



How important are ESG ratings for financial institutions? Evidence from corporate leverage ratios across Europe

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ABSTRACT

This study aims to examine the relationship between corporate leverage and environmental, social and governance (ESG) ratings, and how this relationship is affected by a country's level of financial development. Financial development is examined through its two main components: the development of financial institutions and the development of financial markets. To address our research questions, we analyse a sample of European listed companies observed from 2007 to 2022 and employ various model specifications, including the use of instrumental variables to mitigate endogeneity concerns. Our main findings indicate a negative relationship between leverage and ESG ratings in countries with low levels of financial institution development. However, this negative relationship weakens and even turn positive in countries with more robust financial institutions. The index measuring access to financial institutions is the most important component of financial development in explaining the observed relationships. Moreover, the positive effect of financial institutions on the relationship between ESG ratings and leverage is strengthened when ESG ratings are higher and in industries where fewer companies have ESG ratings. Overall, our findings contribute to the existing literature suggesting that corporate ESG ratings have a different signalling value in the credit assessment of financial institutions than in that of financial market investors. This discrepancy may be due to the more effective monitoring processes implemented by financial institutions, raising important implications, particularly for policymakers, banks and investors.

1. Introduction

Interest in environmental, social, and governance (ESG) practices has grown significantly over the past two decades. Extreme weather events, pandemics and socio-economic crises are increasingly underscoring the urgency for a transition to a sustainable economy to ensure long-term growth and competitiveness. In this vein, policies and regulations, such as the European Climate Law (Regulation (EU) 2021/1119), the Sustainable Finance Disclosure Regulation (Regulation (EU) 2019/2088) and the Corporate Sustainability Reporting Directive (2022/2464/EU), along with pressure from investors, have increased the demand for corporate

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sustainability information in decision-making processes.

In this context, this study investigates the relationship between companies' financial needs and their ESG rating, which is receiving increasing attention, *inter alia* from academics. Research on corporate financial structure has explored the impact of ESG factors on firm risk and, consequently, on the cost of capital (Albuquerque et al., 2019; Carnevale & Drago, 2024; Jung et al., 2018), starting from the assumption that firms with strong environmental engagement should be considered less risky by investors, as their focus on green issues minimises the likelihood of environmental scandals (El Ghoul et al., 2011). In addition, ESG engagement is associated with lower risk perceptions among investors and rating agencies (Attig et al., 2013). Other studies have examined the relationship between ESG scores and corporate debt structure, yielding mixed results. While some find a positive relationship (e.g., Godfrey, 2005; Mishra & Modi, 2013), others show a negative relationship (Asimakopoulos et al., 2023; Bae et al., 2011; Verwijmeren & Derwall, 2010), suggesting that unaddressed factors could influence this link.

Our study contributes to filling this research gap by focusing on the impact that a country's level of financial development might have on the relationship between corporate leverage and ESG score. We start from the assumption that there may be a divergence between financial intermediaries and financial markets in the processing of information for corporate assessment purposes and, consequently, that ESG ratings may act as differential signals between the two financing channels. In particular, banks tend to integrate ESG considerations into a broader information context, also under regulatory pressure on credit risk models (see next section for more details). Not surprisingly, recent studies suggest that firms with higher ESG ratings obtain more loans (Liu et al., 2024, pp. 1–25; Newton et al., 2024), and, similarly, that banks lower their credit supply drastically to borrowers affected by a bad ESG reputation (Homanen, 2018; Houston et al., 2021). Therefore, based on these findings, we expect that the relationship between firm leverage and ESG rating will be affected by the level of development of financial institutions at the country level, which captures banks' sensibility to ESG factors. This aspect is particularly relevant for the allocation of green transition financing and, more broadly, for the achievement of the United Nations Sustainable Development Goals. Understanding whether financial institutions reward "virtuous" companies by granting them more loans is extremely helpful in steering the transition process.

To achieve our research objective, we consider cross-country panel data of European listed companies over the period 2007–2022. Compared to US-based studies (e.g., Asimakopoulos et al., 2023), Europe is an ideal testbed for our hypotheses as it is widely recognized as being at the forefront of sustainable finance regulation (Tschopp, 2005). Furthermore, European countries are characterized by heterogeneity in the levels of development of bank activities, showing more or less market- or bank-oriented financial systems (Levine, 2002). At the same time, Europe is characterized by a harmonized and coordinated regulation and supervision of the financial sector, as well as stronger social concerns for climate change compared to other economies, such as the US and China (see data of the EIB climate survey, 2023).

In a nutshell, our results show a not significant relationship between ESG score and firm leverage, on average. When we consider the degree of financial development at the country level, the results suggest that the relationship depends on how relevant financial institutions are in mobilizing financial resources. Indeed, the relationship between ESG scores and leverage is negative in countries where the index representing the development of financial institutions is low, but the effect weakens in countries where financial institutions are stronger, turning even positive in countries with the most developed financial institutions. Further evidence shows that it is mostly the index that captures the access to financial institutions that moderates the relationship between ESG rating and leverage. Instead, we do not find a significant moderating role for the index capturing the development of financial markets. Our relationships are significant when we consider each of the ESG score components (E, S and G), and both high and low ESG scores, although the magnitude of the effect is greater for higher ESG scores. In other words, we show that company leverage depends, conditional on the development of national financial institutions, not only on the presence of the ESG score but also on the magnitude of the score. These results are robust to the use of alternative dependent variables, including the relative share of short-term debt, and model specifications, including the use of instrumental variables to address endogeneity concerns. We also find that the signalling effect of the ESG score is prevalent when the rating is less frequently present within an industry.

This study's contribution is twofold. First, it offers additional evidence on the relationship between ESG rating and leverage, deepening the understanding of this still much-debated link and providing a rationale for the diverse results found in the literature, which may arise from the analyzed financial contexts. This is essential to the green transition: Companies with varying ESG commitments may have different opportunities to access the financing channels, depending also on the type of financial system in which they operate. Secondly, to the best of our knowledge, this study is the first to examine the moderating impact of financial development on the relationship between ESG rating and leverage, particularly emphasizing the prevailing role of financial intermediaries over financial markets in clarifying this connection.

The structure of this study is as follows. Section 2 presents the literature review, Section 3 illustrates the data and the analysis model, and Section 4 reports the results and discussion, along with a series of robustness checks. Section 5 provides further evidence on the relationship between ESG score and capital structure, and finally, Section 6 concludes.

2. Literature review

Numerous studies analyse the impact of ESG behaviour on firm economic and financial performance (see, e.g., Barnett & Salomon, 2012; Lins et al., 2017; Hussain et al., 2022), including in times of crisis (Albuquerque et al., 2020; Bae et al., 2021). Among these, a few studies analyse the relationship between ESG performance and leverage, showing mixed findings.

Within the framework of signalling theory (Spence, 1973), some articles suggest a positive relationship between ESG performance and leverage. According to signalling theory, firms operate under conditions of asymmetric information and may use capital structure choices to signal their quality to external investors (Ross, 1977). In this context, firms with high ESG performance may credibly

indicate to external financiers a lower risk profile, long-term orientation, and commitment to stakeholder value. Hence, high-ESG firms may choose to issue more debt to reinforce this positive signal, as taking on debt implies confidence in future cash flows and organizational discipline. From this perspective, a positive relationship between ESG scores and the level of debt is expected.

Specifically, the positive relationship is justified by essentially three mechanisms. First, firms with better ESG performance are viewed as more promising (Yoon et al., 2006), ethical (Bacha & Ajina, 2020), trustworthy (Godfrey, 2005), and less risky (Mishra & Modi, 2013; Wang & Yang, 2023), which improves creditworthiness and facilitates access to external funds. Second, the disclosure of ESG information and the transparency of ESG actions are exploited by managers to signal their commitment to adopt sound corporate environmental, social, and governance policies, thus decreasing information asymmetries (Bilyay-Erdogan et al., 2024; Hoepner et al., 2016). Third, higher ESG scores attract investors who have social preferences and wish to improve their social image (Riedl & Smeets, 2017). All in all, firms with a superior ESG score benefit from better debt financing options, due to the lower information asymmetries, increased creditworthiness, and reduced monitoring costs. In line with this view, Oikonomou et al. (2014) find that ESG performance lowers the cost of debt and improves credit ratings. Eliwa et al. (2021) further show that even when accounting for ESG performance, ESG disclosure reduces the cost of debt. Srivastava et al. (2022) reveal that among ESG-rated companies, those with the highest ratings obtain more debt financing during COVID-19 (but not in normal times). In essence, ESG performance helps companies to access capital more easily (Asimakopoulou et al., 2023; Cheng et al., 2014).

In contrast, within the framework of the pecking order theory, a negative relationship between ESG practices and leverage may be hypothesised. The pecking order theory suggests that firms follow a hierarchy in their financing choices based on the cost of information asymmetry (Myers & Majluf, 1984). High-ESG firms, which may have better internal financing capacity due to stronger reputations and stakeholder relationships, might prefer internal funds over debt, and debt over equity. From this perspective, a higher ESG score would be associated with lower levels of debt, consistent with a conservative financing posture.

