# ARE ENVIRONMENTAL, SOCIAL AND GOVERNMENT FACTORS INCORPORATED IN THE CREDIT RATINGS?

Valentina Cioli [*], Alessandro Giannozzi [**], Lucrezia Pescatori [***], Oliviero Roggi [****]

[*] *Corresponding author*, School of Management, Business and Administration Department, University of Florence, Florence, Italy
Contact details: School of Management, Business and Administration Department, University of Florence, Via delle Pandette, 9, 50127, Florence, Italy
[**] School of Management, Business and Administration Department, University of Florence, Florence, Italy
[***] University of Florence, Florence, Italy
[****] University of Catania, Catania, Italy

## Abstract

Sustainability aspects are assuming a key role both in investment decisions and in credit assessment processes. The aim of this research is to investigate the relationship between environmental, social and governance (ESG) variables and credit rating. We conduct an analysis on a sample of 1191 US-listed companies in 2021. We collect S&P credit ratings on Thomson Refinitiv and we regress ESG variables, and the sub-categories of each pillar E/S/G, against credit rating, along with common firm-specific factors affecting credit risk. The result highlights a direct relationship between ESG performance and credit ratings, confirming previous literature (Apergis et al., 2022; Devalle et al., 2017). Companies with good ESG scores achieve better credit ratings of up to three points. Particularly, good social performance is significantly associated with better credit ratings. However, the empirical analysis shows that the current integration of ESG parameters into credit rating assignment processes is only at an early stage because it is still difficult to quantify the impact of these factors by separating them from economic and financial indicators. This study updates previous research with a larger sample and paves the way for improving and strengthening ESG research on environmental, social and governance performance issues. Managers should promote an effective ESG policy and, in particular, social practices to improve a firm's creditworthiness, while regulators should unify the ESG evaluation criteria for credit rating agencies.

**Keywords:** ESG Performance, Capital Structure, Rating, Cost of Debt

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## 1. INTRODUCTION

In this study, we investigate the relationship between environmental, social and governance (ESG) performance and credit ratings. Over time, the focus on ESG factors is becoming increasingly significant and sustainability aspects are assuming a key role both in investment decisions and in credit assessment processes. Following the current environmental issues, the introduction of sustainability in

the performance measures improves companies' reputation with new benchmarks. The study of the relationship between sustainability and financial results has produced ambiguous results. Several authors highlighted a significant and positive relationship between corporate and social responsibility (CSR) and financial performance (Dowell et al., 2000; Golicic & Smith, 2010; King & Lenox, 2001; Pasquariello, 1999; Russo & Fouts, 1997; Wu & Shen, 2013; Zhou et al., 2007).

According to Wu and Shen (2013), CSR is no longer intended as purely altruistic behaviour or an expedient to improve the image of an enterprise (greenwashing), on the contrary, it is an integral part of the corporate strategy. Indeed, social irresponsibility increases financial risk and damages business performance. Conversely, other scholars (Nelling & Webb, 2009) found a negative relationship between CSR and financial performance. In particular, recent studies have focused on the link between CSR and the cost of capital, separating the analysis for both the cost of equity and the cost of debt.

El Ghoul et al. (2011) and Salvi et al. (2018) demonstrate that better sustainability performance is associated with lower operational risk, as perceived by markets and investors. Indeed, CSR has positive effects on the corporate image, which in turn, contributes to the reduction of the cost of equity. In particular, the improvement of corporate reputation leads to a greater appreciation by investors and an improvement in the quality of financial relations (Salvi et al., 2018). This situation has a positive effect on the rate of return on equity and helps to reduce the cost of capital. Therefore, the debate on CSR revolves around whether such investments generate or destroy value for businesses by reducing or, on the contrary, causing agency conflicts. Recently, ESG parameters acquired relevant attention from academic research as tools for measuring corporate social responsibility. Academics and operators consider ESG metrics an important factor, which reflects the ability of companies to generate sustainable value in the medium to long term. There is also a gradual integration of ESG factors into accounting reporting standards, but also into the valuation processes of the capital markets and the financial sector (Apergis et al., 2022). The social and responsible investment (SRI) market rose from $30 trillion in 2019 to over $35 trillion in 2020 and could exceed $50 trillion by 2025 (Apergis et al., 2022). In addition, according to Bloomberg Intelligence's 2021 Midyear Outlook (Bloomberg, 2021, as cited in Apergis et al., 2022), the ESG debt market could grow from $3 trillion to $11 trillion by 2025. The strong focus of companies, investments, and central banks on the ecological transition drives firms' growth. At the same time, investors are promoting the integration of ESG metrics with traditional investment valuation practices, increasing transparency requirements, and encouraging sustainable investment practices. It is no coincidence, therefore, that more and more companies are using ESG information as a tool for non-financial disclosure.

While financial markets are showing increasing interest in integrating ESG criteria into investment decisions, it is still unclear what role they play in capital structure decisions and credit assessment processes (Devalle et al., 2017). Academics and practitioners highlight the need to integrate ESG metrics into credit rating processes and lending policies adopted by banks. Indeed, the financial industry still bases its judgments mostly on estimates of the default risk of borrowers using traditional financial ratios and credit register data.

For these reasons, academic research today is shifting its focus to the correlation between ESG performance and cost of debt, to measure the impact of ESG factors on debt financing processes.

This study aims to enrich existing literature by measuring the impact of ESG factors on credit ratings. In particular, we investigate whether rating agencies incorporate ESG factors in their assessments or, conversely, whether other traditionally important judgment criteria, such as profitability and leverage, continue to dominate decision-making processes. The conceptual framework is based on the idea that high ESG scores positively affect the solvency of a company. In fact, many studies show that companies with high ESG scores can manage a significant part of environmental, social, legal, reputational, operational, and regulatory risks. On the contrary, companies with poor ESG scores may incur cross-checks or penalties that inevitably affect the company's reputation, hence the risk of insolvency (Apergis et al., 2022; Cooper & Uzun, 2015; Cantino et al., 2017).

We conducted an empirical analysis on a sample of 1191 US-listed firms. For those companies, we collect Standard and Poor's (S&P) credit ratings on Thomson Refinitiv and we regress ESG variables against credit ratings, along with several firm-specific factors affecting the cost of debt.

