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The role of environmental, social, and governance rating on corporate debt structure

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ABSTRACT

This paper examines the impact of Environmental, Social, and Governance (ESG) rating on a firm's debt structure. We find that optimal (market and book) leverage ratios and information asymmetry are reduced when firms become ESG rated. More importantly, ESG rated firms redistribute their financing sources from public debt (bonds issuing) to private debt (bank loans). These results are attributed to the incentive of ESG rated firms to avoid debt-overhang and underinvestment issues and to the fact that the ESG rating conveys valuable information to lenders leading to better access towards more internal sources of financing, such as bank loans over debt issuing. We further find that the substitution effect is more pronounced for firms with high financial pressure, low growth opportunities and specialized assets. Finally, these results remain valid under various robustness and endogeneity tests.

1. Introduction

Corporate sustainability and the impact of Environmental, Social, and Governance (ESG) considerations have received growing attention from both industry and academia. The Business Roundtable switches the principles of corporations from maximizing shareholders' value to considering the benefits of all stakeholders,[1] signed by 181 U.S. largest companies' CEOs. According to the Principles for Responsible Investment (PRI), there is a 28% year-over-year increase in the number of signatories with 4902 signatories in March 2022. The total assets under management of these investor signatories are estimated at $121.3 trillions.[2] Moreover, prior papers find that ESG ratings influence firm value, money flows and financial performance (Edmans, 2011; Renneboog et al., 2011; Servaes and Tamayo, 2013; Malik, 2015; Lins et al., 2017), improve credit ratings (Jiraporn et al., 2014; Oikonomou et al., 2014), increase employee productivity and efficiency (Lins et al., 2017), and amplify social reputation and intangible assets (Dai et al., 2021).

In this paper, we concentrate on how becoming ESG rated affects firms' leverage ratios and debt structure. That is, after firms become ESG rated, whether they adjust their optimal/current leverage ratios and specific debt financing sources. The intuition is that as firms become ESG rated, their corresponding financing needs and conditions change, and as a consequence they adjust their leverage ratio. Previous studies assess the impact of ESG on several determinants of firms' capital structure, such as perceived

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[1] Stakeholders are customer, employees, suppliers, communities, and shareholders.
[2] Source: https://www.unpri.org/annual-report-2022.

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risk (Oikonomou et al., 2012; Albuquerque et al., 2019), investor base (Sharfman and Fernando, 2008; El Ghoul et al., 2011; Chava, 2014; Cheng et al., 2014), and the cost of financing (Sharfman and Fernando, 2008; Menz, 2010; El Ghoul et al., 2011; Chava, 2014; Oikonomou et al., 2014; Ng and Rezaee, 2015; Hasan et al., 2017; Flammer, 2021; Javadi and Masum, 2021). However, only a few papers explicitly study the role of social responsibility and ESG ratings on capital structure, i.e. access to various sources of financing (Sharfman and Fernando, 2008; Verwijmeren and Derwall, 2010; Bae et al., 2011; Huang and Shang, 2019; Ho et al., 2021; Asimakopoulos et al., 2023). In addition, these papers do not systematically assess the impact of becoming ESG rated on their leverage ratios and debt structure.

We delve deeper into the effects of becoming ESG rated on debt structure, and not only the overall leverage ratios. Following the seminal work by Modigliani and Miller (1958), capital structure comes into view and researchers assess which factors determine the corporate capital structure decisions. Most studies treat debt uniformly, as if firms solely use one kind of debt or different types of debt have the same properties (Hackbarth et al., 2007). However, it is noteworthy that debt heterogeneity exists and cannot be ignored. On the one hand, firms use multiple debt types simultaneously and alter debt components without changing overall debt ratios. For instance, Rauh and Sufi (2010) find that 68% of firms in their sample use more than two types of debt. In addition, they show that 25% of firm observations adjust their debt elements significantly. On the other hand, debt has different priorities in cash flow claims, information sensitivity, and managers' incentives (Rauh and Sufi, 2010). Thus, assessing firms' overall leverage ratios and debt elements is of paramount importance (see also Colla et al., 2013). Surprisingly, there has been no study that directly investigates the influence of firm-level ESG ratings on debt specific items, i.e. bank versus bond borrowing.

Our paper fills that gap and studies the impact of ESG on firms' debt structure, i.e. the target (optimal) and actual leverage ratios, and debt composition. We further assess the individual ESG components to identify the key drivers of these effects. We employ a merged CRSP-Compustat, Capital IQ, and Refinitiv dataset. Our final sample consists of 11,018 firm-year observations with 2,347 unique U.S. firms during the period 2002 to 2019. Our results show that ESG rated firms reduce their target (optimal) market and book leverage ratios. We further show that firms that become ESG rated utilize this rating as a signal mechanism to reduce information asymmetry. When we delve deeper into the debt structure analysis, we find evidence that firms with an ESG rating redistribute their debt from bonds to bank loans, i.e. towards more internal "safer" sources of financing. Specifically, a one standard deviation increase in the natural logarithm of the ESG with controversies score will lead to an increase of about 3.8% in bank loans and a decrease of about 6.7% in bond issuing. Therefore, our paper shows how ESG ratings fit under the two key capital structure theories, trade-off and pecking order theories.

Our work contributes to the growing literature that investigates the role of ESG ratings on firm financing via expanding the analysis to its role on optimal leverage and debt structure. We are able to provide a more in-depth understanding of how ESG rated firms operate in terms of their financing decision-making process. To the best of our knowledge, we are the first to show how becoming ESG rated affects the target (optimal) market and book leverage ratios, which is in line with the trade-off theory. We are also the first to show the redistribution effect on corporate debt structure towards internal sources of financing that arises via the mitigation of information asymmetry when firms become ESG rated (pecking order theory).