Indeed, higher ESG scores increase the overall firm value since firms have higher growth opportunities (Lins et al., 2017), and amplify social reputation and intangible assets (Dai et al., 2021; Servaes & Tamayo, 2013). At the same time, ESG scores reduce the firms' financial needs. Firms with higher ESG scores can rely more on internal finance since they have better financial performance (Renneboog et al., 2011), and higher employee productivity and efficiency (Lins et al., 2017). Therefore, these firms may have more opportunities to satisfy their financing decisions, including whether or not to rely on external finance, which justifies a reduction in leverage for ESG-rated companies. Empirical evidence supporting this view includes Verwijmeren and Derwall (2010) and Bae et al. (2011), showing that firms supporting employee well-being actions rely less on debt. In the US, Asimakopoulou et al. (2023) find that when firms become ESG-rated, their leverage ratios decrease. Similarly, Lai and Zhang (2022) find that ESG certification reduces excess leverage in Chinese companies by relaxing their financing constraints.

These theoretical lenses - signalling theory and pecking order theory - provide alternative hypotheses on how ESG rating may influence firms' financing behavior. They highlight the potential of the ESG score to function either as a credibility-enhancing signal that supports greater use of debt or as an indicator of financial self-sufficiency, reducing the need for leverage. Correspondingly, we can formulate two alternative Hypotheses (1a and 1 b), as follows:

Hypothesis 1a. The relationship between ESG score and leverage is positive.

Hypothesis 1b. The relationship between ESG score and leverage is negative.

To reconcile these mixed findings on the relationship between ESG scores and capital structure, some authors find that this relationship is non-linear and depends on the stage of ESG engagement by the firm (Li et al., 2024). For instance, in the initial phases of ESG involvement, the expenses associated with ESG initiatives are considerable and the tangible financial gains have not yet materialized, resulting in a situation in which borrowing costs overcome benefits (Devinney, 2009). Mixed results can also depend on the measurement of leverage, recognizing different relationships between ESG scores and book or market leverage (Adeneye et al., 2023). An additional reason for the conflicting evidence in the literature is the presence of significant differences in country-relevant variables. Hence, the relationship between ESG scores and leverage appears to be complex and context-dependent (e.g., Lai & Zhang, 2022).

Our study fits into this influential strand of the literature by providing new insights into the relationship between ESG ratings and firm leverage. Specifically, we identify the level of development of financial markets and institutions at the country level as a key additional factor in shaping this relationship.

The degree of development of financial markets and institutions displays significant cross-country differences (Barth et al., 2004; Beck et al., 2006, 2010; Laeven & Levine, 2009) and notably affects firms' capital structure (see, e.g., Booth et al., 2001; Giannetti, 2003; De Jong et al., 2008; Antzoulatos et al., 2016).

A well-established view in economic theory recognizes the positive role of financial institutions in capital allocation (Diamond, 1984; Ramakrishnan & Thakor, 1984). Financial intermediaries, mainly banks, are considered "special" provider of finance because of their ability to mitigate information asymmetries and moral hazard through effective monitoring, scale economies in information processing, and the establishment of long-term relationships with borrowers (Fama, 1985; Berlin & Loeys, 1988). Banks distinguish themselves from alternative providers of finance due to their access to private information and their capacity to extract and process soft information over time (Boot & Thakor, 1997). From this perspective, banks can use firms' ESG scores as additional source of insight to reduce information asymmetry and lower monitoring costs.

Conversely, market investors typically operate with less access to private information and are therefore more reliant on publicly available ESG scores. This makes them particularly sensitive to the divergence in ESG rating across providers (Berg et al., 2022), and vulnerable to phenomena such as greenwashing (Duchin et al., 2025). The result is a more volatile and procyclical response to ESG

sentiment in capital markets, which can influence pricing, liquidity, and capital access in ways that differ markedly from bank lending dynamics. This divergence in information processing implies that ESG rating functions as a differentiated signal across financing channels. For market participants, ESG scores operate as public signals that directly inform pricing and allocation decisions. For banks, instead, ESG considerations are embedded within a broader and often more nuanced informational environment that includes both hard and soft data, as well as regulatory considerations.

In this respect, evolving regulatory pressures—such as the European Central Bank’s guidelines on climate-related risk—are pushing banks to integrate ESG factors into credit risk models, making them more attuned to ESG risks even in the face of noisy or inconsistent public ratings.

A growing number of empirical studies use proprietary data, such as syndicated loans or granular supervisory data, to investigate the relationship between bank lending and firms’ ESG scores. Recent evidence suggests that highly rated ESG firms obtain larger amounts of bank loans (Guo et al., 2024; Liu et al., 2024) and better financing conditions, such as lower cost of borrowing (Li & Qiu, 2021), fewer collateral and covenants (Hasan et al., 2017), and higher flexibility of renegotiation or longer maturity (Li et al., 2024). Newton et al. (2024) show that firms with a low ESG reputation rely less on bank loans to avoid bank monitoring and scrutiny, indicating that banks value ESG information more efficiently than the financial market. This is most likely due to the effectiveness with which financial intermediaries assess company information to grant credit. Other authors find that banks linked to borrowers with a bad ESG reputation face a reputational risk and are ready to face a sharp drop in credit supply with the ultimate goal of limiting the volatility of the deposit base (Homanen, 2018; Houston et al., 2021). Despite the specific findings, all these studies highlight the importance of firms’ ESG factors in bank lending decisions. Our research complements this strand of literature by providing cross-country evidence about the key role that the banking sector plays in the relationship between firms’ leverage and ESG ratings, and, from there, in financing corporate strategies of green transition and sustainable growth. We therefore test the following hypothesis:

Hypothesis 2. The relationship between ESG score and leverage depends on the development of financial institutions at the country level. ESG-rated companies tend to use more leverage in countries with more developed financial institutions.

3. Data and model

To address our research questions, we consider companies located in Europe¹ over the period 2007–2022. To construct our database, we used two main sources of information.

At firm-level, financial and economic data were retrieved from the Refinitiv database. The database also includes Refinitiv ESG data, which provides the ESG ratings and the Environmental, Social and Governance Pillars for each firm and year.² Refinitiv ESG data is one of the major ESG rating providers with extensive coverage and is widely employed by the industry, such as asset managers. Despite its well-known limitations (Berg et al., 2021, 2022a; Luo & Farag, 2024), it has been widely used also in the academic literature to investigate the relationship between ESG ratings and various company performance indicators (see, e.g., Berg, Koelbel, Pavlova, & Rigobon, 2022) including leverage (Asimakopoulous et al., 2023).

At country-level, we retrieved data from the Financial Development Index database, developed by the International Monetary Fund.³ The database provides a comprehensive indicator of time-variant country-specific financial development, as well as two components capturing the level of development of financial institutions and financial markets based on three pillars: depth, access and efficiency.⁴

To examine the relationship between leverage and ESG score, we follow previous literature and assume that a typical firm has a long-term target leverage ratio and can partially adjust to it (Flannery & Rangan, 2006; Bae et al., 2011; Im et al., 2020; Asimakopoulous et al., 2023). The partial adjustment model can be written as an autoregressive model defined as follows:

$$Leverage_{it} = \beta_0 + \beta_1 Leverage_{it-1} + \beta_2 ESG_{it-1} + \beta_3 FinancialDev_{ct-1} + \beta_4 (ESG_{it-1} \times FinancialDev_{ct-1}) + \gamma X_{it-1} + \omega_i + \mu_t + \epsilon_{it} \quad (1)$$

$Leverage_{it}$ is the dependent variable for the company i located in country c at time t , defined as the long-term debt⁵ over total assets. We alternatively use the ratio between the long-term debt and the market value of total assets (i.e., the market leverage, $mkt_leverage_{it}$). The variable ESG_{it-1} is the ESG rating of a company (which varies between 0 and 100, with higher scores indicating better ESG performance), taken in logarithm at time $t-1$. We set the variable equal to 0 for companies without a rating in a given year. We expect a positive (negative) coefficient for this variable in accordance with Hypothesis 1a (1 b). $FinancialDev_{ct-1}$ is the financial development indicator of country c at time $t-1$; the indicator is composed of the development of financial institutions ($FinancialInst_{ct-1}$) and of financial markets ($FinancialMkt_{ct-1}$). These two last indicators vary between 0 and 1, with higher scores for more developed countries. β_4 is the coefficient of interest, which measures whether the relationship between leverage and the ESG score depends on the national financial development. Specifically, Hypothesis 2 predicts a positive coefficient when considering the development of financial

¹ Including 27 members of the EU as of 2024, the United Kingdom formerly a member of the EU, and 2 EFTA countries (Norway and Switzerland).