The remainder of this paper is structured as follows. Section 2 is a literature review of ESG studies. Section 3 explains the data, the variables definition, and the research methodology. Section 4 analyses the event studies and the results obtained through univariate analysis and firm-level cross-sectional regressions. Finally, Section 5 provides concluding remarks with suggestions for future research.

## 2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

According to the agency theory, ESG information can reduce the information asymmetry in the relationship between companies and credit institutions (Cantino et al., 2017; Ashbaugh-Skaife et al., 2006). The disclosure of environmental, social, and corporate governance information by companies allows for reducing information risk and overcoming the problem of adverse selection and moral hazard. For these reasons, increased disclosure can lead to better credit ratings by reducing the cost of financing (Nandy & Lodh, 2012).

Several studies have used stakeholder theory to analyse the relationship between ESG criteria and the cost of debt (Jones, 1995). Jones (1995) highlights the role played by CSR in achieving the support of stakeholders and the resources necessary for business activity. Good ESG performance should enable financial resources to be raised from the capital market at a lower cost. This implies that ESG scores can affect the cost of debt

by as a direct application of stakeholder theory. Under this perspective, ESG performance can become a tool to manage risk in a risk mitigation view. Indeed, according to the risk-mitigation theory, ESG reduces idiosyncratic business risk, with positive effects on cash flows. By contrast, companies that incur environmental, social, or corporate governance disputes increase reputational, financial, or litigation risks (Cooper & Uzun, 2015). These risks jeopardise a company's ability to repay its debts, and hence its creditworthiness. Therefore, as idiosyncratic risk affects a company's ability to repay creditors, corporate social irresponsibility could increase the financial risk of firms, while socially responsible companies should have better ratings. Cooper and Uzun (2015) developed a study on a sample of over two thousand bond issues in the period 2006–2013 and showed a negative relationship between CSR practices and the cost of debt, whereby higher CSR performance results in lower bond spreads. Ge and Liu (2012) base their analysis on a sample of over four thousand public bond issues, issued in the US market between 1992 and 2009. Again, the results seem to confirm the stakeholder theory. Indeed, CSR performance implies higher credit ratings and lower yield spreads. The relationship between CSR-strengths and CSR-concerns sub-scores also supports the theoretical framework. In this case, the CSR-strengths score is associated with lower yield spreads, while the CSR-concerns score is associated with higher interest rates. On a sample of over eleven thousand observations, the research of Attig et al. (2013) identifies a positive link between CSR and credit ratings. The analysis produces significant results for both the total CSR score and the CSR-strengths and CSR-concerns sub-scores. The authors also measure the relationship between credit ratings and six of the seven components that make up the CSR score: community relations, diversity, employee relations, environmental performance, human rights, and product characteristics. Among these, employee relationships, diversity, product characteristics, community relations, and environmental issues have a positive and significant impact on company ratings. However, the human rights dimension was not significant. These findings suggest that the elements of CSR that most affect credit ratings are those that have direct effects on the satisfaction of primary stakeholders. Differently, Nandy and Lodh (2012) conducted their own analysis focusing exclusively on the relationship between the cost of debt and the environmental dimension. In particular, the results show that eco-friendly companies engage in debt at substantially better contractual conditions than companies with lower environmental scores. Based on these findings, the environmental dimension becomes a real determining factor in the process of defining the cost of debt and contributes to default risk mitigation.

In the opposite view (overinvestment cost-concern view), ESG performance represents "costly" deviations in the use of company resources and can cause first-class agency problems (Goss & Roberts, 2011). ESG investments can cause conflicts of interest between managers and shareholders. This occurs when managers invest in ESG projects to gain private benefits (e.g., strengthen their reputation as responsible directors) at the expense of shareholders. ESG investments burn resources otherwise destined to generate profits and investors could see an improper use of shareholders' money. The reduction in profits, in turn, reduces the company's ability to repay its debts and results in an increased risk of insolvency (Ge & Liu, 2012). Moreover, high levels of ESG investments increase a company's fixed costs, since they require maintaining a multitude of stakeholder relationships (Barth et al., 2022; Kim et al., 2014). In summary, these authors assume that over-investment in ESG practices destroys value and increases credit risk. Also, the results of the studies conducted by Menz (2010) and Goss and Roberts (2011) confirm this point of view and prove that companies most involved in CSR practices achieve higher bond spreads and thus lower credit ratings. Out of a sample of 498 European corporate bonds issued in the period 2004–2007, Menz (2010) finds that companies with good ESG performance ask for a higher risk premium, rather than the reverse. However, as the author argues, the lack of consideration of CSR by creditors is not so much due to a lack of interest in the issue. As for the fact that this kind of information is often already included in the credit ratings of companies, therefore an additional CSR rating does not seem to add information value for bondholders. Ultimately, the author denounces the lack of complete, reliable, and easily accessible data to measure ESG performance, an element that undoubtedly affects the willingness to use these evaluation parameters. This study is older than Eliwa et al.'s (2021) and probably investors' sentiment and model were not prepared to consider the value of CSR performance. In the same time period, Goss and Roberts (2011) analyse a sample of almost four thousand bank loans granted in the period 1991–2006. This research differs from the previous one because it assumes the creditors' point of view, but the results are in line with Menz (2010). Goss and Roberts (2011) show that banks do not reward CSR policies. In particular, they complain about the small impact of CSR on bond spreads, which shows that financial institutions consider CSR only a secondary determinant in their credit assessments. In addition, the authors document significant differences in the creditworthiness associated with borrowers. For example, CSR strengths could be negative in the sense of the overinvestment view if the borrower's credit quality is low, setting higher interest rates and shorter maturities. However, CSR concerns are perceived as a risk factor, so they see the allocation of higher bond spreads from 7 to 18 basis points.

Recently, several studies have used credit spreads or credit ratings to understand the existence of a relationship between CSR-ESG and the cost of debt and there is a large literature on the theory that CSR-ESG scores act as a risk mitigation factor (Cantino et al., 2017).

The most recent studies (Agnese & Giacomini, 2023; Apergis et al., 2022; Barth et al., 2022; Eliwa et al., 2021; Raimo et al., 2021; Yang, 2020; Devalle et al., 2017) shift the focus turning from CSR practices to ESG performance as a tool for measuring corporate social responsibility. Devalle et al. (2017) analysed the relationship between ESG performance and credit ratings using a sample of

twenty-six Italian public companies and thirty Spanish public companies operating in the manufacturing sector. The authors found that the social and governance scores are significant with a significance level of 1%. On the contrary, there is no significant impact of environmental performance on credit ratings. The authors argue that ESG performance has a positive impact on credit ratings because it can reduce the information asymmetry between companies and rating agencies through more and better information gathering. In this way, banks allocate lower interest rates and borrowers can benefit from better contractual conditions.