Therefore, the provision of an ESG rating leads to a dual benefit. On the one hand, the increased information disclosed in the market by the ESG rating provision reduces asymmetric information, because uncertainty regarding a firm's ESG responsibility is limited. On the other hand, ESG rating provision, along with reducing asymmetric information, plays the role of a signalling mechanism to capital markets helping firms to redistribute their debt borrowing from bonds to bank loans, i.e. towards more internal "safer" sources of financing. ESG rating agencies specialize in evaluating the three pillars of a firm's responsibility (environment, society, and governance), conveying invaluable information to financial intermediaries, such as banks.

The remainder of this paper is organized as follows. Section 2 reviews relative previous literature and provides the main hypotheses. Section 3 introduces the data and descriptive statistics. Section 4 provides benchmark estimations. Section 5 introduces various endogeneity tests. Section 6 offers a set of robustness checks, and Section 7 concludes the paper.

2. Literature review and hypotheses

In this section, we provide an overview of the related literature on firm-level ESG[3] and access to finance, and the discussion between trade-off and pecking order theories. We also form our main hypotheses.

2.1. ESG and access to finance

Are companies with a sense of sustainability in an advantageous position in terms of financing? Cheng et al. (2014) find that firms with superior ESG performance face lower capital constraints due to the mitigation of agency problems and lower information asymmetry. Other studies that focus on the cost of equity, i.e. El Ghoul et al. (2011) and Ng and Rezaee (2015), find that social strengths may reduce it. By contrast, Chava (2014) argues that environmental strengths have no effects on the cost of equity. Moreover, some papers focus on the cost of debt, i.e. public debt (issue bonds) and private debt (bank loans). Goss and Roberts (2011), for example, show that firms that invest in positive ESG activities are charged from 7 to 18 basis points (bps) less than firms with negative ESG activities. Likewise, firms with environmental concerns in all dimensions pay about 25 bps higher than firms without these concerns (Chava, 2014). However, Menz (2010) indicates that for socially responsible firms the cost of bonds is

[3] Corporate Social Responsibility (CSR), ESG, and sustainable finance are used interchangeably in this paper.

higher compared to firms without CSR engagement. Even though related studies document the importance of ESG on firm financing, they appear to be far from reaching a consensus.

In addition, some studies examine the relationship between ESG and firm leverage ratios. Specifically, environmental risk management increases the leverage ratios (Sharfman and Fernando, 2008), but fair employee treatment or higher employee well-being decreases debt ratios (Verwijmeren and Derwall, 2010; Bae et al., 2011). In addition, Huang and Shang (2019) show that locating in regions with high altruistic tendency and mutual trust lowers firms' debt ratio, and Ho et al. (2021) estimate how ESG performance influences firms' speed of adjustment towards target leverage ratios. However, these papers either emphasize the effects of one type of stakeholder (environment or employees), or the impact of regional-level social capital on the leverage ratio, or the speed of leverage adjustment, not the level of leverage. More importantly, these studies do not assess how becoming ESG rated affects firms' debt structure directly.

2.2. Capital (debt) structure theory

Since Modigliani and Miller (1958) proposed that capital structure is irrelevant to firm value under a perfect capital market, the capital structure issue has been discussed by many researchers. The key capital structure theories studied are the trade-off theory and the pecking order theory.

Trade-off theory suggests that firms take advantage of tax shields from debt financing, while firms face the potential risks of bankruptcy and financial distress simultaneously as they increase their leverage ratios. Tax savings and the cost of financial distress determine an optimal leverage ratio when both opposite forces are offset. Empirically, researchers are interested in whether this target (optimal) leverage ratio exists and whether it is possible to narrow the gap between actual leverage ratio and the target leverage ratio. For example, a firm whose actual debt ratio deviates from the optimal debt ratio can mitigate this deviation by paying relatively small costs (Ju et al., 2005). Flannery and Rangan (2006) develop the partial (incomplete) adjustment model and argue that firms converge to their optimal capital structure, approximately at a speed of one-third per year, but Huang and Ritter (2009) say that the speed is moderate.

The pecking order theory, modified by Myers and Majluf (1984), begins from the asymmetric information issue. Information asymmetry is defined as the heterogeneous access to information among parties (such as borrowers and lenders) and is noticeable in the financial market (Leland and Pyle, 1977; Asimakopoulos et al., 2017). Generally, the borrower has more information on firm risk, prospects, and collateral. Keeping this information private benefits the firm to finance at an advantageous position and avoids leaking information to competitors, which results in competing in a worse position and further lowering future profits (Dhaliwal et al., 2011). The pecking order theory suggests that firms seek more internal "safer" financing sources due to asymmetric information (Denis and Mihov, 2003). Specifically, if firms have insufficient financial budgets and need to search for capital, their borrowing order starts from internal cash, then debt and at the end equity (Myers and Majluf, 1984).

Private debt and public debt both belong to debt, however, they are given different priorities (Denis and Mihov, 2003). Compared to corporate bonds, bank loans are regarded as inside debt (James, 1987). This is because commercial banks issue loans using firm private information and public information. In other words, asymmetric information is less severe if firms borrow from banks (Besanko and Kanatas, 1993) and it plays a role in the choice of security type (Gomes and Phillips, 2012). In addition, the debt overhang could lead to the underinvestment issue (Myers, 1977), which further induces debt restructure of firms (Frantz and Instefjord, 2019).