² Methodological details are available in the data provider’s methodological note (Refinitiv, 2022).

³ <https://data.imf.org/>.

⁴ We explore the three sub-pillars in Section 4.2.

⁵ Long-term debt represents debt (i.e. bank borrowings, bonds ...) with maturities beyond one year. In Section 5.4 we will consider the short-term debt.

institutions, in accordance with a positive moderating effect of this variable on the relationship between corporate leverage and ESG score. Equation (1) is augmented with further controls, one-year lagged to lower endogeneity issues. Specifically, the vector X_{it-1} includes size, market-to-book ratio, tangibility, profitability, sales, general and administrative (SGA) costs, dividend, and capex, as in Asimakopoulou et al. (2023). Size is defined as the logarithm of the total assets ($\ln Assets$). The market-to-book ratio is the market capitalization at the end of the year over total equity (Mkt_Book). Leverage is also affected by collateral requirements, hence we control for tangibility, defined as property, plant, and equipment over total assets (PPE). SGA_{cost} is the ratio between operating (sales, general, and administrative) expenses and revenues and captures the cost structure of a company. The firm capacity to generate an economic return is proxied by profitability, which is expressed as the ratio between operating income and total assets ($EBITDA_totalassets$). DIV is a dummy variable equal to 1 if in a given year the company has distributed dividends, 0 otherwise. $CAPEX$ is the ratio of capital expenditure over total assets. We further control for the ratio of cash and cash equivalents over total assets, which captures the firm's liquidity ($Cash_totalassets$).

In all specifications, we control for the company (ω_i) and year (μ_t) fixed effects. Finally, ϵ_{ict} is the error term, robust to heteroskedasticity. All financial variables are winsorized at the 1st and 99th percentiles and lagged to reduce reverse causality.

It is worth pointing out that our model specification accounts for the fact that the relationship between leverage and ESG is likely partially influenced by other firm characteristics, including size, liquidity and profitability. Literature suggests that ESG practices benefit these indicators, thus improving the creditworthiness of the firm and its access to debt. By including these controls in our analysis, we focus our attention on the signalling effect that ESG ratings have on leverage, rather than the effect due to improved creditworthiness.

Our final sample includes all European listed companies available in Refinitiv from countries where at least one company has an ESG rating. We exclude companies with industrial codes in the financial and utility sectors (Global Industry Classification Standard equal to 40 and 55) to avoid our results being driven by some specificities of these industries (i.e. the financial sector is highly leveraged, the utility sector is often state-owned). After these steps, we obtain a sample of 1938 companies with at least one ESG rating and 4714 non-rated companies.

To address the imbalance in the dependent variable (i.e., leverage) between rated and non-rated companies in our sample, following Asimakopoulou et al. (2023) we adopt a propensity score matching procedure. To carry out the matching, we restrict the sample to the first year in which the companies were assigned an ESG rating, and to all observations related to the companies that never received an ESG rating.⁶ We use this sample to run a probit regression using as dependent variable a dummy equal to one for companies that had their first ESG rating in that year, and 0 otherwise. As matching variables, we use industry, country, and year dummies, as well as leverage and market leverage computed in the year before. We use the predicted probabilities of the probit model to compute propensity scores on which we match each rated company in the year of the first rating with its nearest non-rated neighbour (Rosenbaum & Rubin, 1983), allowing for replacement. We also impose common support by dropping observations of ESG-rated companies whose propensity score is higher than the maximum or lower than the minimum score of the non-rated companies. To assess the appropriateness of our matching algorithm, we test the balancing of matching variables after matching. Rubin's B, i.e., the absolute standardized difference of the means of the linear index of the propensity score in the "treated" (in our case, rated) companies and matched groups, drops from 150.9 before matching to 19.8 after matching. Rubin's R, i.e., the ratio of the variances of the propensity score in the two groups, is 0.61 before matching and 0.72 after matching. Values of Rubin's B below 25 and R between 0.5 and 2 are generally considered indicators of balanced matching (Rubin, 2001). These results confirm that the matching variables are similar between ESG-rated companies before the first ESG rating and non-ESG-rated companies after matching.⁷

After matching and excluding missing values in the control variables, our sample was reduced to 1787 companies: 1230 companies with at least one ESG rating and 557 matched companies without an ESG rating in the observation period.⁸ Companies are observed between 2007 (or their IPO year if it takes place later) and 2022, for a total of 16,511 annual observations. Table 1 shows the distribution of our sample companies by country and industry (Global Industry Classification Standard). The most represented countries are the United Kingdom (18.13 %), Germany (15.22 %), France (13.77 %) and Sweden (12.48 %). In terms of industries, industrials (29.27 %), consumer discretionary (14.05 %) and information technology (13.32 %) are the most common.

Table 2 shows the average of the country-level lagged financial indicators from the International Monetary Fund by country and year in our sample countries in the 2007–2022 period.⁹ Unsurprisingly, we find the highest indexes in Switzerland and the United Kingdom. Financial institutions are also particularly strong in France and Luxembourg. Overall, although our sample includes European countries only, we document a persistent level of heterogeneity across countries. Over time, financial development has gradually decreased since the Global Financial Crisis in 2008. The effect is driven mainly by the deterioration in the index capturing the development of financial institutions.

Statistics on the ESG scores are reported in Table 3. The percentage of sample firms with an ESG rating is the highest in Malta,

⁶ We also excluded from the sample companies located in Bulgaria, Croatia, Denmark, Estonia, Hungary, Latvia, Lithuania, Poland, and Romania, as there are no ESG-rated companies in those countries in Refinitiv.

⁷ T-tests on the lagged leverage and market leverage differences in the matching year between ESG-rated and non-rated matched companies are not significant at standard confidence levels (0.176 and 0.185 for leverage, 0.124 and 0.130 for market leverage, respectively).

⁸ We only consider ESG ratings from Refinitiv. Even though there are many other ESG rating agencies, we cannot consider these in our analysis due to data availability and access restrictions. This means we cannot detect if another agency has rated the firms in our sample. Following Asimakopoulou et al. (2023), footnote 8, this should not be considered a limitation of our study.

⁹ This table is based on the original International Monetary Fund country-year data.

Table 1

Distribution of sample firms by country and industry of operations.

	Total N firms	%	Without rating N firms	%	With rating N firms	%
Distribution by country						
AUT	35	1.96	12	2.15	23	1.87
BEL	57	3.19	22	3.95	35	2.85
CHE	110	6.16	12	2.15	98	7.97
CYP	6	0.34	3	0.54	3	0.24
DEU	272	15.22	84	15.08	188	15.28
ESP	64	3.58	26	4.67	38	3.09
FIN	83	4.64	25	4.49	58	4.72
FRA	246	13.77	92	16.52	154	12.52
GBR	324	18.13	94	16.88	230	18.70
GRC	29	1.62	13	2.33	16	1.30
IRL	39	2.18	8	1.44	31	2.52
ITA	108	6.04	41	7.36	67	5.45
LUX	29	1.62	7	1.26	22	1.79
MLT	2	0.11	0	0.00	2	0.16
NLD	63	3.53	22	3.95	41	3.33
NOR	77	4.31	26	4.67	51	4.15
PRT	20	1.12	9	1.62	11	0.89
SWE	223	12.48	61	10.95	162	13.17
Total	1787	100.00	557	100.00	1230	100.00
Distribution by industry						
10 - Energy	71	3.97	24	4.31	47	3.82
15 - Materials	134	7.50	32	5.75	102	8.29
20 - Industrials	523	29.27	140	25.13	383	31.14
25 - Consumer Discretionary	251	14.05	81	14.54	170	13.82
30 - Consumer Staples	144	8.06	44	7.90	100	8.13
35 - Health Care	172	9.63	61	10.95	111	9.02
45 - Information Technology	238	13.32	86	15.44	152	12.36
50 - Communication Services	114	6.38	36	6.46	78	6.34
60 - Real Estate	128	7.16	45	8.08	83	6.75
Missing	12	0.67	8	1.44	4	0.33
Total	1787	100.00	557	100.00	1230	100.00

Table 2

Descriptive statistics (mean) on the variables of financial development and development of financial institutions and markets by country and year.