Eliwa et al. (2021) use institutional theory to test whether credit institutions reward businesses for their ESG performance by reducing bond yield spreads. Out of a sample of more than six thousand observations by European companies for the period 2005–2016, the results suggest that companies with good ESG performance have access to credit at lower interest rates. The negative relationship between ESG performance/reporting and debt cost supports the idea that these practices can reduce agency conflict between shareholders and credit institutions, as they reduce the information asymmetry between the parties. However, the authors denounce the existence of a substitute relationship between ESG performance and ESG disclosure. In other words, sometimes companies tend to mystify ESG reporting to improve their image and gain benefits of various kinds (e.g., lower yield spreads). This result confirms the idea that ESG disclosure becomes a form of greenwashing to improve one's reputation and benefit from the associated benefits.

In line with the previous study, Raimo et al. (2021) argue that companies that disclose environmental, social, and corporate governance information manage to raise debt at a lower cost. Once again, ESG information helps to decrease the information asymmetry between companies and credit institutions. In fact, to date, information asymmetry mainly concerns non-financial aspects. In this regard, the ESG disclosure, combining information on environmental, social, and governance issues, provides a comprehensive picture of business management. At the same time, as disclosure of ESG increases the degree of transparency of companies, it simplifies the risk assessment processes of default by banks, resulting in a reduction in the cost of debt financing.

Yang (2020) draws attention to credit ratings and the effect of ESG performance on their allocation. The study shows that companies with good environmental and social scores tend to enjoy higher credit ratings. Corporate governance, however, although historically important, does not seem to play a leading role in the definition of credit ratings. Companies that contribute to the well-being of stakeholders can more easily get their support and can achieve resources at lower costs. At the same time, it appears that CSR-ESG practices reduce specific business risk (risk mitigation view), as evidenced by higher credit ratings or lower bond spreads. By contrast, companies engaged in environmental, social, or corporate governance disputes are riskier because they are subject to reputational, financial, or litigation risks. This situation deteriorates credit ratings and credit access conditions. Finally, numerous studies show

that ESG performance and environmental, social, and corporate governance reporting minimise the information asymmetry between companies and credit institutions. This situation provides more information to analyse the creditworthiness of borrowers.

The analysis by Apergis et al. (2022) shows a link between the cost of debt and the ESG score. Investors consider companies with low ESG scores riskier because of the exposition to environmental, social, and governance controversies. These factors can negatively affect borrowers' cash flows and their risk of insolvency. However, the analysis shows that the coefficients associated with the ESG scores and the respective E/S/G pillars are much lower than the financial indicators used in the model. Therefore, the authors conclude that the analysis of the financial position remains one of the most important assessments in determining creditworthiness. Moreover, this research highlights that ESG scores can vary from industry to industry in terms of materiality, as well as the significance of some ESG factors can vary its weight over time.

Barth et al. (2022) find no significant values for the governance pillar, while they highlight opposing conclusions for the environmental and social metrics. In relation to the environmental pillar, the results support the risk mitigation view, so higher E-scores imply a specific risk reduction and, consequently, a borrower's credit risk.

In light of recent studies, we consider that ESG performance has an impact on a company's short- and long-term risk, which is relevant for both companies and investors. According to stakeholder theory, we believe that CSR plays a leading role in achieving stakeholder support and resources needed for business activity. Therefore, good ESG performance can allow better credit assessments. This paper seeks to align with the studies of Apergis et al. (2022), Barth et al. (2022), and Devalle et al. (2017) that support risk mitigation theory. ESG scores and reporting can reduce the information asymmetry between shareholders and creditors and allows banks and rating agencies to have more information in order to make accurate estimates of issuers. This situation implies advantageous conditions for borrowers (Roy, 2023).

We expect that the good ESG performance can reduce the probability of corporate insolvency by acting as an insurance mechanism in the event of negative events. In the rating process, agencies continuously check the financial information of rated companies, the actions taken toward sustainability, and the firms' changes and prospects. The quality of credit ratings provided to market participants is in general very high. Therefore, consistent with agency and risk mitigation theory, we make the following assumptions:

*H1: There is a positive relationship between ESG score and credit rating so, as the ESG score increases, the credit rating improves.*

*H2: There is a positive relationship between environmental (E), social (S), and governance (G) performance and credit rating, so higher E/S/G scores have higher credit ratings.*

*H3: There is a positive relationship between the sub-categories of each pillar E/S/G and credit rating, with higher scores for each category resulting in a higher credit rating.*

In addition, the previous research (Apergis et al., 2022) shows that social, environmental, and governance issues take on different relevance depending on the sector to which they belong, affecting credit ratings more or less significantly. Therefore, this study aims to control the sectoral effects on the dependent variable by including three sector dummies. In this way, we check how the industry influences the dependent variable and the coefficient of the variables ESG.

*H4: The effect of the ESG variable on credit ratings is influenced by the sector to which the company belongs.*

*H5: The effect of pillar E/S/G on credit ratings is influenced by the sector to which the company belongs.*

Finally, the study aims to analyse the effect on the employee credit rating variable when there is an interaction between industry dummies and ESG explanatory variables, *ESG_Environmental, ESG_Social,* and *ESG_Governance.* In fact, we want to check whether the partial effect of explanatory variables on the dependent variable depends on one or more industry dummies.

*H6: The effect of ESG on credit ratings is influenced by the interaction between sector and ESG explanatory variables.*

*H6: The effect of ESG on credit ratings is influenced by the interaction between the sector and the subcategories of each pillar E/S/G.*

## 3. DATA, VARIABLES AND METHODOLOGY

### 3.1. Data

We use a sample of 1191 US-listed companies, and we collect the following variables:

*Credit combined implied rating:* Credit rating for public enterprises. It expresses the ability of a company to repay its debts. The ratings fluctuate on a scale from CC to AAA, where CC indicates highly speculative investments, while AAA designates the excellent ability to honour the obligations assumed.