Although both trade-off theory and pecking order theory are proposed and examined, there is no empirical work on how these theories matter in debt (re-)structuring and financing decisions when firms become ESG rated.

2.3. Hypotheses development

After being assigned ESG ratings, it might be more sensible for firms to adjust their target leverage ratios, due to the corresponding changes in financing conditions and investors' attention. First of all, firms with (high) ESG ratings have higher growth opportunities (Lins et al., 2017) and they want to avoid a situation with high levels of debt that will lead to foregone profitable investment opportunities, debt-overhang and underinvestment issues, leading to a reduction in their leverage ratios. Secondly, stakeholders face high switching costs if firms are liquidated (Titman, 1984), and they prefer firms with a low level of leverage. Given that ESG-rated firms tend to attract and retain stakeholders, they will reduce their leverage ratios to avoid ending up in a high financial pressure situation. Thirdly, ESG-rated firms are facing lower costs of bank loans and bonds (El Ghoul et al., 2011; Goss and Roberts, 2011; Chava, 2014; Ng and Rezaee, 2015).

The above indicates that firms that become ESG rated should reduce their target leverage ratio, leading to our first hypothesis:

Hypothesis I: *Firms that become ESG rated exhibit lower target (optimal) leverage ratios.*

According to the pecking order theory, firms tend to prefer more internal financing sources, i.e. debt over equity. However, it is worth mentioning that although both private debt (bank loans) and public debt (bonds) are more internal than equity, they are also given different priorities. Compared to issuing bonds, bank loans are treated as inside debt (James, 1987) because banks have their monitoring system to gain firms' information. In this case, borrowing from banks exhibits less asymmetric information (Besanko and Kanatas, 1993), meaning that bank loans are regarded as a more internal "safer" financing option than bond issuing (James, 1987).

Bank loans are also preferred by considering both supply and demand drivers of borrowing. From the perspective of borrowers, using bank loans can avoid floatation costs of bond issues (Easterwood and Kadapakkam, 1991) and increase stock prices (James,

1987; Lummer and McConnell, 1989), namely, borrowing from banks makes firms gain higher returns via decreasing cost and increasing rewards. Banks also provide higher flexibility of renegotiation, compared to bonds where bondholders are dispersed (Rajan, 1992; Chemmanur and Fulghieri, 1994; Denis and Mihov, 2003; Chen et al., 2020). From the perspective of lenders (banks), they are eager to maintain a long-haul business relationship with ESG-rated firms. The reason is that these firms are more likely to disclose highly readable information to show high ethical standards (Bacha and Ajina, 2019), which reduces banks' monitoring costs. Also, socially responsible firms have richer growth opportunities (Lins et al., 2017) and are less risky (Goss and Roberts, 2011; Mishra and Modi, 2013) so that these firms are potentially good borrowers. To attract these firms, banks might lower collateral and covenant requirements (Hasan et al., 2017) making bank loans even more appealing than bond issuance.

Therefore, we propose our second hypothesis:

Hypothesis II*: Firms that become ESG rated are able to redistribute financing from external to internal sources, i.e. from issuing bonds to bank loans.*

3. Data and descriptive statistics

In this section, we introduce our data sources and sample selection process. Next, we provide descriptive statistics for our full and matched sample respectively.

3.1. Database

To test our hypotheses we employ three different databases, Refinitiv, Capital IQ, and CRSP-Compustat merged (CCM) annual databases for U.S. firms from 2002 to 2019.

Refinitiv database (previously named Thomson Reuters Asset4 database) supplies firm-level ESG ratings, which covers more than 80% of global market capitalization. It starts in 2002 and has been used widely in relative studies over the past several decades. For example, using this database, Halbritter and Dorfleitner (2015) examine the connection between firms social performance and financial performance, while Dai et al. (2021) explore whether socially responsible consumers could drive suppliers onto socially responsible behaviour. This database contains over 630 ESG scores, and each of them ranges from 0 to 100. Among these ratings, we choose the most comprehensive ESG score, the ESG combined (ESGC) score, as our main indicator to measure whether firms have ESG ratings or not. This ESGC score is an overall score that takes both positive and negative ESG aspects into account.

Capital IQ database provides debt structure information. There are seven debt financing sources: commercial paper, drawn credit lines (revolving credit), term loans, senior bonds and notes, subordinated bonds and notes, capital leases, and other debt. Finally, CRSP-Compustat merged (CCM) annually database offers firm-level data to describe firm characteristics.

3.2. Sample selection

After merging the above three databases, there are 4762 unique firms and 36,921 firm-year observations. As a next step, we perform the standard data "cleaning" approach. To that end, we drop observations that meet the following criteria. (1) Financial firms (sic 6000–6999) and utilities (sic 4000–4049), because these firms use special regulations and we only consider common firms (25,992 observations left); (2) Observations whose total asset value is missing or zero (25,010 observations left); (3) Total debt level of the observation is missing or equals to zero (23,400 observations left); (4) Observations with book leverage or market leverage value outside unit circle [0,1], as in Colla et al. (2013) (17,991 observations left); (5) Observations prior to 2002 because the availability of comprehensive Capital IQ data starts in 2002 (16,536 observations left); (6) Observations where the difference of total debts between CCM and Capital IQ exceeds 10%, as in Lin (2016) and Colla et al. (2013). Specifically, total debt in the CCM database is the sum of short-term debt and long-term debt. In the Capital IQ database, total debt is the sum of all seven debt components. If the difference between the former and the latter is larger than 10%, we drop that observation (14,817 observations remaining); (7) Observations where debt ratios, using seven debt types divided by total debts respectively, have values larger than 1. At the end we also winsorize the 1st and 99th percentile of all variables. Our final dataset consists of 11,018 firm-year observations with 2,347 unique U.S. firms during the period 2002–2019. Table 1 summarizes each step followed in our data cleaning process.

