables are defined in Table 3. Robust standard errors are clustered at the firm level and reported in parentheses. ***,** and * denote 1%, 5%, and 10% significance, respectively. The sample comprises 1,717 unique firms (Refinitiv) from 2002 to 2022 and 1,273 unique firms (Sustainalytics) over the 2009–2022 period.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A				**Panel B**			
$\widehat{ESG}$	0.013				0.044			
	(0.017)				(0.027)			
$\widehat{ESG} \times D16$	-0.005				-0.007			
	(0.006)				(0.012)			
$\widehat{E}$		0.009				0.018		
		(0.009)				(0.021)		
$\widehat{E} \times D16$		-0.004				-0.015		
		(0.004)				(0.009)		
$\widehat{S}$			0.006				0.027	
			(0.013)				(0.020)	
$\widehat{S} \times D16$			-0.002				-0.005	
			(0.005)				(0.011)	
$\widehat{G}$				0.009				0.025
				(0.009)				(0.024)
$\widehat{G} \times D16$				-0.007				-0.013
				(0.008)				(0.011)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y
N	16752	16752	16752	16752	11591	10971	10971	10971

6 Conclusion

The current state-of-the-art academic studies on the relationship between ESG and financial performance predominantly show that firms with higher ESG ratings achieve better financial performance. Little attention has been dedicated to the plausible relationship between ESG, cost of equity, and credit ratings. Understanding whether and to what extent ESG ratings proxy for some hidden systematic risk and the role of CRAs is essential because CRAs may be pivotal in addressing rising ESG concerns and related challenges. We verify whether corporate ESG performance relates to a firm's cost of equity and if CRAs manage to incorporate such relation into their creditworthiness evaluations.

Our results add two insights to the current state of the art. First, we show a negative and significant relation between overall ESG ratings and the cost of equity. On average, improving the ESG rating by one standard deviation reduces the cost of equity by around 4% yearly. The result remains when decomposing the overall ESG rating into its single-dimensions, even after addressing further endogeneity concerns. Second, we find a positive and significant relationship between ESG and credit ratings. However, this cancels out after controlling for further endogeneity concerns. Our results are robust to using different ESG rating providers and proxies for the cost of equity.

The results confirm those reported by the literature about the cost of equity but contrast the results about credit ratings. Two possible explanations could be provided for the different results for credit ratings. First, there can be a mismatch between the methodologies that credit rating agencies use to assess the capability of the firm to generate cashflows on the short term and the long term consequences related to ESG concerns. Second, the literature utilizes different methodologies to control for endogeneity concerns. Third, the additional complexity posed by ESG concerns when evaluating firms' default probabilities makes it difficult to incorporate such concerns into the credit ratings.

The results of our study have important implications. First, if CRAs want to be pivotal in addressing climate change and related issues, they must improve their rating methodologies to explicitly include ESG considerations when assessing creditworthiness. For example, they could provide two credit risk assessments, focusing on short- and long-term risks (e.g., climate risk). Second, when incorporating ESG risks in their portfolios, practitioners and financial market participants should be aware that credit ratings generally do not consider these risks.

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Appendix: Additional Empirical Evidence

Table A-1. Sample Breakdown by Country and Industry

The table reports the sample distribution by: $Country$ and $Industry$ based on Refinitiv sample (Panel A and C) and Sustainalytics sample (Panel B and D) the GICS. The sample comprises 1,717 unique firms (Refinitiv) from 2002 to 2022 and 1,273 unique firms (Sustainalytics) over the 2009–2022 period.

	Panel A		**Panel B**	
	Unique	%	*Unique*	%
Australia	22	1.28	20	1.57
Austria	2	0.12	2	0.16
Belgium	12	0.70	11	0.86
Canada	96	5.59	80	6.28
Chile	16	0.93	11	0.86
China	19	1.11	16	1.26
Colombia	1	0.06	1	0.08
Czech Republic	1	0.06	1	0.08
Denmark	8	0.47	7	0.55
Finland	8	0.47	7	0.55
France	3	0.17	3	0.24
Germany	54	3.15	43	3.38
Hong Kong	67	3.90	61	4.79
Hungary	1	0.06	1	0.08
India	14	0.82	14	1.10
Indonesia	9	0.52	6	0.47
Ireland; Republic of	2	0.12	2	0.16
Italy	22	1.28	17	1.34
Japan	69	4.02	66	5.18
Kazakhstan	3	0.17	-	-
Lithuania	1	0.06	1	0.08
Malaysia	6	0.35	6	0.47
Mexico	23	1.34	10	0.79
Netherlands	17	0.99	16	1.26
New Zealand	11	0.64	8	0.63
Norway	10	0.58	9	0.71
Peru	1	0.06	2	0.16
Philippines	2	0.12	1	0.08
Poland	1	0.06	1	0.08
Portugal	2	0.12	-	-
Qatar	3	0.17	3	0.24
Romania	1	0.06	-	-
Saudi Arabia	3	0.17	3	0.24
Singapore	6	0.35	6	0.47
South Africa	7	0.41	7	0.55
Spain	22	1.28	18	1.41
Sweden	27	1.57	26	2.04
Switzerland	19	1.11	19	1.49
Taiwan	10	0.58	10	0.79
Thailand	6	0.35	6	0.47
United Arab Emirates	4	0.23	2	0.16
United Kingdom	75	4.37	69	5.42
United States of America	1031	60.05	681	53.50
Total	1717		1273	