*ESG score (ESG):* Expressed in absolute values. This score is a synthetic valuation of the solidity of a company from the point of view of environmental, social, and governance performance. The score is awarded on a scale from 0 to 100, where 0 corresponds to poor ESG performance and 100 to excellent ESG performance.

*ESG controversies:* Score expressed in absolute values on a scale from 0 to 100. The judgment assesses episodes related to actions that have had a sanction or legal implications. When the ESG controversies is equal to or higher than the ESG score, the final score coincides with the ESG score, when it is lower than the ESG score, then the final result is calculated as the average between the ESG controversies and the ESG score.

*ESG combined score:* Score expressed in absolute values on a scale from 0 to 100. The ESG combined score is equal to the overall ESG score when the ESG controversies is equal to or greater than the ESG score. Otherwise, it is calculated as the average between the ESG score and the ESG controversies.

*Environmental pillar:* Assesses ESG performance on environmental issues. The result is expressed in absolute values on a scale from 0 to 100.

It is divided into three categories (resource use, emissions, innovation) and the score is expressed by a weighted average of the three metrics.

• *Resource use:* Environmental pillar evaluation metric. The score is expressed in absolute values on a scale from 0 to 100. It weighs 11% on the overall score.

• *Emissions:* Environmental pillar evaluation metric. The score is expressed in absolute values on a scale from 0 to 100. It weighs 15% on the overall score.

• *Innovation:* Environmental pillar evaluation metric. The score is expressed in absolute values on a scale from 0 to 100. It weighs 11% on the overall score.

*Social pillar:* Evaluates ESG performance on social issues. The final score is expressed in absolute values on a scale from 0 to 100 and takes into account four metrics: employees, human rights, local communities and product responsibility.

• *Workforce:* Social pillar evaluation metric. The score is expressed in absolute values on a scale from 0 to 100. It has a 16% weight on the overall score.

• *Human rights:* Evaluation metric of the Social pillar. The score is expressed in absolute values on a scale from 0 to 100. It weighs 4% on the overall score.

• *Community:* Social pillar rating metric. The score is expressed in absolute values on a scale from 0 to 100. It weighs 8% on the overall score.

• *Product responsibility:* Social pillar evaluation metric. The score is expressed in absolute values on a scale from 0 to 100. It has a 5% weight on the overall score.

*Governance pillar:* Assesses ESG performance related to corporate governance practices. The final score is expressed in absolute values on a scale from 0 to 100 and is based on three metrics: business management, shareholders, and CSR strategy.

• *Management:* Governance pillar evaluation metric. The score is expressed in absolute values on a scale from 0 to 100. It weighs 19% on the overall score.

• *Shareholders:* Evaluation metric of the Governance pillar. The score is expressed in absolute values on a scale from 0 to 100. It has a weight of 6% on the overall score.

• *CSR strategy:* Governance pillar evaluation metric. The score is expressed in absolute values on a scale from 0 to 100. It has a 5% weight on the overall score.

We extrapolated each of these variables from the Thomson Refinitiv database. All data refer to the year 2021 and include enterprises belonging to four different sectors: manufacturing, retail, services, transport, and utilities as shown in Table 1.

This table shows the four sectors to which the companies in our sample belong. The main sector is manufacturing with 577 companies.

**Table 1.** Sectors

| Kind of sector | No. | Sector weight (%) |
|---|---|---|
| Manufacturing | 577 | 48.5% |
| Retail | 103 | 8.7% |
| Transportation and utilities | 180 | 15.1% |
| Services | 331 | 27.8% |
| **Total** | **1191** | **100%** |

## 3.2. Variables

The dependent variable is the credit rating of S&P found on Thomson Refinitiv for the year 2021. The overall ESG score, pillar E/S/G, and sub-categories are independent variables. To isolate the effects of the ESG variables, four control variables are selected among the factors used in previous studies and found relevant to explain the cost of debt and they are added to the models (Eliwa et al., 2021; Ge & Liu, 2012; Attig et al., 2013). We used the following:

• Business size (*Log_Tot_Assets*): Calculated as the logarithm of total assets in millions of dollars. Larger companies are exposed to a lower probability of insolvency because they can better withstand negative cash flow shocks. In addition, reputational risk decreases with increasing business size. Investors consider larger companies less risky, so they should benefit from higher ratings. Therefore, we assume that there is a positive relationship between the corporate dimension and credit rating.

• Return on assets *(ROA):* Measures the rate of return on the total assets of an enterprise. It is one of the most frequently used balance sheet indices in business profitability analyses. A higher return on total assets implies a higher profitability. For this reason, we expect a positive ROA correlated to credit rating.

• Leverage (*Debt_Equity*): Expressed in the D/E ratio. It has been shown in several studies that companies with higher leverage are exposed to the probability of default and increase their credit risk. We assume that there is a negative relationship with the dependent variable.

• Interest coverage ratio (*ICR*): Measures a company's ability to honour debt payments. It is the ratio of earnings before interest and taxes (EBIT) or earnings before interest, taxes, depreciation and amortization (EBITDA) on total interest expenses. If the ratio is below one, the company is not generating sufficient liquidity from its operating EBIT to meet its payment obligations. To compensate for the difference, the company must therefore resort to available liquidity or incur new debt. In this case, we expect a positive ICR related to the dependent variable.

Table 2 shows the variables in the model.

**Table 2.** Variables

| Variables | Name | Source |
|---|---|---|
| *Dipendent variable* | | |
| Credit combined implied rating | Credit rating | Thomson Refinitiv |
| *Explainatory variables* | | |
| ESG Score | ESG | Thomson Refinitiv |
| *Environmental pillar* | *ESG_Environmental* | Thomson Refinitiv |
| Resource use | *ESG_Env_Resource_Use* | Thomson Refinitiv |
| Emissions | *ESG_Env_Emissions* | Thomson Refinitiv |
| Innovation | *ESG_Env_Innovation* | Thomson Refinitiv |
| *Social pillar* | *ESG_Social* | Thomson Refinitiv |
| Workforce | *ESG_Social_Worforce* | Thomson Refinitiv |
| Human rights | *ESG_Social_Human_Rights* | Thomson Refinitiv |
| Community | *ESG_Social_Community* | Thomson Refinitiv |
| Product responsibility | *ESG_Social_Product* | Thomson Refinitiv |
| *Governance pillar* | *ESG_Governance* | Thomson Refinitiv |
| Management | *ESG_Gov_Management* | Thomson Refinitiv |
| CSR strategy | *ESG_Gov_CSR_Strategy* | Thomson Refinitiv |
| Shareholders | *ESG_Gov_Shareholders* | Thomson Refinitiv |
| *Control variables* | | |
| Size | *Log_Tot_Assets* | Thomson Refinitiv |
| ROA | *ROA* | Thomson Refinitiv |
| Leverage | *Debt_Equity* | Thomson Refinitiv |
| Coverage ratio | *ICR* | Thomson Refinitiv |

The variables are divided into dependent, explanatory, and control determinants. The source is always Thomson Refinitiv.