3.3. Descriptive statistics of the full sample

In this paper, we classify main variables into three categories, which are debt structure, ESG, and control variables. Table 2 provides a description of the variables we used and the relevant source and Table 3 provides the descriptive statistics of these variables for our full sample.

Debt structure variables indicate different measurement of firms' leverage ratios and debt components, which are classified into three classes. In the first class, we use book leverage and market leverage to show firms' overall leverage ratios. Book leverage is measured by long-term debt divided by the book value of assets. Similarly, market leverage equals the long-term debt over the market value of assets. For the full sample, average book leverage and market leverage ratios are 21.2% and 15.1% respectively. In the second class, we further construct two broad debt categories, bonds debt and banks debt. Following Colla et al. (2013) and Lin (2016), the bonds debt is the sum of senior bonds and notes and subordinated bonds and notes, and the bank debt is the sum of revolving credit and term loans. We find that these two types of financing sources account for 87% of total debt, suggesting that firms mainly use these forms of financing. This finding is also consistent with Lin (2016). Furthermore, bank debt ratio (53.5%) is

Table 1
The number of remaining firms and firm-year observations.

Process	Firm			Firm-year observations		
	With	Without	Total	With	Without	Total
After merging	437	4,425	4,762	2,238	34,683	36,921
Drop, non-common firms	304	3,262	3,566	1,590	24,402	25,992
Drop, if assets=. or =0	304	3,262	3,540	1,588	23,422	25,010
Drop, if debts=. or =0	292	3,153	3,445	1,520	21,880	23,400
Drop, if bl(ml) < 0 or > 1	290	2,894	2,923	1,491	16,500	17,991
Drop, if year < 2002	290	2,550	2,840	1,491	15,046	16,536
Drop, if difference > 10%	283	2,454	2,737	1,385	13,432	14,817
Drop, if debt ratios > 1	250	,2097	2,347	1,132	9,886	11,018
Winsor 1% and 99%	250	2,097	2,347	1,132	9,886	11,018

Notes: This table shows the process of data clean. The first column describes conditions used to drop observations. Here, we drop observations in financial firms and utilities, without assets and debts or values of assets and debts are missing, are outside of unit interval, and are before the year 2002. Also, observations with total debt in CCM and Capital IQ databases exceeds 10% or any debt ratio exceeds one are deleted. We winsorize top and bottom 1% values. The second column to the fourth column introduce the number of rated firms, non-rated firms, and total firms respectively. The fifth to the seventh columns show the number of remaining firm-year observations with ESGC scores, without ESGC scores and the number of all observations for each. In the end, there are 11,018 firm-year observations with 2,347 unique firms from 2002 to 2019.

higher than bonds debt ratio (33.5%), suggesting that private debt is more attractive to firms than public debt in our sample. In the third class, we utilize seven more detailed debt ratios, scaled by total debt, to analyse firms' debt structure. The summary statistics for these variables are very similar with Colla et al. (2013), which also uses the Capital IQ database to analyse firm debt structure. In our sample, the three most popular debt sources are term loans, senior bonds and notes, and revolving credit. Each one of them is above 20% of total debt, and the mean ratio of term loans reaches 31.9%.

ESG variables are used to assess whether firms are rated or non-rated. Ln(ESGC), defined as the natural logarithm of ESG combined score (ESGC), is the main ESG rating indicator we are using in our analysis.[4] We further incorporate various firm characteristics as control variables, such as total book value of assets, Market-to-Book ratio, sales, tangibility, profitability, Research and Development (R&D) expenditures, Sales, General and Administrative (SGA) expense, dividend payment dummy variable, and sales-to-assets ratio.

3.4. Matched sample

Due to the large imbalance between firms with ESG and without ESG scores, we perform a matching sample procedure. Specifically, the number of ESG rated firms is 250, while that of non-rated firms is 2097, as shown in Table 1. Therefore, we use a *Marginal Propensity Score* matching approach. This approach helps us isolate the impact of having a firm with an ESG score on its debt structure since we are going to use a subset of firms *without* an ESG score that are similar to firms *with* an ESG score in terms of certain firm characteristics.

Specifically, we follow a one-to-one matching procedure and we classify firms according to whether they receive an ESG rating at any period in our sample (Group A) and to firms that never become ESG rated in our sample (Group B). Each firm-year observation from group A will be matched with the closest observation in group B according to three control variables, sale-to-asset ratio, tangibility, and profitability,[5] which are the variables differ the most between the two groups.

Table 4 shows that the size of matched sample is around 4000 firm-year observations. Similar to the full sample, in the matched sample firms lean towards bank debt (52.1%). Also, the most appealing financing sources are still term loans, senior bonds and notes, and revolving credit.

For our empirical analysis we are going to use the matched sample to avoid reaching conclusions based on the heavily unbalanced full sample between ESG and non-ESG rated firms. However, we do perform a robustness check with the full sample and our key findings remain valid.[6]

4. Empirical analysis

4.1. Model

To assess how ESG rating affects a firm's target (optimal) leverage ratio, actual leverage ratio and debt components, we begin with the definition of target leverage ratio. Following Bae et al. (2011) and Im et al. (2020), we initially define the target leverage

[4] In the Refinitiv data, there is no ESG combined score equal to 0. We only assign a value of Ln(ESGC) equal to zero if the firm is not ESG rated. This does not create any artificially low ESG scores.