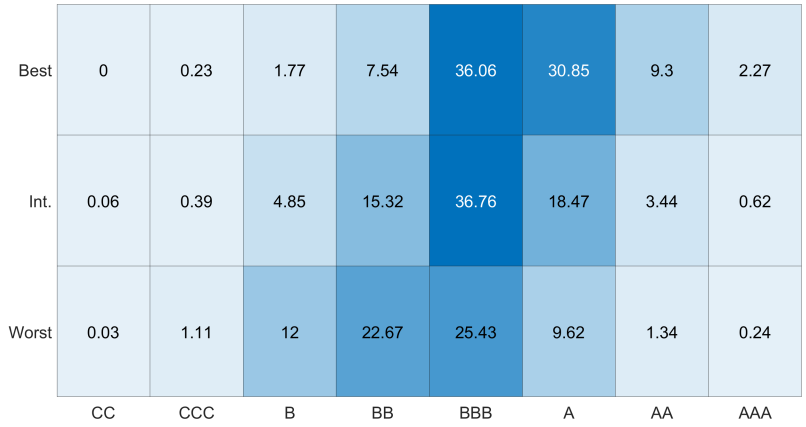
Table A-1 (Continue). Sample Breakdown by Country and Industry

	Panel C		Panel D	
	Unique	%	*Unique*	%
Automobiles & Components	48	2.80	37	2.91
Capital Goods	204	11.88	154	12.10
Commercial & Professional Services	68	3.96	47	3.69
Consumer Discretionary Distribution & Retail	65	3.79	51	4.01
Consumer Durables & Apparel	60	3.49	39	3.06
Consumer Services	76	4.43	50	3.93
Consumer Staples Distribution & Retail	27	1.57	21	1.65
Energy	141	8.21	102	8.01
Equity Real Estate Investment Trusts (REITs)	100	5.82	75	5.89
Food, Beverage & Tobacco	75	4.37	58	4.56
Health Care Equipment & Services	65	3.79	42	3.30
Household & Personal Products	20	1.16	16	1.26
Materials	183	10.66	142	11.15
Media & Entertainment	75	4.37	41	3.22
Pharmaceuticals, Biotechnology & Life Sciences	53	3.09	44	3.46
Real Estate Management & Development	53	3.09	39	3.06
Semiconductors & Semiconductor Equipment	34	1.98	27	2.12
Software & Services	57	3.32	41	3.22
Technology Hardware & Equipment	51	2.97	45	3.53
Telecommunication Services	54	3.15	44	3.46
Transportation	63	3.67	47	3.69
Utilities	145	8.44	111	8.72
Total	1717		1273	

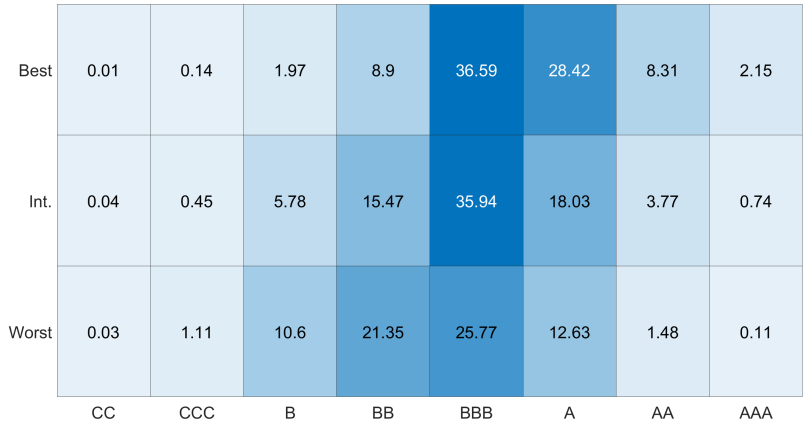
Figure A-1. Single-dimension ESG rating and Credit Rating Category

The figure reports the probability of ending up in each of the credit rating categories under consideration, conditioning on the environmental (Panel A), social (Panel B), or governance (Panel C) group to which the firm belongs: $Worst$, $Intermediate$, and $Best$. $Worst$ is the group of firms with an E score lower or equal than the $30th$ percentile of the overall E score distribution; $Intermediate$ ($Int.$) is the group of firms with a score between the $30th$ and the $70th$ percentile; and $Best$ is the group of firms with a score greater than the $70th$ percentile.