The endogenous variable of the model is the *Credit rating*. Credit ratings express the creditworthiness of an issuer; therefore, they reflect the risk of insolvency, and, for this, they are used in numerous studies as a proxy of the cost of debt. Ratings were found on Thomson Refinitiv and vary on a CC to AAA scale. In line with previous studies, the score was encoded on a numerical scale of 20 values, where 0, the lowest score, corresponds to C, while 20, the highest score, corresponds to AAA.

For *Credit rating*, it is used the S&P scale of scores dividing the ratings into twenty parts with a score of 20 to AAA rating and a score of 0 to C rating.

The distribution graph of the endogenous variable shows an approximately normal distribution. In addition, the scores mostly settle on values between 12 and 13 corresponding to BBB and BBB+ ratings.

**Table 3.** Ratings and score

| S&P's credit rating | Score |
|---|---|
| AAA | 20 |
| AA+ | 19 |
| AA | 18 |
| AA- | 17 |
| A+ | 16 |
| A | 15 |
| A- | 14 |
| BBB+ | 13 |
| BBB | 12 |
| BBB- | 11 |
| BB+ | 10 |
| BB | 9 |
| BB- | 8 |
| B+ | 7 |
| B | 6 |
| B- | 5 |
| CCC+ | 4 |
| CCC | 3 |
| CCC- | 2 |
| CC | 1 |
| C | 0 |

Out of 1191 observations, we find missing values for some variables as Table 3 shows.

**Table 4.** Data

| Variables | No. | Missing data | % |
|---|---|---|---|
| *Credit rating* | 1191 | 0 | 0.00% |
| *ESG* | 1191 | 0 | 0.00% |
| ***ESG_Environmental*** | 1191 | 0 | 0.00% |
| *ESG_Env_Emissions* | 768 | 423 | 35.52% |
| *ESG_Env_Resource_Use* | 436 | 411 | 34.51% |
| *ESG_Env_Innovation* | 780 | 755 | 63.39% |
| ***ESG_Social*** | 1191 | 0 | 0.00% |
| *ESG_Social_Workforce* | 1191 | 0 | 0.00% |
| *ESG_Social_Human_Rights* | 692 | 499 | 41.90% |
| *ESG_Social_Community* | 1160 | 0 | 0.00% |
| *ESG_Social_Product* | 1191 | 31 | 2.60% |
| ***ESG_Governance*** | 1191 | 0 | 0.00% |
| *ESG_Gov_Management* | 1191 | 0 | 0.00% |
| *ESG_Gov_CSR_Strategy* | 1191 | 595 | 49.96% |
| *ESG_Gov_Shareholders* | 596 | 0 | 0.00% |
| *Control variables* | | | |
| *Log_Tot_Assets* | 1090 | 0 | 0.00% |
| *ROA* | 977 | 8 | 0.67% |
| *Leverage* | 1191 | 101 | 8.48% |
| *Interest coverage ratio* | 1183 | 214 | 17.97% |
| ***Total observations*** | | **1191** | |

This table highlights the numbers and the percentage of missing values for each variable in our sample of 1191 chosen companies.

The higher missing value is the sub-category of *ESG_Env_Innovation* with 63.39% missing information followed by *ESG_Gov_CSR_Strategy* with 49.96% missed values.

There are also many missing values for the Environmental pillar and other sub-categories (*ESG_Env_Resource_Use, ESG_Env_Innovation*), as well as *ESG_Social_Human_Rights* and three control

variables (*ROA, Debt_Equity, ICR*). Due to the low number of these variables, the analyses could give non-significant results.

## 3.3. Methodology

Before testing the models, we carried out three preliminary analyses. First, we extrapolate some descriptive statistics to outline the most salient characteristics of the phenomenon under investigation. The observations are then divided into two sub-groups, based on whether they had a total ESG greater/equal to or less than its mean value. In this way, we can observe the behaviour of the dependent variable in the two different sub-samples. Then, we develop a correlation matrix to assess the degree of interdependence between variables.

The analysis is first carried out on the overall ESG scores, then on the three pillars, and finally on the sub-categories of each pillar.

## 4. RESULTS OF THE EMPIRICAL ANALYSIS

### 4.1. Descriptive statistics and univariate analysis

We calculate statistics about sample firms' variables. Table 5 shows that the credit rating of our sample has a maximum of 20 and a minimum of 1, while the total ESG scores of Thomson Refinitiv have a maximum of 88.5 and a minimum of 4.16. The average credit rating is around 11, corresponding to a BBB rating, while the average ESG score is just below 41. The average value of pillars is 37.61 (E), 46.53 (S), and 49.39 (G). Only the *ESG_Social* and *ESG_Governance* are close to the theoretical average of 50.