[5] In untabulated results we find that these three control variables appear to differ the most between these two types of firms. However, our results remain consistent even if we choose all the control variables at the Marginal Propensity Score matching approach (see Table A.2).

[6] We have also performed an entropy balancing approach to create our matching sample and we find that our benchmark results remain consistent (see Table A.3).

Table 2
Variables description.

Variables	Description	Source
Debt structure		
Market leverage	Long-term debt (9)/((assets (6) − common equity (60)) + price close (31) ∗ common shares outstanding (25))	CCM
Book leverage	Long-term debt (9)/assets (6)	
Bank debt ratio	(Revolving credit + term loans)/debt	
Bond debt ratio	(Senior bonds notes + subordinated bonds notes)/debt	
Commercial paper ratio	Commercial paper/debt, where debt = debt in current liabilities (34) + long-term debt (9)	Capital IQ & CCM
Revolving credit ratio	Revolving credit/debt	
Term loans ratio	Term loans/debt	
Senior bonds & notes ratio	Senior bonds & notes/debt	
Subordinated bonds & notes ratio	Subordinated bonds & notes/debt	
Capital leases ratio	Capital leases/debt	
Other debt ratio	(other debt + total trust-preferred stock)/debt	
ESG indicators		
Ln(ESGC)	Natural logarithm of ESG combined score	Refinitiv ESG
Ln(ESG)	Natural logarithm of ESG score	
Ln(EP)	Natural logarithm of environment pillar score	
Ln(SP)	Natural logarithm of social pillar score	
Ln(GP)	Natural logarithm of governance pillar score	
Firm characteristics		
Assets	Natural logarithm of assets (6)	CCM
Market-to-Book ratio	Market value of equity divided by book value of equity, i.e. price close (31) ∗ common shares outstanding (25)/(stockholders' equity (144) + deferred taxes (74) + investment tax credit (208) -preferred_stock), where preferred_stock = pstkrv (56) (if missing, use pstkl (10); if still missing, use pstk (130))	
Sales	Natural logarithm of sales (12)	
Tangibility	Property, plant, and equipment (8)/assets (6)	
Profitability	Operating income before depreciation (13)/assets (6)	
R&D expense	Research and development expense (46)/sales (12)	
SGA cost	Selling, general and administrative expenses (132)/sales (12)	
Dividend	Dummy = 1, if dividend payment (21) = 0	
Sales over assets	Sales (12)/assets (6)	
Financial pressure	Cash flow divided by interest payments, i.e. (operating income before depreciation (13) − interest and related expense (15) − income taxes (16))/interest and related expense	
R&D intensity	R&D expenses (46)/number of employees (29)	

ratio as:

$$d_{i,t}^{*} = \alpha + B'\mathbf{X}_{i,t} + \eta_i \tag{1}$$

where the optimal debt ratio ($d_{i,t}^{*}$) is determined by a set of firm characteristics (**X**). Following Bae et al. (2011) and Huang and Shang (2019), we use book value of total assets, the Market-to-Book ratio, sales, tangibility, profitability, R&D expenditures, SGA expenses, dividend payment and sale-to-asset ratio as firm characteristics in our estimations. In Eq. (1), we also introduce η_i indicating firm fixed effects, as in Im et al. (2020). Compared with the estimation model in Bae et al. (2011), the use of η_i allows the firm fixed effects to influence firms' target debt ratio. Finally, to test our *Hypothesis I*, we introduce ESG rating as an additional firm characteristic that takes the value of the actual ESG score when the firm is rated and zero otherwise.

As a next step, we assume that a typical firm has a long-term target leverage ratio and can partially adjust to it (Flannery and Rangan, 2006; Bae et al., 2011; Im et al., 2020). Therefore, we define the partial adjustment model as:

$$d_{i,t} - d_{i,t-1} = \lambda(d_{i,t}^{*} - d_{i,t-1}) + \gamma_t + \nu_{i,t} \tag{2}$$

where $d_{i,t}$ and $d_{i,t-1}$ denote actual debt ratios of firm i in time t and time $t-1$, respectively. The first term in the right hand side, $d_{i,t}^{*} - d_{i,t-1}$, indicates the difference of past debt ratio from the optimal debt level, and λ captures the speed of adjustment. γ_t reflects year fixed effects and $\nu_{i,t}$ is the error term for firm i in time t.

Substituting Eq. (2) into Eq. (1) we get:

$$d_{i,t} = \lambda\alpha + (1-\lambda)d_{i,t-1} + \lambda B' X_{i,t} + \gamma_t + \lambda\eta_i + \nu_{i,t} \tag{3}$$

where firm i's actual debt ratio in time t is determined by firm i's last period debt ratio, firm characteristics (including the ESG rating in our case), year and firm fixed effects. To simplify further, we use a set of βs to substitute coefficients in Eq. (3). In more detail, $\beta_0 = \lambda\alpha$, $\beta_1 = 1-\lambda$, $B_2' = \lambda B'$, to get the following equation:

$$d_{i,t} = \beta_0 + \beta_1 d_{i,t-1} + B_2' X_{i,t} + \gamma_t + \theta_i + \nu_{i,t} \tag{4}$$

Table 3
Descriptive statistics (full sample).