Country	FinancialDev _{t-1}	FinancialInst _{t-1}	FinancialMkt _{t-1}	Year	FinancialDev _{t-1}	FinancialInst _{t-1}	FinancialMkt _{t-1}
AUT	0.648	0.687	0.583	2007	0.730	0.775	0.657
BEL	0.669	0.799	0.513	2008	0.757	0.778	0.707
CHE	0.954	0.967	0.904	2009	0.727	0.755	0.671
CYP	0.549	0.626	0.451	2010	0.735	0.775	0.666
DEU	0.723	0.679	0.740	2011	0.726	0.774	0.651
ESP	0.854	0.825	0.849	2012	0.711	0.758	0.636
FIN	0.630	0.611	0.624	2013	0.697	0.759	0.607
FRA	0.802	0.868	0.704	2014	0.693	0.756	0.604
GBR	0.873	0.862	0.849	2015	0.695	0.744	0.618
GRC	0.568	0.560	0.554	2016	0.694	0.734	0.626
IRL	0.699	0.780	0.590	2017	0.686	0.729	0.616
ITA	0.766	0.750	0.752	2018	0.699	0.721	0.650
LUX	0.730	0.841	0.589	2019	0.686	0.708	0.638
MLT	0.524	0.689	0.340	2020	0.679	0.698	0.633
NLD	0.763	0.741	0.754	2021	0.676	0.688	0.638
NOR	0.696	0.570	0.795	2022	0.670	0.685	0.629
PRT	0.702	0.791	0.585				
SWE	0.794	0.782	0.775				
Total	0.704	0.740	0.640	Total	0.704	0.740	0.640

Ireland and the Netherlands, and the smallest in Italy and Greece, and it has sharply increased over time, reaching 76.5 % in 2021. The average ESG rating is the highest in the Netherlands, Spain, and Portugal. Over time, it increased till 2018 (60.1 %) and has remained stable above 50 % in the most recent years.

In Tables 4 and 5, we report the descriptive statistics and correlation matrix of the dependent and independent variables in our sample. Most correlations are significant. The highest correlations pertain to variables that are never included in the same model, such

Table 3

Descriptive statistics on firm-level ESG ratings (without logarithms) by country and year.

Country	% with ESG rating	Mean ESG rating	Year	% with ESG rating	Mean ESG rating
AUT	39.89 %	52.736	2007	8.35 %	28.017
BEL	41.30 %	53.770	2008	31.34 %	44.727
CHE	57.62 %	49.898	2009	33.10 %	49.780
CYP	38.60 %	21.272	2010	34.57 %	51.421
DEU	40.61 %	55.652	2011	34.43 %	53.602
ESP	43.97 %	60.835	2012	33.61 %	55.021
FIN	45.73 %	58.664	2013	34.22 %	55.123
FRA	42.08 %	58.603	2014	34.75 %	55.652
GBR	52.64 %	53.340	2015	37.19 %	56.230
GRC	35.79 %	34.516	2016	36.87 %	57.953
IRL	65.42 %	53.103	2017	41.25 %	58.810
ITA	32.67 %	54.271	2018	57.62 %	60.107
LUX	48.78 %	53.045	2019	60.63 %	55.793
MLT	70.00 %	42.763	2020	76.05 %	56.080
NLD	61.14 %	61.778	2021	76.49 %	53.490
NOR	42.23 %	53.622	2022	70.77 %	54.982
PRT	38.22 %	59.650			
SWE	47.42 %	54.373			
Total	45.87 %	54.884	Total	45.87 %	54.884

as market and book leverage and the different components of the financial development index. Nevertheless, to rule out multicollinearity issues, we monitor the mean Variance Inflation Factor (VIF) of the models, as discussed below.

4. Results and discussion

4.1. Main results

Table 6 shows the results of the analysis in which the dependent variable is book leverage. The sample includes ESG-rated firms and their matched peers. The model controls for the lagged book leverage and firm-level characteristics and includes year and firm fixed effects. In Column I, we analyse the relationship between ESG ratings and book leverage. We do not find a significant coefficient for ESG_{t-1} , suggesting that on average the relationship is not significant in our sample. This result does not support either [Hypothesis 1a](#) or [Hypothesis 1b](#). The VIF of the model is 3.69, well below the threshold of 5 which would raise concerns about multilinearity according to [James et al. \(2017\)](#).

In Column II, we include the country-level index of financial development as well as its interaction with ESG. Here we find interesting results. ESG has a negative and significant (at the 5 % level) coefficient, while its interaction with FinancialDev has a positive and significant (at the 5 % level) coefficient. These results suggest that the negative relationship between ESG and leverage weakens in more financially developed countries. As the financial development index varies between 0 and 1, the interpretation of the magnitude of the effect is straightforward. Marginal effects indicate that in countries with financial development indexes smaller or equal to 0.7, the effect of ESG is negative and significant, while it turns insignificant for larger values of the index.

In Columns III and IV, we repeat the analysis and consider the two pillars of the financial development index: the development of financial institutions and the development of financial markets, respectively. The results suggest that the development of financial institutions is the most powerful moderator of the relationship between ESG ratings and leverage. In Column III, we find significant coefficients for ESG (negative at the 1 % level) and its interaction with FinancialInst (positive at the 1 % level). Marginal effects suggest that in countries where financial institutions are weaker (the index is smaller or equal to 0.7), having an ESG rating leads to lower book leverage. Instead, in countries where financial institutions are stronger, such a negative relationship is weaker (and it turns positive when the index is higher or equal to 0.9). For completeness, in Column IV we investigate the role of the development of financial markets and we do not find a significant moderating effect on the relationship between ESG ratings and leverage. Our results support [Hypothesis 2](#), which poses a higher use of leverage from ESG-rated companies in countries where financial institutions play a key role.

In terms of control variables, we find as expected that companies with higher leverage in the past continue to display higher levels of leverage (p-value < 1 %). Moreover, larger and more profitable companies, with more investments in capital assets and lower cash flows tend to have higher leverage (p-value < 1 % or better).

In Table 7, we repeat the analysis focusing on market leverage. We find a negative and slightly significant coefficient for ESG_{t-1} in Column I (p-value < 10 %), providing weak evidence of a negative relationship between ESG and market leverage, consistent with [Hypothesis 1b](#). The VIF of the model is 3.69, suggesting that multicollinearity issues are not a concern. In Column II, we also do not find a significant moderating effect of the country's financial development index. However, results in Column III confirm the relevance of the country-level development of financial institutions in the relationship between ESG and leverage, as we find significant coefficients for ESG_{t-1} (negative at the 1 % level) and its interaction with FinancialInst_{t-1} (positive at the 1 % level), in conformity with [Hypothesis 2](#). Again, the relationship is negative in countries where financial institutions are weak (i.e., the financial institution index is lower or

Table 4
Descriptive statistics.

	Obs	Mean	Std. Dev.	P.le25	P.le50	P.le75
leverage _{it}	16,511	0.178	0.147	0.063	0.151	0.260
mtk_leverage _{it}	16,511	0.143	0.134	0.040	0.108	0.205
ESG _{it-1}	16,511	1.627	1.961	0.000	0.000	3.937
lnAssets _{it-1}	16,511	20.451	2.151	18.936	20.458	21.915
Mkt_Book _{it-1}	16,511	2.911	4.973	0.962	1.674	3.043
PPE _{it-1}	16,511	0.510	0.433	0.164	0.401	0.768
EBITDA_totalassets _{it-1}	16,511	0.217	0.206	0.078	0.197	0.336
SGAcost _{it-1}	16,511	2.231	56.213	0.867	0.930	0.976
CAPEX _{it-1}	16,511	0.054	0.064	0.019	0.038	0.067
DIV _{it-1}	16,511	0.702	0.458	0.000	1.000	1.000
Cash_totalassets _{it-1}	16,511	0.088	0.105	0.020	0.057	0.116
FinancialDev _{it-1}	16,511	0.779	0.093	0.718	0.782	0.831
FinancialInst _{it-1}	16,511	0.779	0.111	0.708	0.799	0.855
FinancialMkt _{it-1}	16,511	0.748	0.108	0.695	0.756	0.817

equal to 0.7), but weakens in countries where financial institutions are stronger (it becomes positive when the financial institution index is higher than 0.9). In Column IV, we do not find a moderation effect on the development of financial markets.

Our findings do not appear to support Hypotheses 1a and 1 b. However, when the degree of development of financial institutions at the country level is introduced, two interesting facts can be observed. When the financial development index is low, the ESG rating is associated to lower leverage, while the effect is attenuated in countries with higher level of financial development. However, this is driven mainly by the development of financial institutions. Overall, this suggests that the ESG score may have a signalling value, particularly among banks which include ESG information in their creditworthiness assessment process.

In terms of control variables, we find very similar results to those shown for the book value of leverage. The only relevant difference is a significant (at the 10 % level) negative coefficient of the market-to-book ratio, consistent with an increased reliance on equity rather than debt to drive the growth of companies highly valued by investors.

Overall, our results suggest that ESG ratings seem to be more relevant in the financing process conducted by financial institutions rather than by financial markets. This finding is particularly interesting in the context of the green transition process. As banks are the primary intermediaries that finance carbon-intensive companies (ECB, 2023), it could be argued that scrutiny of the sustainability profile of companies applying for bank credit will encourage these borrowers to increasingly prioritize the implementation of ESG principles in their internal processes and disclose this information to stakeholders.