**Table 5.** Statistics

| Variable | No. | Mean | Std. Dev. | CV | Skewness | Kurtosis | Min. | Perc. 25 | Perc. 75 | Max. |
|---|---|---|---|---|---|---|---|---|---|---|
| *Credit rating* | 1191 | 11.07 | 3.91 | 35.31% | -0.303 | -0,34 | 1 | 8 | 14 | 20 |
| *ESG* | 1191 | 40.99 | 17.67 | 43.12% | 0.335 | - 0-53 | 4.16 | 27.35 | 53.65 | 88.5 |
| ***ESG_Environmental*** | 883 | 37.61 | 26.68 | 70.93% | 0.333 | -1.11 | 0.03 | 12.92 | 60.04 | 97.14 |
| *ESG_Env_Emissions* | 768 | 46.45 | 30.17 | 63.59% | 0.149 | -1.30 | 0.12 | 19.57 | 74.19 | 99.74 |
| *ESG_Env_Resource* | 780 | 50.25 | 29.71 | 48.22% | 0.182 | -0.55 | 0.31 | 25 | 76.56 | 99.75 |
| *ESG_Env_Innovation* | 436 | 48.37 | 23.33 | 59.12% | 0.017 | -1.25 | 0.61 | 34.36 | 61.98 | 97.32 |
| ***ESG_Social*** | 1191 | 46.53 | 21.56 | 46.33% | 0.383 | -0.69 | 1.88 | 29.89 | 61.65 | 97.58 |
| *ESG_Soc_Workforce* | 1191 | 44.02 | 27.22 | 34.28% | -0.211 | -0.68 | 0.26 | 21.44 | 65.36 | 99.82 |
| *ESG_Soc_Human Rights* | 692 | 51.46 | 27.57 | 53.57% | -0.017 | -1.11 | 0.31 | 28.27 | 73.08 | 98.96 |
| *ESG_Soc_Community* | 1191 | 63.49 | 21.77 | 57.04% | 0.465 | -1.01 | 1.72 | 48.71 | 81.84 | 99.9 |
| *ESG_Soc_Product* | 1160 | 45.5 | 25.95 | 61.84% | 0.382 | -0.94 | 3.8 | 25.71 | 68.25 | 99.77 |
| ***ESG_Governance*** | 1191 | 49.39 | 22.07 | 44.69% | -0.086 | -0.93 | 0.89 | 31.24 | 66.67 | 96.59 |
| *ESG_Gov_Management* | 1191 | 53.41 | 27.96 | 52.36% | -0.098 | -1.17 | 0.4 | 29.27 | 77.63 | 99.87 |
| *ESG_Gov_CSR* | 596 | 51.36 | 28.84 | 55.31% | -0.037 | -1.22 | 0.18 | 23.66 | 77.32 | 99.67 |
| *ESG_Gov_Shareholders* | 1191 | 51.88 | 28.7 | 56.15% | -0.037 | -1.22 | 0.01 | 27.02 | 77.11 | 99.9 |
| *Log_Tot_Assets* | 1191 | 3.32 | 0.79 | 209.71% | 10146 | 157.69 | 1.43 | 2.75 | 3.85 | 5.74 |
| *ROA* | 1183 | 0 | 0.15 | 1010.23% | 6430 | 106.93 | -0-89 | -0.03 | 0.07 | 0.82 |
| *Debt_Equity* | 1000 | 1.09 | 2.28 | 23.83% | 0.350 | -0.34 | 0 | 0.14 | 1.22 | 45.42 |
| *ICR* | 977 | 15.57 | 157.25 | 9510.77% | -1.563 | 6.43 | -1406.38 | 0.87 | 9.66 | 2339.65 |

We note that most dependent variables have a slight positive asymmetry with a prevalence of queues on the right. In contrast, the credit rating and some sub-categories of the pillar E/S/G (*ESG_Social_Workforce, ESG_Social_Human_Rights, ESG_Gov_Management, ESG_Gov_CSR_Strategy,* and *ESG_Gov_Shareholders*) are characterised by a slight negative asymmetry code (prevalence of left). Almost all variables, except the two control variables *Log_Tot_Assets* and *ROA*, have a negative coefficient, an expression of a platykurtic curve, that is "flatter"

than a normal one. By contrast, the coefficient of acceptance and *ROA* are positive. In this case, the curve is defined leptokurtic and is therefore more "pointed" than a normal one.

At this point, we carried out a preliminary analysis to study the relationship between credit rating and ESG score, dividing the sample between companies with a lower-than-average ESG score (low score) and companies with an ESG score equal to or above the average (high score) (Table 6).

**Table 6.** High-score and low-score companies

| Variable | No. | Mean | Std. Dev. | Min. | Pctl. 25 | Pctl. 75 | Max. |
|---|---|---|---|---|---|---|---|
| *High score: ESG ≥ 40.99* | | | | | | | |
| Sectors | 568 | | | | | | |
| Credit rating | 568 | 11.76 | 3.46 | 1 | 9.75 | 14 | 20 |
| ESG | 568 | 56.23 | 11.33 | 41 | 46.68 | 63,41 | 88,5 |
| Log_Tot_Assets | 568 | 3.7 | 0.72 | 1,95 | 3.21 | 4.19 | 5.48 |
| ROA | 567 | 0.03 | 0.12 | -0.76 | 0.01 | 0.08 | 0.53 |
| Debt_Equity | 527 | 1.12 | 1.58 | 0 | 0.28 | 1.27 | 15.56 |
| ICR | 492 | 18.49 | 116.1 | -206.24 | 2.4 | 11.83 | 2339.6 |
| *Low score: ESG < 40.99* | | | | | | | |
| Variable | No. | Mean | Std. Dev. | Min. | Pctl. 25 | Pctl. 75 | Max. |
| Sectors | 623 | | | | | | |
| Credit rating | 623 | 10.44 | 4.18 | 1 | 8 | 14 | 20 |
| ESG | 623 | 27.09 | 8.66 | 4.16 | 20.58 | 34.05 | 40.95 |
| Log_Tot_Assets | 623 | 2.98 | 0.7 | 1.43 | 2.5 | 3.35 | 5.74 |
| ROA | 616 | -0.03 | 0.17 | -0.89 | -0.08 | 0.06 | 0.82 |
| Debt_Equity | 563 | 1.05 | 2.77 | 0 | 0.03 | 1.11 | 45.42 |
| ICR | 485 | 12.6 | 190.2 | -1406.38 | -1.04 | 7.35 | 2171.63 |

The table summarizes the two samples and highlights the statistics of the dependent variable (*Credit rating*) and the main determinant (*ESG*) in addition to the control variables' statistics.

The breakdown of the sample shows that high-score companies have a credit rating on average higher than that of low-score companies. Indeed, it is noted that companies with an ESG score greater than 40.99 have on average a credit rating of 12 (equivalent to BBB), while, on the contrary, low-score companies have on average a credit rating of 10 (equivalent to BB+). From this observation, therefore, we could confirm the *H1* hypothesis.

Based on this result, we analyse the following correlation matrix matching independent variables and their sub-categories with the dependent variable represented by credit rating.