	N	Mean	P25	P50	P75	Std. Dev.
Debt structure variables						
Market leverage	10,981	0.151	0.005	0.090	0.243	0.172
Book leverage	11,018	0.212	0.012	0.153	0.350	0.216
Bank/debt	11,018	0.535	0.044	0.586	0.984	0.410
Bond/debt	11,018	0.335	0	0.118	0.707	0.385
Commercial paper/debt	11,018	0.002	0	0	0	0.030
Revolving credit/debt	11,018	0.217	0	0	0.336	0.338
Term loans/debt	11,018	0.319	0	0.083	0.655	0.384
Senior b&n/debt	11,018	0.286	0	0.006	0.603	0.375
Subordinated b&n/debt	11,018	0.049	0	0	0	0.170
Capital leases/debt	11,018	0.098	0	0	0.021	0.260
Other debt/debt	11,018	0.040	0	0	0	0.161
ESG variables						
Ln(ESGC)	11,018	0.348	0	0	0	1.043
Control variables						
Ln(asset)	11,018	5.418	3.912	5.553	7.083	2.356
Market-to-Book ratio	10,681	2.523	0.824	1.732	3.425	11.402
Ln(sale)	10,455	5.054	3.638	5.270	6.731	2.457
Tangibility	11,014	0.315	0.063	0.188	0.539	0.299
Profitability	10,998	−0.069	−0.056	0.077	0.136	0.504
R&D expense	11,018	0.372	0	0	0.051	1.889
SGA cost	9,550	0.648	0.101	0.225	0.473	1.929
Dividend	11,018	0.232	0	0	0	0.422
Sales/assets	11,018	0.876	0.292	0.657	1.203	0.829

Notes: This table provides descriptive statistics of the main variables under the full sample. Data comes from merged CRSP-Compustat, Capital IQ, and Refinitiv databases between 2002 and 2019. Variables are split into debt structure variables, ESG variables, and control variables. N denotes the number of firm-year observations. Noting that senior b&n and subordinated b&n means senior and subordinated bonds and notes; Research and Development expenditure is called R&D expense; SGA cost is Selling, General, and Administrative expense.

Table 4
Descriptive statistics (matched sample).

	N	Mean	P25	P50	P75	Std. Dev.
Debt structure variables						
Market leverage	4,322	0.169	0.025	0.130	0.259	0.163
Book leverage	4,328	0.243	0.049	0.212	0.379	0.211
Bank/debt	4,328	0.521	0.068	0.540	0.971	0.401
Bond/debt	4,328	0.361	0	0.228	0.728	0.383
Commercial paper/debt	4,328	0.003	0	0	0	0.031
Revolving credit/debt	4,328	0.198	0	0	0.272	0.319
Term loans/debt	4,328	0.323	0	0.118	0.637	0.377
Senior b&n/debt	4,328	0.309	0	0.046	0.647	0.376
Subordinated b&n/debt	4,328	0.052	0	0	0	0.175
Capital leases/debt	4,328	0.090	0	0	0.018	0.250
Other debt/debt	4,328	0.036	0	0	0	0.151
ESG variables						
Ln(ESGC)	4,328	0.870	0	0	2.262	1.506
Control variables						
Ln(asset)	4,328	6.499	5.252	6.546	7.855	1.966
Market-to-Book ratio	4,144	2.756	1.109	2.028	3.571	7.589
Ln(sale)	4,300	6.116	4.880	6.288	7.518	2.085
Tangibility	4,328	0.270	0.064	0.167	0.416	0.260
Profitability	4,328	0.089	0.061	0.109	0.156	0.155
R&D expense	4,328	0.206	0	0	0.046	1.366
SGA cost	3,989	0.318	0.096	0.204	0.365	0.849
Dividend	4,328	0.292	0	0	1	0.455
Sales/assets	4,328	0.903	0.436	0.755	1.211	0.661

Notes: This table provides descriptive statistics for the matched sample. Data is from merged CRSP-Compustat, Capital IQ, and Refinitiv databases between 2002 and 2019. The variables are split into debt structure variables, ESG variables, and control variables. N denotes the number of firm-year observations. Noting that senior b&n and subordinated b&n means senior and subordinated bonds and notes; MB ratio is Market-to-Book ratio; SGA cost is Selling, General, and Administrative expense.

We treat Eq. (4) as our main regression model. Here, the dependent variable is the firm's actual debt ratio in time t, which is proxied by several variables that are classified into three classes. Initially, we use the standard (aggregate) level of firm debt ratios, i.e. book leverage and market leverage. This way we examine if firms that are ESG rated have a higher or lower overall leverage

Table 5
T-test of optimal leverage ratio.

	Before rated	After rated	T-test
Market leverage	0.159	0.126	70.894***
Book leverage	0.239	0.210	53.217***

Notes: This table reports t-statistics of firms target market and book leverage ratios before and after becoming ESG rated. The optimal leverage ratio is the predicted value (residuals) of regressing leverage ratios on firm characteristics.

ratio than firms that are not ESG rated. Next, we consider the bonds and bank debt ratios as another different measure of firms' financing position. According to this second group, we expect to find differences in choosing private financing (borrowing from banks) and public financing sources (issuing bonds) for firms with and without ESG score, as argued in our *Hypothesis II*. Finally, we also consider seven specific debt ratios separately to further assess firms' debt components. These components are commercial paper, revolving credit, term loans, senior bonds and notes, subordinated bonds and notes, capital leases, and other debts. All of these ratios are scaled by total debt (long-term and short-term debt).

Regarding independent variables, we have firm's i actual debt ratio at time $t-1$ and a set of control variables, $\mathbf{X}$. For control variables we include various firm characteristics and their ESG ratings. These firm characteristics are as mentioned in Eq. (1) together with the natural logarithm of the ESG combined score (ln(ESGC)) for firms' ESG indicator. This indicator includes ESG score and relevant controversies. We further control for various unobservable time-invariant firm characteristics and year fixed-effects.