From an environmental perspective, this result could be interpreted as indirect evidence of investor behaviour linked to country-level climate policies and not so much to firm ESG specificities. In compliance with this view, brown companies seem to be penalised in countries where environmental policies are stringent and leave no room for disorderly transitions: here, investors are aware of the heavy burdens that brown firms have to bear. Conversely, where environmental policies are loose, brown companies are rewarded by the market: it is the delay in implementing the transition that gives them an advantage (Bolton & Kacperczyk, 2021; Hsu et al., 2022). Consequently, in financial systems where intermediaries play an important role in mobilising financial resources, regulatory measures, such as the CSRD (2022/2464/EU), may strengthen the orientation of intermediaries to reward sustainable firms by enlarging the loans granted, but also non-sustainable firms that are making ambitious sustainability commitments.

4.2. Robustness checks

We test the robustness of our main results in several ways.

The first set of checks is related to the sample strategy. Acknowledging that ESG-rated companies might be different to the others in ways that might not be captured by our baseline matching strategy, we test alternative matching procedures. First, we replicate the exact matching procedure of Asimakopoulou et al. (2023), matching on each observation of ESG-rated and non-ESG-rated companies, and using sales divided by assets, EBITDA_totalassets and PPE as matching variables. Second, we exclude companies without ESG ratings altogether and just focus on the panel of ESG-rated companies in the 2007–2022 period. We also test less strict matching procedures using our baseline algorithm but choosing 3 nearest neighbors instead of 1, or including in our estimates companies with an ESG which were not matched with non-ESG-rated companies because of the lack of common support. We further test if our sampling strategy influenced our results by excluding companies based in the United Kingdom, as they represent a large share of our sample and operate in a country with a mostly market-based financial system compared to continental Europe.

We also modify our model specification. We use as an alternative dependent variable the annual change in the book or market leverage, rather than the annual level. Alternatively, we do not control for the lagged book or market leverage avoiding the use of an autoregressive model.

Table 5

Correlation matrix.

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	leverage _t	1.00												
2	mtk leverage _t	0.84	1.00											
3	ESG _{t-1}	0.08	0.02	1.00										
4	lnAssets _{t-1}	0.18	0.21	0.65	1.00									
5	Mkt_Book _{t-1}	−0.01	−0.21	0.04	−0.07	1.00								
6	PPE _{t-1}	0.05	0.08	0.02	0.05	−0.08	1.00							
7	EBITDA_totass _{t-1}	−0.12	−0.11	−0.05	0.10	−0.02	−0.03	1.00						
8	SGAcost _{t-1}	0.01	0.00	−0.02	−0.03	0.00	−0.02	−0.03	1.00					
9	CAPEX _{t-1}	0.07	0.06	−0.08	−0.08	0.05	0.22	−0.06	−0.01	1.00				
10	DIV _{t-1}	0.00	0.00	0.20	0.37	−0.03	0.03	0.06	−0.04	−0.05	1.00			
11	Cash_totalassets _{t-1}	−0.13	−0.19	−0.10	−0.23	0.12	−0.12	−0.09	0.05	0.03	−0.17	1.00		
12	FinancialDev _{t-1}	−0.05	−0.08	0.02	−0.01	0.04	−0.06	−0.28	−0.01	−0.02	0.02	0.00	1.00	
13	FinancialInst _{t-1}	−0.04	−0.06	−0.01	0.01	0.02	−0.07	−0.12	−0.02	−0.05	0.04	−0.02	0.84	1.00
14	FinancialMkt _{t-1}	−0.05	−0.07	0.05	−0.04	0.05	−0.04	−0.35	0.00	0.01	−0.01	0.02	0.82	0.38

Table 6

Results on the relationship between ESG and book leverage: the role of financial development, development of financial institutions and development of financial markets

The table reports the coefficients and, in parenthesis, the robust standard errors of fixed effects models whose dependent variable is *leverage_t*. The sample includes firms that obtained at least one ESG rating and matched companies without ratings. Significance levels: *p < 0.1, **p < 0.05, ***p < 0.01

	I	II	III	IV
leverage _{t-1}	0.483*** (0.019)	0.483*** (0.019)	0.482*** (0.019)	0.483*** (0.019)
lnAssets _{t-1}	0.013*** (0.003)	0.013*** (0.003)	0.013*** (0.003)	0.013*** (0.003)
Mkt_Book _{t-1}	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
PPE _{t-1}	0.011 (0.007)	0.011 (0.007)	0.011 (0.007)	0.011 (0.007)
EBITDA_totalassets _{t-1}	0.026* (0.016)	0.026* (0.016)	0.026* (0.016)	0.026* (0.016)
SGAcost _{t-1}	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
CAPEX _{t-1}	0.043** (0.019)	0.042** (0.019)	0.042** (0.019)	0.042** (0.019)
DIV _{t-1}	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)
Cash_totalassets _{t-1}	-0.031* (0.016)	-0.030* (0.016)	-0.030* (0.016)	-0.031* (0.016)
ESG _{t-1}	-0.001 (0.001)	-0.012** (0.005)	-0.013*** (0.004)	-0.004 (0.004)
FinancialDev _{t-1}		-0.017 (0.031)		
ESG*FinancialDev _{t-1}		0.014** (0.006)		
FinancialInst _{t-1}			-0.047 (0.035)	
ESG _{t-1} *FinancialInst _{t-1}			0.016*** (0.005)	
FinancialMkt _{t-1}				0.004 (0.019)
ESG*FinancialMkt _{t-1}				0.004 (0.005)
Constant	-0.178*** (0.063)	-0.166** (0.068)	-0.142** (0.068)	-0.181*** (0.065)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
N of observations	16,511	16,511	16,511	16,511
N of firms	1787	1787	1787	1787
F (dof)	41.166 (24)***	38.374 (26)***	39.229 (26)***	38.304 (26)***
Log likelihood	20306.336	20310.665	20314.257	20306.98
Overall R ²	0.622	0.621	0.620	0.622

In terms of our main independent variable, we include the ESG ratings without the lag, we use the lagged ESG rating without taking its logarithm, and we use the ESG rating that also incorporates the number of ESG controversies (the so-called ESGC score).¹⁰ Further, we make use of the results by Li et al. (2024) and allow for a non-linear relationship between ESG and leverage. Specifically, we include the squared logarithm of ESG rating among regressors.

We replicate our models without firm fixed effects but with year-time industry fixed effects to control for persistent differences across sectors in the ESG ratings. Lastly, we cluster the standard errors at the firm level.

In all cases, the results are virtually identical to those reported in Tables 6 and 7 and available from the authors upon request.

4.3. Endogeneity

Our results suggest that having an ESG rating leads companies to use more leverage in countries where financial institutions are

¹⁰ ESGC score measures a company's ESG performance, based on information reported on ESG pillars, considering related ESG controversies. The main objective of this score is "to discount the ESG performance score based on negative media stories. It does this by incorporating the impact of significant, material ESG controversies in the overall ESGC score" (Refinitiv, 2022).

Table 7

Results on the relationship between ESG and market leverage: the role of financial development, development of financial institutions and development of financial markets

The table reports the coefficients and, in parenthesis, the robust standard errors of fixed effects models whose dependent variable is *mkt leverage_t*. The sample includes firms that obtained at least one ESG rating and matched companies without ratings. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

	I	II	III	IV
mtk_leverage _{t-1}	0.481*** (0.018)	0.481*** (0.018)	0.480*** (0.018)	0.481*** (0.018)
lnAssets _{t-1}	0.018*** (0.002)	0.018*** (0.002)	0.018*** (0.002)	0.018*** (0.002)
Mkt_Book _{t-1}	−0.000* (0.000)	−0.000* (0.000)	−0.000* (0.000)	−0.000* (0.000)
PPE _{t-1}	0.010* (0.006)	0.010* (0.006)	0.011* (0.006)	0.010* (0.006)
EBITDA_totalassets _{t-1}	0.022* (0.011)	0.022* (0.011)	0.023** (0.011)	0.022* (0.011)
SGAcost _{t-1}	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
CAPEX _{t-1}	0.040** (0.019)	0.039** (0.019)	0.039** (0.019)	0.039** (0.019)
DIV _{t-1}	−0.003 (0.002)	−0.003 (0.002)	−0.003 (0.002)	−0.003 (0.002)
Cash_totalassets _{t-1}	−0.038*** (0.010)	−0.038*** (0.010)	−0.038*** (0.010)	−0.038*** (0.010)
ESG _{t-1}	−0.001* (0.001)	−0.006 (0.004)	−0.010*** (0.003)	0.001 (0.003)
FinancialDev _{t-1}		−0.006 (0.026)		
ESG*FinancialDev _{t-1}		0.006 (0.005)		
FinancialInst _{t-1}			−0.047 (0.029)	
ESG _{t-1} *FinancialInst _{t-1}			0.012*** (0.004)	
FinancialMkt _{t-1}				0.015 (0.016)
ESG*FinancialMkt _{t-1}				−0.003 (0.004)
Constant	−0.299*** (0.050)	−0.294*** (0.055)	−0.261*** (0.054)	−0.310*** (0.052)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
N of observations	16,511	16,511	16,511	16,511
N of firms	1787	1787	1787	1787
F (dof)	54.59 (24)***	50.85 (26)***	52.523 (26)***	51.421 (26)***
Log likelihood	22948.144	22949.227	22954.402	22948.882
Overall R ²	0.591	0.59	0.59	0.591