Panel A (Environmental)



Panel B (Social)



Panel C (Governance)

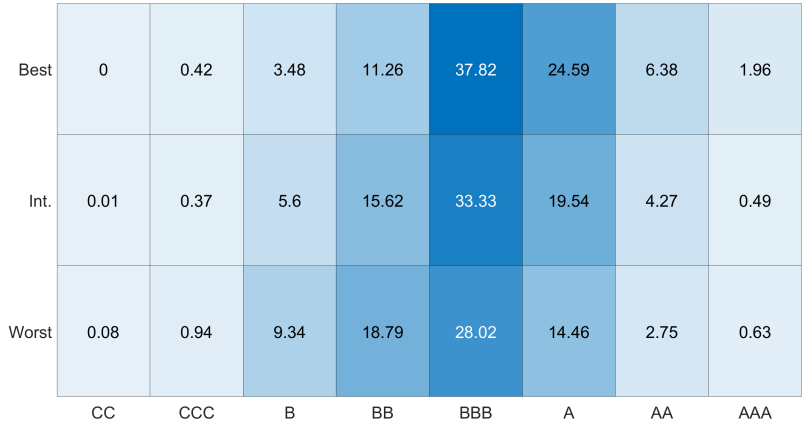
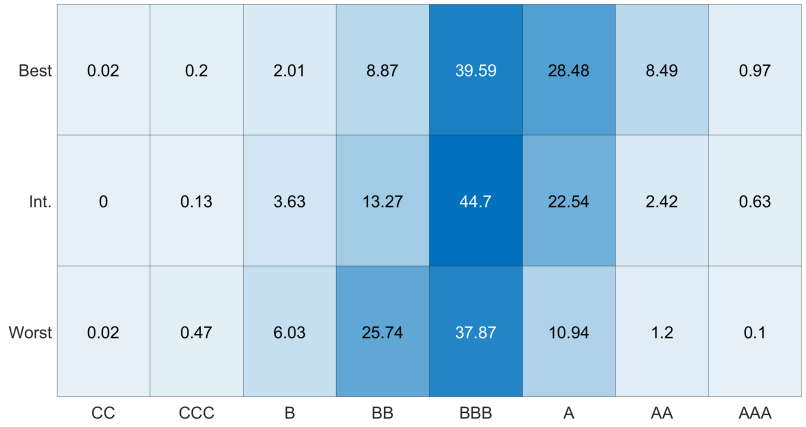


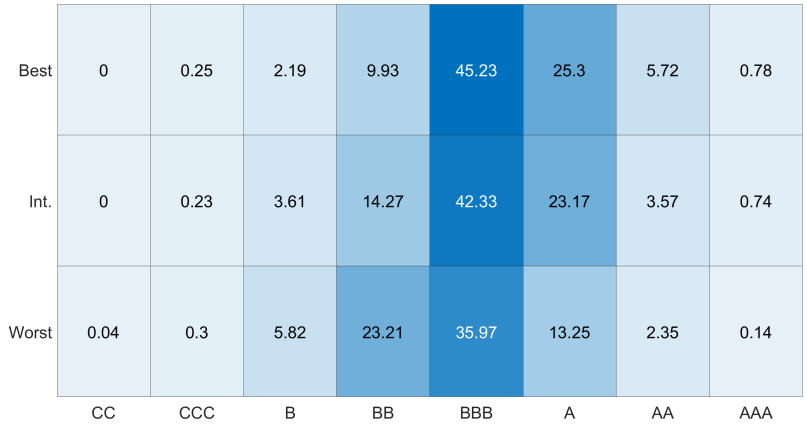
Figure A-2. Single-dimension ESG rating and Credit Rating Category – Sustainalytics

The figure reports the probability of ending up in each of the credit rating categories under consideration, conditioning on the environmental (Panel A), social (Panel B), or governance (Panel C) group to which the firm belongs: $Worst$, $Intermediate$, and $Best$. $Worst$ is the group of firms with an E score lower or equal than the $30th$ percentile of the overall E score distribution; $Intermediate$ ($Int.$) is the group of firms with a score between the $30th$ and the $70th$ percentile; and $Best$ is the group of firms with a score greater than the $70th$ percentile.