**Table 7.** Correlation matrix

| Independent variable | Credit rating | p-value |
|---|---|---|
| **ESG** | 0.2078 | < 0.0001 |
| **ESG_Environmental** | 0.1584 | < 0.0001 |
| ESG_Env_Emissions | 0.1417 | < 0.0001 |
| ESG_Env_Innovation | 0.1332 | 0.0053 |
| ESG_Env_Resource_Use | 0.1455 | < 0.0001 |
| **ESG_Social** | 0.1777 | < 0.0001 |
| ESG_Social_Community | 0.1383 | < 0.0001 |
| ESG_Social_Human_Rights | 0.0969 | 0.0108 |
| ESG_Social_Product | 0.0963 | 0.001 |
| ESG_Social_Workforce | 0.1595 | < 0.0001 |
| **ESG_Governance** | 0.1838 | < 0.0001 |
| ESG_Gov_CSR_Strategy | 0.0611 | 0.1364 |
| ESG_Gov_Management | 0.1682 | < 0.0001 |
| ESG_Gov_Shareholders | 0.0643 | 0.0265 |
| Log_Tot_Assets | 0.0802 | 0.0056 |
| ROA | 0.412 | < 0.0001 |
| Debt_Equity | -0.2408 | < 0.0001 |
| ICR | 0.1162 | 0.0003 |

Although weak, the correlation between credit rating and independent variables (ESG score, pillar E/S/G, and sub-categories), with the exception of *ESG_Gov_CSR_Strategy*, is significant and positive, whereby as the overall or pillar-specific ESG score increases or sub-categories increase, the credit rating improves. The only variable reporting a non-significant correlation is the *ESG_Gov_CSR_Strategy* which has a p-value above 5%. However, this situation is not relevant because there is a small number of data available for that category, as shown in Table 4.

The assumptions made for control variables also seem to be respected. The ratios of *Log_Tot_Assets, ROA,* and *ICR* are positive and significant, suggesting that larger companies, more profitable companies, and companies with a higher rate of interest cover achieve higher credit ratings. By contrast, the ratio of the *Debt_Equity* variable is negative and significant, therefore a higher risk of insolvency is associated with companies with higher leverage, which results in a lower credit rating.

## 4.2. Firm-level regressions

We carried out the empirical analysis by constructing seven different models that tested the hypotheses *H1, H2, H3, H4, H5, H6,* and *H7,* respectively. We use a multiple linear regression for each model.

**Table 8.** Regression analysis

| Variable | Model 1 (H1) | Model 2 (H2) | Model 3 (H3) | Model 4 (H4) | Model 5 (H5) | Model 6 (H6) | Model 7 (H7) |
|---|---|---|---|---|---|---|---|
| Intercepts | 10.9015*** | 10.5753*** | 7.8867*** | 10.9112*** | 10.6389*** | 11.0791*** | 10.6372*** |
| *Explanatory variables* | | | | | | | |
| **ESG** | 0.0312*** | | | 0.0273*** | | 0.0217* | |
| *ESG_Environmental* | | -0.0008653 | | | -0.0023 | | 0.0006 |
| ESG_Env_Emissions | | | 0.0055 | | | | |
| ESG_Env_Innovation | | | 0.0094 | | | | |
| ESG_Env_Resource_Use | | | 0.0143 | | | | |
| **ESG_Social** | | 0.0312*** | | | 0.0287*** | | 0.0221514 |
| ESG_Social_Community | | | 0.0077 | | | | |
| ESG_Social_Human_Rights | | | 0.0038 | | | | |
| ESG_Social_Product | | | 0.0066 | | | | |
| ESG_Social_Workforce | | | 0.0017 | | | | |
| **ESG_Governance** | | -0.0002 | | | 0.0004 | | 0.0024208 |
| ESG_Gov_Management | | | -0.0022 | | | | |
| ESG_Gov_Shareholders | | | -0.0011 | | | | |
| ESG_Gov_CSR_Strategy | | | -0.0158 | | | | |
| *Control variables* | | | | | | | |
| Debt_Equity | -0.2773*** | -0.2924*** | -0.5492*** | -0.2679*** | -0.2824*** | -0.2638*** | -0.2769*** |
| Interest coverage ratio | 0.0010 | 0.0018* | 0.0079 | 0.0013 | 0.0021* | 0.0013 | 0.0023** |
| Log_Tot_Assets | -0.2750 | -0.2490 | 0.4505 | -0.1369 | -0.1425 | -0.1162 | -0.1089 |
| ROA | 10.6884*** | 13.0043*** | 14.0836*** | 10.8632*** | 13.2011*** | 108.665 | 13.2774*** |
| *Sectorial dummy* | | | | | | | |
| Retail | NO | NO | NO | -1.7085*** | -1.7942*** | -0.9126 | -0.4351 |
| Services | NO | NO | NO | -0.2594 | -0.2468 | -10.841 | -12.279 |
| Transportation and utilities | NO | NO | NO | -0.8329** | -0.5649 | -13.191 | -0.8501 |
| *Interaction* | | | | | | | |
| ESG × Retail | NO | NO | NO | NO | NO | -0.0191 | NO |
| ESG × Services | NO | NO | NO | NO | NO | 0.01942 | NO |
| ESG × Transportation and utilities | | | | | NO | 0.0111 | NO |
| ESG_Environmental × Retail | NO | NO | NO | NO | NO | NO | 0.0145 |
| ESG_Environmental × Services | NO | NO | NO | NO | NO | NO | -0.0199 |
| ESG_Environmental × Transportation and utilities | NO | NO | NO | NO | NO | NO | 0.0018 |
| ESG_Social × Retail | NO | NO | NO | NO | NO | NO | -0.0159 |
| ESG_Social × Services | NO | NO | NO | NO | NO | NO | 0.0443* |
| ESG_Social × Transportation and utilities | NO | NO | NO | NO | NO | NO | -0.0117 |
| ESG_Governance × Retail | NO | NO | NO | NO | NO | NO | -0.0198 |
| ESG_Governance × Services | NO | NO | NO | NO | NO | NO | -0.0143 |
| ESG_Governance × Transportation and utilities | NO | NO | NO | NO | NO | NO | 0.0121 |
| R-squared | 0.2167 | 0.243 | 0.3211 | 0.2337 | 0.2618 | 0.2362 | 0.2712 |

*Note: *, **, and *** signs, respectively, significance at $p < 0.10$, $p < 0.05$, and $p < 0.01$.*

In the first model, we test the *H1* hypothesis to quantify the relationship between overall ESG score and credit rating.