4.2. Baseline estimations

4.2.1. Target leverage ratio

Do firms that become ESG rated alter their optimal leverage ratio? To answer this question we compare firms' optimal leverage ratios before being rated and after they become rated. Note that at this part of the empirical analysis we only use a subset of firms that do get an ESG rating at a given year. The optimal leverage ratio is estimated by the predicted value (residuals) of regressing market or book leverage ratios on firm characteristics, as defined in Eq. (1), similarly to De Jong et al. (2011).

Table 5 shows that on average a firm's optimal market leverage ratio reduces from 15.9% to 12.6% after they become ESG rated. This reduction is at a magnitude of 20.7% and statistically significant. Similarly, optimal book leverage ratio drops to the level of 21% which is a 12.1% reduction in book leverage when the firm becomes ESG rated. This result verifies our *Hypothesis I*.

The main driving force of this result comes from investors' preference. Firms tend to search for investment to expand their operations and grow. However, not all investors are willing to invest in all kinds of firms. For example, Hong and Kacperczyk (2009) find that institutional investors, such as pension funds, do not invest in "sin" stocks that engage in producing tobacco, gaming, and alcohol. The announcement of green bonds contributes to the increase of long-term investors and green investors (Flammer, 2021). Consistent with these findings, our results indicate that firms take the advantage of attracting investors who are interested in ESG after they become rated. Thus, due to the higher growth opportunities that the ESG rated firms have they limit the use of borrowing to avoid underinvestment issues that arise from high leverage.

4.2.2. Asymmetric information

What is the role of the ESG rating signal to the market? It has been shown that firms with high ESG ratings will alleviate some of their capital constraints due to lower asymmetric information (Cheng et al., 2014). This implies though that firms have already received an ESG rating. Is it still the case that firms that become ESG rated use it as a signal to reduce information asymmetry? To answer this question we focus on the firms in our sample that become ESG rated at a given year, similar to the analysis in the previous subsection.

For firm asymmetric information proxies we use firm size measured by total assets, intangible assets as a share of total assets, and the volatility of firm's earning measured by EBITDA over total assets, similar to Javakhadze et al. (2014). Assuming that the ESG rating is used as a signal of managers' private information about firm's quality and respect towards the environment, society and the stakeholders, it is expected that these firms that are in need of this signalling mechanism will increase their size, increase the level of intangible assets, and decrease their earnings volatility once they become ESG rated.

In Table 6 we show the mean values of size, intangible assets holdings and volatility of earnings for the same set of firms before and after they become ESG rated. The results indicate clearly that these firms utilize their ESG rating as a signal mechanism to reduce information asymmetry and improve their access to financial markets.

4.2.3. Debt (re-)structure

In this section we assess corporate debt structure and leverage ratios differences between ESG and non-ESG rated firms. Using Eq. (4) and the matched sample, as described in the previous section, we are able to isolate the role of becoming ESG rated on firms' debt structure and current debt ratios, controlling for a set of firm characteristics. In other words, in our empirical analysis the ESG coefficient acts as the differences-in-differences estimator.

Table 7 shows the results of regressing firms debt structure on ESG ratings, firm control variables, firm and year fixed-effects. In the first two columns, firms' leverage ratios are measured by overall market and book leverage. We find that, on average, there is no significant effect of ESG rating on firms' market and book current leverage ratios. As expected, firms do partially adjust their leverage

Table 6
ESG rating and asymmetric information.

Asymmetric information proxy	Before rated	After rated	T-test
Size	1329.68	8319.99	16.2143***
Intangible assets	0.2459	0.2842	3.6519***
sd(EBITDA)	0.0715	0.0463	−7.1432***

Notes: This table shows the impact when a firm becomes ESG rated on asymmetric information. We use three different proxies to capture asymmetric information: size (total assets), intangible assets scaled by total assets and the standard deviation of EBITDA over assets, for the same set of firms before and after they become ESG rated. This table reports the mean values and t-statistics of the difference between the two regimes. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

ratios from period t − 1 to period t (Flannery and Rangan, 2006), at a speed of adjustment of about 55.6% (one minus 44.4%) and 50.6% (one minus 49.4%), respectively. The results also show that firms with high level of profits and turnover rate (high sales-asset ratio) have low leverage ratios due to their higher current and future internal funding compared to their counterparts. As a result, there is no need to rely on borrowing from outside.

Even though it does not appear to be any significant effect from ESG ratings on total leverage, there still might be an impact on the actual debt structure of firms. To assess that, the last two columns of Table 7 show the results from using bank and bond debt ratios as firm's leverage proxies. The results indicate that compared to non-rated firms, firms with an ESG rating tend to redistribute their source of financing from issuing bonds to bank loans. In particular, we find that a one standard deviation increase in the natural logarithm of the ESG with controversies score will lead to an increase of about 3.8% in bank loans and a decrease of about 6.7% in bond issuing. Therefore, our results are statistically and economically significant. This finding supports our *Hypothesis II* showing that when a firm becomes ESG rated it discloses some form of information to the public, leading to reduced information asymmetry and better access to external funding.

The driving forces of this result come from both the supply and demand channels. From the perspective of demand, firms favour more internal "safer" sources of funding, according to pecking order theory. Compared to bonds debt, bank loans are considered more internal because of banks' higher level of private information than dispersed bondholders (James, 1987). Therefore, the acquired ESG rating will allow these firms to search for more internal "safer" sources of financing.