stronger, possibly because the ESG rating conveys information to potential lenders. However, an alternative explanation is that endogeneity drives our results and creates biased coefficients in our analysis. To tackle the potential endogeneity of ESG ratings, we rely on a two-stage least-squares (2SLS) regression with fixed effects and instrumental variables. We focus on model III reported in Tables 6 and 7, and we treat both ESG and its interactions with the country index on the development of financial institutions as endogenous. As instrumental variables, we use the percentage of companies that have an ESG rating in the country, industry, and year of the focal company (excluding the focal company itself) in the population, lagged by one period (Perc_ESGrated). We also consider as instrument its interaction with FinInst, especially relevant for the interaction between ESG and FinInst. As an additional instrument, we utilize the Union Nation indicator, which expresses each country's progress in achieving the Sustainable Development Goals,¹¹ lagged by one period (SDGindex). We expect companies to be more likely to have an ESG rating when their peers adopt it in the same industry, country, and year, and to have higher ratings in countries that are closer to reaching the SDGs (see, e.g., Srivastava et al., 2022). As such, both of these variables should meet the desired properties of instruments from a theoretical standpoint: they are likely correlated with the endogenous firm-level ESG rating, but they are not likely to have a direct impact on the firm leverage. We formally test these assumptions in the following.

¹¹ <https://dashboards.sdindex.org/>.

We show the results of the estimates in Table 8. For each dependent variable, we report the output of the first-stage regression as well as that of the second-stage IV-regression. In Columns I and IV, we find that companies' ESG ratings negatively correlate with past leverage, while they are higher for companies with higher values of assets, market-on-book ratios, investment in fixed assets, in less profitable companies and countries with stronger financial institutions (p-values < 5 % or better). The two instruments have the expected positive and significant sign (p-value < 1 %). The interaction term between Perc_ESGrated_t and FinInst_t is also significant. We further test the relevance of the instruments using the Anderson canonical correlation LR statistic and the Cragg-Donald weak identification test. The former, which under the null hypothesis that the model is under-identified (i.e., the instruments are not relevant), has a $\chi^2(2)$ equal to 1816.68 for book leverage and 1812.25 for market leverage, both significant (with p-value < 1 %). The Cragg-Donald weak identification tests, which test whether the instruments are only weakly correlated with the endogenous regressor, in which case the instrumental variable regression may perform poorly, are 643.28 and 641.61, comfortably above the critical values tabulated by Stock and Yogo (2005) of 13.43. We test the exogeneity of the instruments using the Hansen J-statistic. The null hypothesis of the test is that the instruments are uncorrelated with the error term of the main equation, and are correctly excluded from it. The tests, which under the null hypothesis have a $\chi^2(1)$ distribution, do not reject the null hypothesis that the instruments are valid for book leverage (1.623, corresponding to a p-value of 0.203) and market leverage (1.757, corresponding to a p-value of 0.185).

Coming to the results of the second step, the coefficients of the instrumented endogenous variables maintain their expected signs: ESG has a negative and significant coefficient, while its interaction with the development of financial institutions is positive and significant (all p-values < 1 %). In short, this analysis allows us to conclude that our main results are robust to endogeneity concerns.

5. Additional evidence

As proven, the relationship between leverage and ESG rating is moderated by the index capturing the level of development of financial institutions in a given country. In this section, we further explore this relationship and provide additional evidence.

5.1. Financial institutions index component

We deem it interesting to investigate which elements of the financial institutions index drive this result. The International Monetary Fund explains that the financial institution development index is the composition of three pillars. The "Financial institutions access index" includes data on bank branches per 100,000 adults and ATMs per 100,000 adults. The "Financial institutions depth index" compiles data on bank credit to the private sector as a percentage of GDP, pension funds and mutual funds assets to GDP and insurance premiums to GDP. The "Financial institutions efficiency index" depends on data on the banking sector's net interest margin, lending-deposits spreads, non-interest income to total income, overhead costs to total assets, returns on assets and returns on equity. We consider each of these three indexes as moderators in our analysis and show the results in Table 9. Our findings show that financial access is the most relevant pillar of the financial institutions' indicators: Columns I and IV reveal negative coefficients for ESG_{t-1} (p-value < 1 %) and positive coefficients for its interactions with the financial institutions' access index (p-value < 1 %), both in the book leverage and market leverage regressions. ESG-rated companies have lower leverage, except if they are located in countries with easier access to local banks. On the contrary, the interactions are not significant for the other two pillars of the financial institution development index.

5.2. ESG index variations

The ESG indicator includes three distinct pillars: environment, social, and governance. Here, we explore which of these is driving our results on the relationship between ESG, leverage, and the development of financial institutions. To do so, we replicate our analysis by substituting the ESG score with the three components: the environmental score (Escore), the social score (Sscore), and the governance score (Gscore). As the three scores are highly correlated, we consider them one by one in separate analyses. The results, which are shown in Table A1 in the Appendix, are very similar across all the scores. In other terms, all of the ESG score's components are relevant to the relationships investigated in this study. They have significant coefficients (negative at the 1 % level) and their interaction with $\text{FinancialInst}_{t-1}$ is positive at the 1 % level.

In addition, we test the idea that our results on the relevance of ESG scores for company leverage (depending on the level of financial institutions' development) are not driven by how high the score is, but rather by the fact that the company has a score. It could be that having an ESG score sends a signal to the financial institutions and decreases the cost of debt for companies, regardless of how high the score is. We test this conjecture in two ways. First, instead of including in the analysis the ESG score (ESG), we use the step dummy variable ESGrated_t , equal to 1 in the first year in which the company gets an ESG score, and in all the following years, and 0 for years before the first rating or for all years for companies that never get an ESG score. Second, we split the ESGrated_t step variable into two components: ESGratedHigh_t and ESGratedLow_t , which turn from 0 to 1 in the year when the company gets a first rating which is higher (for the former dummy) and lower (for the latter one) than the sample mean. The results are shown in Table 10. In Column I, the coefficient of ESGrated_t is negative and significant at the 1 % level, while the coefficient of $\text{ESGrated}_t * \text{FinInst}_t$ is positive and significant at the 1 % level. In other terms, companies' leverage is lower for ESG-rated companies, but the effect is less negative in countries with stronger financial institutions. In Column II, both $\text{ESGratedHigh}_{t-1}$ and ESGratedLow_{t-1} dummies have negative and significant coefficients (at the 1 % level), and both their interactions with FinInst_{t-1} are instead positive and significant (at least at the 5 % level), confirming once again that the relationship between having an ESG score and leverage is moderated by the level of development of financial institutions. Interestingly, the estimated coefficients are larger in magnitude for higher scores (a test confirms that the

Table 8

Results on the relationship between ESG and leverage: two-stage least squares.

	I			II		
Step of the 2SLS:	First	First	Second	First	First	Second
Dependent variable:	ESG	ESG*FinInst	leverage	ESG	ESG*FinInst	mtk_leverage
leverage _{t-1}	−0.391*** (0.090)	−0.274*** (0.069)	0.482*** (0.017)			
mtk_leverage _{t-1}				−0.660*** (0.105)	−0.480*** (0.080)	0.480*** (0.016)
lnAssets _{t-1}	0.376*** (0.023)	0.285*** (0.018)	0.013*** (0.003)	0.386*** (0.023)	0.293*** (0.018)	0.018*** (0.002)
Mkt_Book _{t-1}	0.007*** (0.002)	0.005*** (0.002)	0.000 (0.000)	0.005** (0.002)	0.004** (0.002)	−0.000** (0.000)
PPE _{t-1}	0.025 (0.052)	0.013 (0.040)	0.011* (0.007)	0.034 (0.053)	0.020 (0.040)	0.011** (0.005)
EBITDA_totalassets _{t-1}	−0.246*** (0.079)	−0.193*** (0.059)	0.027* (0.016)	−0.303*** (0.080)	−0.236*** (0.060)	0.023** (0.012)
SGAcost _{t-1}	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
CAPEX _{t-1}	0.309* (0.160)	0.245** (0.121)	0.041** (0.020)	0.264* (0.161)	0.213* (0.121)	0.039** (0.018)
DIV _{t-1}	0.023 (0.026)	0.014 (0.020)	0.000 (0.002)	0.015 (0.026)	0.008 (0.020)	−0.002 (0.002)
Cash_totalassets _{t-1}	0.079 (0.122)	0.075 (0.094)	−0.030** (0.013)	0.059 (0.122)	0.059 (0.094)	−0.038*** (0.009)
FinInst _{t-1}	1.725*** (0.381)	1.743*** (0.292)	−0.074** (0.033)	1.699*** (0.381)	1.724*** (0.292)	−0.064** (0.027)
Perc_ESGrated _{t-1}	0.077*** (0.018)	0.067*** (0.014)		0.078*** (0.018)	0.068*** (0.014)	
Perc_ESGrated _{t-1} *FinInst _{t-1}	5.052*** (0.499)	−0.049 (0.380)		5.034*** (0.499)	−0.063 (0.380)	
SDGindex _{t-1}	−1.372** (0.635)	4.099*** (0.506)		−1.359** (0.635)	4.110*** (0.506)	
ESG _{t-1}			−0.021*** (0.006)			−0.015*** (0.005)
ESG _{t-1} *FinInst _{t-1}			0.027*** (0.007)			0.019*** (0.006)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N of observations	16,419	16,419	16,419	16,419	16,419	16,419
N of firms	1695	1695	1695	1695	1695	1695
F	250.812***	218.849***	43.703***	251.500***	219.382***	67.824***
ll	−20706.173	−16605.095	20150.772	−20696.020	−16595.570	22778.342
R2	0.466	0.432	0.240	0.466	0.433	0.268
Cragg-Donald F			643.28			641.61
Anderson canon. corr. LR			1816.675***			1812.249***
Hansen J (p-value)			1.623 (0.203)			1.757 (0.185)