The explanatory variable ESG is significant and has a positive coefficient (0.03). These observations confirm the *H1* hypothesis. There is a positive and significant relationship between *ESG score* and *Credit rating*. As the ESG performance increases, its credit rating may increase by up to three points, as for each additional point in the overall ESG score the credit rating increases by 0.03. However, the correlation with the dependent variable is very weak. For control variables, only *Debt_Equity* and *ROA* are significant and confirm the initial assumptions. The first has a negative ratio, which confirms that companies with a higher level of debt have a lower credit rating. The *ROA* variable, on the other hand, with a positive coefficient, supports the hypothesis that companies that are more profitable get higher credit ratings. The explanatory variable with the greatest impact on the dependent variable is the *ROA* with a coefficient of 10.7.

The second model investigates the impact that every single pillar has on the credit rating. Contrary to Apergis et al. (2022) and Agnese and Giacomini (2023), but in line with Devalle et al. (2017), only the *ESG_Social* variable is significant with a positive sign. These findings could be generated by the point of view of credit rating agencies that care about the downside default risk of firms when evaluating their creditworthiness. While it is difficult to discriminate between ESG factors reflecting CSR and ESG factors reflecting corporate social irresponsibility (CSI), we believe that the Social pillar is a good proxy of irresponsibility when below a certain level. CSI will increase financial risk whereas CSR is not necessarily cared about by the debtholders and credit rating agencies.

The maximum excursion of the *ESG_Social* from 0 to 100 results in a maximum three-point increase in the dependent variable. Among the control variables, once again *ROA* and *Debt_Equity* confirm the initial assumptions that more profitable and less indebted companies benefit from higher ratings. In terms of significance, there is also the *ICR* variable, which supports the view that a higher interest rate reduces the risk of insolvency and increases credit ratings.

The third model tests the *H3* hypothesis with the significance of the single sub-categories. In this case, the analysis does not reveal any significance in Social sub-categories, probably due to the small number of observations in some sub-categories.

The fourth model tests the *H4* hypothesis to check how each sector affects the dependent variable and the coefficient of the *ESG* variable.

As in Model 1, the explanatory variable *ESG* was significant with a significance level of 1. However, it denotes a weaker impact on the dependent variable than in the previous case, as demonstrated by a coefficient of 0.0273. The main contribution of the model is due to the inclusion of industry dummies. Among these, the retail and transportation and utilities sectors are significant. The coefficients of the dummies show that membership in the retail or transport sector leads to a reduction in the effect of the *ESG score* on *Credit ratings* of 1.71 and 0.83 points, respectively.

The last two models include interaction variables to check whether the results achieved at the sample level are confirmed in each sector. Model 6 shows a reduced significance for the *ESG* variable and no significant impact on sector dummies. In Model 7, with single pillars of ESG, the interaction variable *ESG_Social × Services*, with a significance level of 1%, shows that in the services sector, the *ESG_Social* variable has a different impact than the average impact on the credit rating in the presence of other sectors. In particular, the combined effect of *ESG_Social* and the services sector has a better significant and positive impact on credit ratings, as demonstrated by a coefficient of 0.0443.

## 5. CONCLUSION

This study investigated the ESG factors and credit ratings for US-listed companies. Our findings, almost in line with the study conducted by Devalle et al. (2017), confirm the existence of a positive relationship between ESG performance and credit ratings. In particular, we prove that:

1. The companies with good overall ESG scores achieve higher credit ratings.
2. The social performance (*ESG_Social*) exerts a positive effect on the credit rating; this effect is incremental compared to traditional financial ratios used in the rating models.
3. The effect of social performance tends to differ among different industries.

Although the hypothesis of a positive relationship between ESG performance and credit rating is confirmed, the results of this work show that ESG factors have an extremely slight impact on the allocation of credit ratings. In fact, the coefficients E/S/G and ESG only play a minor part in the definition of the dependent variable. By contrast, profitability and financial performance indicators such as *ROA* and *Debt_Equity* dominate credit rating processes. These results are in line with Apergis et al. (2022) and Goss and Roberts (2011), according to which creditors do not reward sustainability performance. Specifically, only the Social pillar has reached the threshold of significance, reflecting the greater appreciation of this issue by investors and creditors.

These findings could be explained by the fact that environmental and corporate governance performance is indirectly reflected in the traditional financial ratios used by rating agencies and they are mainly considered for the bank bonds pricing (Agnese & Giacomini, 2023). Based on our conclusion, managers should promote an effective ESG strategy and social practices to improve their creditworthiness, while regulators should unify the ESG evaluation criteria helping to improve the information disclosure mechanism to the markets on firms ESG.

In conclusion, the results of the empirical analysis seem to show that the current integration of ESG parameters into credit rating processes is only at an early stage. Indeed, it is still difficult to quantify the impact of these factors by separating them from economic and financial indicators. The main problem lies, as Menz (2010) argued, not so much in the lack of interest in the issue from rating agencies and creditors in general, but rather in the lack of complete, reliable, and easily accessible data to evaluate ESG performance. It is, therefore, the absence of a strong guideline on measuring the impact of ESG performance the biggest hurdle to overcome. Indeed, rating agencies' implementation of new methodologies for analysing ESG performance shows that they appreciate sustainability and are increasingly aware of the importance of ESG issues in borrowers' solvency assessments. Given their role in the global financial environment, we confirm that traditional financial information alone will no longer be sufficient to assess the financial soundness of companies. The financial system plays, in fact, a crucial role in laying the foundations of the future, therefore, in ensuring sustainable growth, mobilising capital towards environmentally and socially responsible investments, and triggering a virtuous circle that encourages companies to adopt a proactive approach to sustainability to reduce the specific risk and the cost of capital.

We are aware that our analysis could be affected by several limitations. The first refers to the sample that is not global, so there could be a country effect. With larger samples, the analysis could detect the different impacts of country risk effect. The sample is limited to only US companies and to fiscal year 2021. Future studies may enlarge the period of analysis and they could probe the relationship between ESG criteria and credit ratings by expanding the sample of observations to include different cultural and institutional contexts. A further section of analysis and validation of the results obtained could include the evolution over time of the relationship between ESG scores and credit ratings, also considering possible changes in regulations.

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