Panel A (Environmental)



Panel B (Social)



Panel C (Governance)

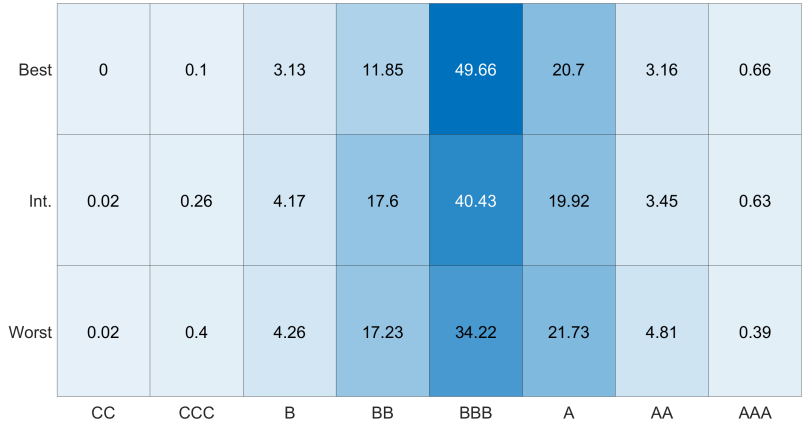


Table A-2. Instrumented Overall and Single-dimension ESG rating

The table presents the results of the first stage for the overall and single-dimension ESG ratings provided by Refinitiv (Panel A) and Sustainalytics (Panel B). The instruments used to compute the instrumented overall and single-dimension ESG rating (ESG_{IV1} and ESG_{IV2}) are computed by taking the average of the overall ESG rating (column 1), and E (column 2), S (column 3), or G (column 4) single-dimension score across time and Industry (ESG_{IV1}) or time and country legal origin (ESG_{IV2}). The controls include the logarithm of total assets in $ million ($Size$), earnings before interest and taxes plus interest expense divided by interest expense (Cov), the ratio of operating income to sales (Mar), the ratio of long-term debt to total assets (Lev), the ratio of property plant and equipment to total assets (Cap). Robust standard errors are clustered at the firm level and reported in parentheses. ***,** and * denote 1%, 5%, and 10% significance, respectively. The sample comprises 1,717 unique firms (Refinitiv) from 2002 to 2022 and 1,273 unique firms (Sustainalytics) over the 2009–2022 period.

	(1)	(2)	(3)	(4)
			Panel A	
ESG_{IV1}	0.686***	0.797***	0.747***	0.827***
	(0.068)	(0.065)	(0.065)	(0.064)
ESG_{IV2}	0.262***	0.482***	0.385***	0.817***
	(0.086)	(0.077)	(0.077)	(0.131)
$Size$	6.062***	9.183***	5.972***	4.026***
	(0.276)	(0.376)	(0.317)	(0.351)
Cov	0.000	0.001	0.000	-0.001
	(0.001)	(0.001)	(0.001)	(0.002)
Mar	-0.004*	-0.003*	-0.013**	0.012***
	(0.002)	(0.002)	(0.005)	(0.001)
Lev	-1.702	-2.201	-1.634	-1.490
	(1.335)	(1.959)	(1.437)	(1.767)
Cap	1.694	3.600	1.391	1.877
	(1.716)	(2.280)	(1.914)	(2.772)
$Constant$	-14.970***	-37.264***	-19.178***	-34.211***
	(4.810)	(4.374)	(4.797)	(7.862)
Time FE	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y
Country FE	Y	Y	Y	Y
N	20221	20221	20221	20221
R^2_{Adj}	0.455	0.485	0.426	0.189
			Panel B	
ESG_{IV1}	0.921***	0.878***	0.918***	0.933***
	(0.055)	(0.058)	(0.051)	(0.067)
ESG_{IV2}	0.476***	0.282**	0.632***	0.612***
	(0.092)	(0.110)	(0.093)	(0.092)
$Size$	1.772***	2.809***	1.629***	0.682***
	(0.187)	(0.257)	(0.225)	(0.197)
Cov	-0.003**	-0.002	-0.003	-0.003
	(0.001)	(0.002)	(0.002)	(0.002)
Mar	-0.002	-0.029***	0.027***	0.011
	(0.007)	(0.007)	(0.006)	(0.008)
Lev	-1.829**	-1.417	-2.310**	-2.212**
	(0.812)	(1.204)	(0.939)	(1.030)
Cap	2.411**	1.635	2.616**	3.056***
	(1.004)	(1.393)	(1.254)	(1.038)
$Constant$	-24.641***	-18.407***	-30.209***	-29.433***
	(5.843)	(6.671)	(5.614)	(7.174)
Time FE	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y
Country FE	Y	Y	Y	Y
N	13519	12792	12792	12792
R^2_{Adj}	0.439	0.414	0.420	0.399

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