coefficients of ESGratedHigh*FinInst and ESGratedLow*FinInst are significantly different at the 1 % level). This suggests that the beneficial effect of financial institutions on the relationship between ESG and leverage is also present for low ESG scores, but is stronger when ESG ratings are higher, or, in other words, financial institutions are more sensitive to high ESG scores than to low ESG scores. This result provides another perspective always supporting our [hypothesis 2](#). The results are similar when we look at market leverage in Columns III and IV.

5.3. Heterogeneity analysis

Previous studies find that ESG and company leverage are industry-dependent variables (see, e.g., [Breuer et al., 2018](#)). To account for the existing heterogeneity, in [Table 11](#) we split the sample based on the number of companies with an ESG score, reporting in Columns I and III (II and IV) companies operating in sectors with availability of the ESG score below (above) the median. The coefficient of interest is statistically significant at the 1 % level in Columns I and III, suggesting that the ESG score is more valuable in

Table 9

Results on the relationship between ESG and leverage: the role of financial institutions access, depth and efficiency

The table reports the coefficients and, in parenthesis, the robust standard errors of fixed effects models whose dependent variable is $leverage_t$ in columns I-III and is $mkt_leverage_t$ in columns IV-VI. The sample includes firms that obtained at least one ESG rating and matched companies without ratings. All controls and a constant are included in the analysis but omitted from the table. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

	DepVar: leverage			DepVar: mkt_leverage		
	I	II	III	IV	V	VI
Leverage _{t-1}	0.481*** (0.019)	0.482*** (0.019)	0.483*** (0.019)			
mkt_leverage _{t-1}				0.479*** (0.018)	0.479*** (0.018)	0.481*** (0.018)
ESG _{t-1}	-0.006*** (0.002)	0.000 (0.003)	0.000 (0.004)	-0.005*** (0.001)	0.000 (0.002)	0.000 (0.003)
FinancialInstAccess _{t-1}	0.000 (0.016)			-0.008 (0.014)		
ESG _{t-1} * FinancialInstAccess _{t-1}	0.008*** (0.002)			0.006*** (0.002)		
FinancialInstDepth _{t-1}		-0.058** (0.029)			-0.056** (0.023)	
ESG _{t-1} * FinancialInstDepth _{t-1}		-0.001 (0.004)			-0.002 (0.003)	
FinancialInstEfficiency _{t-1}			0.022 (0.023)			0.044* (0.023)
ESG _{t-1} * FinancialInstEfficiency _{t-1}			-0.007 (0.006)			-0.005 (0.006)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N of observations	16,511	16,511	16,511	16,511	16,511	16,511
N of firms	1787	1787	1787	1787	1787	1787
F (26 dof)	39.98***	39.24***	38.36***	53.54***	51.58***	50.83***
Log likelihood	20318.518	20313.824	20307.309	22957.243	22957.788	22950.968
Overall R ²	0.614	0.608	0.622	0.586	0.585	0.593

industries in which it is less frequently available. As a robustness check, we replicate the analysis based on the share of companies with an ESG rating in each industry, finding similar results. This supports the signalling value of ESG rating on a company's creditworthiness: the signal is more valuable when it is less frequently present within an industry.¹²

5.4. Short-term debt analysis

Our main dependent variable, $Leverage_{it}$, is defined as the long-term debt over total assets. Compared to short-term debt, long-term debt is arguably a more relevant element of a company's capital structure, because it is more difficult to secure and more informative of the company's creditworthiness. For this reason, we expect that the information disclosed by the ESG rating will be more likely to influence long-term debt than short-term debt. Therefore, it is interesting to analyse how ESG rating influences the mix between short-term and long-term debt. In the Chinese context, Zhou et al. (2024) find a positive relationship between the use of debt maturity and ESG, while the relationship is U-shaped according to Li et al. (2024).

We expect that the ESG rating will result in a lower incidence of short-term debt in the company's capital structure in contexts where financial institutions are more developed. To evaluate this expectation, we create a variable called "STdebt_percentage", which is the ratio of short-term debt to total financial debt of a company, and we use it as an alternative dependent variable. The information is available for 1538 sample companies. The results are presented in Table 12. Column II confirms the negative relationship between ESG and the use of short-term debt in companies operating in more financially developed countries. In Column III, we discover that it is mostly the financial development of institutions that drives this relationship, while we do not find significance for the financial markets in Column IV. Thus, the results support our expectations.

6. Conclusions

A company's ESG performance is of utmost importance to stakeholders. There is a growing demand for companies to communicate transparently and reliably about their impact on the ecosystems in which they operate. Simultaneously, regulators and policymakers

¹² In an omitted analysis, we replicate the estimation splitting the sample on the basis of the frequency of ESG-rated companies within countries, rather than industries. The results are similar: in countries where more ESG companies are rated, the relationship between ESG, leverage and development of financial institutions is less significant.

Table 10

Results on the relationship between ESG and leverage: High or low rating

The table reports the coefficients and, in parenthesis, the robust standard errors of fixed effects models whose dependent variable is $leverage_t$ in columns I-II and is $mkt_leverage_t$ in columns III-IV. The sample includes firms that obtained at least one ESG rating and matched companies without ratings. All controls and a constant are included in the analysis but omitted from the table. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

	DepVar: Leverage		DepVar: mkt_leverage	
	I	II	III	IV
Leverage _{t-1}	0.482*** (0.019)	0.481*** (0.019)		
mkt_leverage _{t-1}			0.480*** (0.018)	0.479*** (0.018)
FinInst _{t-1}	-0.045 (0.035)	-0.065* (0.036)	-0.046 (0.028)	-0.059** (0.029)
ESGrated _{t-1}	-0.049*** (0.015)		-0.038*** (0.013)	
ESGrated _{t-1} *FinInst _{t-1}	0.059*** (0.019)		0.045*** (0.016)	
ESGratedHigh _{t-1}		-0.205*** (0.049)		-0.143*** (0.044)
ESGratedLow _{t-1}		-0.040*** (0.015)		-0.033** (0.013)
ESGratedHigh _{t-1} *FinInst _{t-1}		0.211*** (0.055)		0.142*** (0.048)
ESGratedLow _{t-1} *FinInst _{t-1}		0.046** (0.019)		0.036** (0.016)
Constant	-0.143** (0.069)	-0.125* (0.069)	-0.263*** (0.054)	-0.251*** (0.054)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
N	16,511	16,511	16,511	16,511
N _g	1787	1787	1787	1787
F	38.865 (26)***	36.855 (28)***	52.367 (26)***	49.432 (28)***
ll	20,313.39	20,323.29	22,954.77	22,961.05
R2 (overall)	0.619	0.618	0.59	0.597

Table 11

Results on the relationship between ESG and leverage: heterogeneity analysis

The table reports the coefficients and, in parenthesis, the robust standard errors of fixed effects models whose dependent variable is $leverage_t$ in columns I-II, V-IV and is $mkt_leverage_t$ in columns III-IV, VII-VIII. The sample includes firms that obtained at least one ESG rating and matched companies without ratings. All controls and a constant are included in the analysis but omitted from the table. Significance levels.

	DepVar: leverage		DepVar: mkt_leverage		DepVar: leverage		DepVar: mkt_leverage	
	N Rated in sector		N Rated in sector		Share Rated in sector		Share Rated in sector	
	<p50	>p50	<p50	>p50	<p50	>p50	<p50	>p50
	I	II	III	VI	V	VI	VII	VIII
leverage _{t-1}	0.494*** (0.023)	0.461*** (0.031)			0.464*** (0.026)	0.506*** (0.026)		
mkt_leverage _{t-1}			0.498*** (0.023)	0.453*** (0.028)			0.445*** (0.026)	0.525*** (0.023)
ESG _{t-1}	-0.022*** (0.006)	-0.006 (0.005)	-0.017*** (0.005)	-0.004 (0.005)	-0.016** (0.007)	-0.012** (0.005)	-0.016*** (0.006)	-0.005 (0.004)
FinInst _{t-1}	-0.113** (0.048)	0.022 (0.048)	-0.085** (0.040)	-0.006 (0.039)	-0.057 (0.053)	-0.039 (0.046)	-0.082* (0.044)	-0.019 (0.036)
ESG _{t-1} *FinInst _{t-1}	0.028*** (0.007)	0.007 (0.007)	0.020*** (0.006)	0.004 (0.006)	0.018** (0.008)	0.015** (0.006)	0.019** (0.007)	0.006 (0.005)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N of observations	8912	7599	8912	7599	8249	8262	8249	8262
N of firms	918	869	918	869	954	833	954	833
F (26 dof)	30.028 **	21.22***	33.216***	28.053***	24.046***	49.23***	24.065***	49.17***
ll	10968.293	9390.78	12152.815	10842.96	9559.506	10910.714	10740.835	12427.181
R2	0.62	0.622	0.596	0.583	0.654	0.557	0.592	0.578

Table 12

Results on the relationship between ESG and percentage of short term debt: the role of financial development, development of financial institutions and development of financial markets

The table reports the coefficients and, in parenthesis, the robust standard errors of fixed effects models whose dependent variable is *STdebt_percentage*. The sample includes firms that obtained at least one ESG rating and matched companies without ratings. Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

	I	II	III	IV
STdebt_percentage _{t-1}	0.232*** (0.018)	0.232*** (0.018)	0.231*** (0.018)	0.232*** (0.018)
lnAssets _{t-1}	-0.029*** (0.009)	-0.029*** (0.009)	-0.029*** (0.009)	-0.029*** (0.009)
Mkt_Book _{t-1}	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
PPE _{t-1}	0.019 (0.017)	0.019 (0.017)	0.019 (0.017)	0.019 (0.017)
EBITDA_totalassets _{t-1}	0.010 (0.035)	0.009 (0.035)	0.009 (0.035)	0.010 (0.035)
SGAcost _{t-1}	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
CAPEX _{t-1}	-0.122** (0.052)	-0.119** (0.051)	-0.119** (0.052)	-0.121** (0.051)
DIV _{t-1}	-0.001 (0.007)	-0.001 (0.007)	-0.001 (0.007)	-0.001 (0.007)
Cash_totalassets _{t-1}	-0.018 (0.045)	-0.019 (0.045)	-0.019 (0.044)	-0.019 (0.045)
ESG _{t-1}	0.002 (0.003)	0.030* (0.017)	0.035** (0.014)	0.004 (0.012)
FinancialDev _{t-1}		-0.021 (0.101)		
ESG*FinancialDev _{t-1}		-0.035* (0.021)		
FinancialInst _{t-1}			-0.020 (0.103)	
ESG _{t-1} *FinancialInst _{t-1}			-0.042** (0.018)	
FinancialMkt _{t-1}				-0.014 (0.063)
ESG*FinancialMkt _{t-1}				-0.003 (0.016)
Constant	0.808*** (0.180)	0.824*** (0.201)	0.839*** (0.202)	0.816*** (0.187)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
N of observations	12,074	12,074	12,074	12,074
N of firms	1538	1538	1538	1538
F (dof)	11.925 (24)***	11.262 (26)***	11.581 (26)***	11.043 (26)***
Log likelihood	3138.883	3141.96	3145.364	3138.976
Overall R ²	0.319	0.316	0.308	0.32

are spearheading efforts to raise awareness about ESG issues and are implementing reforms to ensure that companies integrate these factors into their decision-making processes and inform stakeholders (among others, Regulation (EU) 2021/1119, Regulation (EU) 2019/2088, and CSRD 2022/2464/EU).

The growing focus on ESG performance has led to an increase in academic research on how a company's ESG rating affects its capital structure. Existing literature analyzed the phenomenon from various perspectives, including the impact on financing costs, as well as the maturity and amount of debts.

Our study aims to shed light on the relationship between ESG rating and leverage, which is still a widely debated issue due to the co-existence of mixed results in the literature. Our findings suggest that ESG ratings do influence firms' leverage decisions—but this relationship is not uniform across contexts. Crucially, we show that the degree of development of national financial institutions plays a moderating role: in countries where financial institutions are less developed, ESG ratings are associated with lower leverage, while in more developed financial systems, the relationship turns positive.

Among the dimensions of financial development, access to financial institutions emerges as the most relevant driver of this relationship. This suggests that banks may use ESG ratings as part of their broader assessment of creditworthiness, particularly in systems where financial institutions are equipped to process such information effectively. Furthermore, the signalling effect of ESG ratings is stronger when such ratings are less prevalent within an industry and is more pronounced for long-term rather than short-term debt. These findings are consistent with the idea that ESG ratings can serve as informative signals—especially for banks—about a firm's

quality and commitment to sustainable practices. We therefore find more support for the signalling theory, rather than pecking order theory, explaining the relationship between ESG and corporate leverage.

These findings have significant policy implications. They highlight the importance of encouraging the disclosure of reliable and credible ESG information to allow financial institutions to better incorporate sustainability into lending and credit risk assessment. Initiatives aimed at curbing greenwashing—such as the Green Claims Directive—are thus highly relevant. At the same time, our results suggest that more needs to be done to raise awareness of sustainability issues among financial market participants, whose portfolio decisions appear less influenced by ESG performance. Recent steps, such as the inclusion of sustainability preferences in MiFID questionnaires (ESMA (European Securities and Markets Authority), 23 September 2022) and the Sustainable Finance Disclosure Regulation, are promising in this direction. These efforts, if effectively implemented, could help ensure that both banks and markets reward sustainable firms, regardless of the structure of the financial system in place.

Despite the important policy implications, the study suffers from some limitations that call for further research. For instance, the sample size could be increased to include non-listed companies, even if this may be challenging due to the limited availability of ESG data. Further, while we consider the effect of ESG rating and development of financial institutions on the total book or market leverage, further research could disentangle the effect on loans and bonds issuance, for which we expect that the former might drive our results on the moderation effect of financial institutions index.

Author agreement statement

We the undersigned declare that this manuscript is original, has not been published before and is not currently being considered for publication elsewhere. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us. We understand that the Corresponding Author is the sole contact for the Editorial process.

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Appendix

Table A1

Results on the relationship between ESG and leverage: the role of the three ESG pillars

The table reports the coefficients and, in parenthesis, the robust standard errors of fixed effects models whose dependent variable is *leverage_t* in columns I–III and is *mkt_leverage_t* in columns IV–VI. The sample includes firms that obtained at least one ESG rating and matched companies without ratings. All controls and a constant are included in the analysis but omitted from the table. Significance levels: **p* < 0.1, ***p* < 0.05, ****p* < 0.01

	DepVar: Leverage			DepVar: mkt_leverage		
	I	II	III	VI	V	VI
Leverage _{t-1}	0.482*** (0.019)	0.482*** (0.019)	0.482*** (0.019)			
mtk_leverage _{t-1}				0.480*** (0.018)	0.480*** (0.018)	0.480*** (0.018)
FinInst _{t-1}	−0.045 (0.035)	−0.048 (0.035)	−0.046 (0.035)	−0.047 (0.029)	−0.047* (0.029)	−0.048* (0.028)
Escore _{t-1}	−0.014*** (0.004)			−0.011*** (0.003)		
Escore _{t-1} *FinInst _{t-1}	0.016*** (0.005)			0.012*** (0.004)		
Sscore _{t-1}		−0.013*** (0.004)			−0.010*** (0.003)	
Sscore _{t-1} *FinInst _{t-1}		0.016*** (0.005)			0.012*** (0.004)	
Gscore _{t-1}			−0.013*** (0.004)			−0.010*** (0.003)
Gscore _{t-1} *FinInst _{t-1}			0.016***			0.012***

(continued on next page)

Table A1 (continued)

	DepVar: Leverage			DepVar: mkt_leverage		
	I	II	III	VI	V	VI
Constant	−0.145** (0.069)	−0.141** (0.068)	(0.005) −0.142** (0.068)	−0.261*** (0.054)	−0.261*** (0.054)	(0.004) −0.259*** (0.054)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
N	16,511	16,511	16,511	16,511	16,511	16,511
N_g	1787	1787	1787	1787	1787	1787
F (26 dof)	39.413***	39.318***	38.948***	52.907***	52.496***	52.41***
ll	20314.666	20314.634	20313.834	22954.879	22954.649	22954.642
Overall R2	0.620	0.620	0.620	0.591	0.590	0.590

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