From the perspective of supply, banks are eager to maintain a long-haul business relationship with socially responsible firms and thus make efforts to attract these kind of firms. The information disclosure of ESG rated firms decreases banks monitoring costs. Bacha and Ajina (2019) finds that CSR firms are more likely to disclose highly readable information to show high ethical standards. Therefore, lending to these firms helps banks save costs. In addition, socially responsible firms are more stable borrowers with richer growth opportunities and less risky (Goss and Roberts, 2011; Mishra and Modi, 2013; Lins et al., 2017).

Overall, although ESG ratings have no effects on firms' aggregate leverage ratios, firms with an ESG score tend to restructure their borrowing towards more internal sources of financing, from bonds issuing to bank debt. These findings contribute to the related literature that assess the borrowing constraints of socially responsible firms, such as Chava (2014) and Goss and Roberts (2011) that argue that socially responsible firms are charged lower interest rates by banks.

Furthermore, we investigate the effect of becoming ESG rated on the use of specific debt items. The choice among public debt, bank debt, and non-bank private debt has been explored in depth by prior studies (Denis and Mihov, 2003; Mather and Peirson, 2006; Arena, 2011; Kale and Meneghetti, 2011). For instance, the use of particular debt items is influenced by credit quality (Denis and Mihov, 2003; Arena, 2011), and each debt item exhibits heterogeneous response to financial convents (Mather and Peirson, 2006) and renegotiation of contract terms (Kale and Meneghetti, 2011). In order to further examine whether ESG rating plays a role in the choice of the various debt items, we delve deeper into debt structure, beyond bank loans and bonds, using the seven specific debt components.

Table 8 shows the results from estimating Eq. (4) using as dependent variable the commercial paper (column 1), revolving credit (column 2), term loans (column 3), senior bonds and notes (column 4), subordinated bonds and notes (column 5), capital leases (column 6), and other debt (column 7) separately. The results show that ESG rated firms tend to reduce senior bonds and notes (column 4) and increase term loans (column 3). Therefore, the restructuring of debt for ESG rated firms takes place mainly via these two key debt components.[7]

5. Endogeneity

It has been shown that endogeneity is a concern in corporate finance studies and can lead to biased and inconsistent parameter estimators (Wintoki et al., 2012; Roberts and Whited, 2013). In our setting, there are various possible causes of endogeneity. Specifically, we have individual firm heterogeneity, omitted variables bias, the fact that current values of the independent variables are employed as a function of past values of the dependent variable (leverage ratios), and reverse causality (simultaneity) between leverage and ESG rating.

[7] We also performed the same estimation replacing the continuous ESG variable with an ESG dummy variable to further isolate the fact of having an ESG rating or not. We found that the results remain valid.

Table 7
The regression of leverage and bank (bond) debt ratios on ESGC (matched).

	(1) ML_t	(2) BL_t	(3) Bank_t	(4) Bond_t
Ln(ESGC)	−0.003	−0.003	0.013*	−0.016***
	(−1.370)	(−0.981)	(1.920)	(−2.779)
Market leverage(t−1)	0.444***			
	(14.615)			
Book leverage(t−1)		0.494***		
		(14.555)		
Bank debt(t−1)			0.427***	
			(15.416)	
Bond debt(t−1)				0.465***
				(17.458)
Ln(asset)	0.056***	0.026	−0.036	0.057*
	(4.109)	(1.301)	(−0.968)	(1.959)
Market-to-Book ratio	−0.000	−0.000	0.001	−0.000
	(−0.539)	(−0.531)	(1.266)	(−0.257)
Ln(sale)	−0.016	0.005	−0.006	0.002
	(−1.162)	(0.284)	(−0.170)	(0.082)
Tangibility	0.107***	0.062	0.089	−0.297***
	(2.607)	(1.272)	(0.818)	(−3.254)
Profitability	−0.177***	−0.201***	0.110	−0.207***
	(−4.407)	(−3.800)	(1.224)	(−2.591)
R&D expense	−0.005	−0.001	0.025	0.045**
	(−0.573)	(−0.084)	(1.294)	(1.994)
SGA cost	−0.009*	−0.003	−0.005	−0.002
	(−1.648)	(−0.380)	(−0.266)	(−0.144)
Dividend	−0.001	0.010	−0.006	0.015
	(−0.143)	(1.144)	(−0.287)	(0.835)
Sales/assets	−0.004	−0.022	−0.022	0.007
	(−0.307)	(−1.246)	(−0.597)	(0.213)
Intercept	−0.173***	−0.046	0.460***	0.001
	(−4.371)	(−1.006)	(4.270)	(0.012)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	3,203	3,205	3,205	3,205
Adjusted R^2	0.361	0.344	0.225	0.304

Notes: This table describes the regressions of the market and book leverage ratios, and bank and bonds debt ratios on ESG combined score and various controls under matched samples. Data from merged CRSP-Compustat, Capital IQ, and Refibitiv databases between 2002 and 2019 are used. The dependent variables are market leverage, book leverage, bank debt and bonds debt in columns (1) to (4) respectively. For each regression, we also control firm and year fixed effects. Numbers in parentheses are robust t-statistics. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

To control for the various endogeneity concerns, we perform three different estimations. We initially isolate the year when the firm becomes ESG rated via the introduction of a dummy that takes the value of one that year and zero otherwise. This way we are able to assess the turnover effect of a firm from non-ESG to ESG rated. Next we perform a two-stage least square (2SLS) estimation with an instrumental variable. However, the exclusion criterion of the instrument used at the 2SLS methodology is always a concern. Therefore, we also perform a Generalized Methods of Moments (GMM) approach with instrumental variables. In this case, we use the historical values of our control variables as instruments, which has been shown to be the best way to control for endogeneity (Bazzi and Clemens, 2013).

5.1. Turnover effect

Starting with the turnover effect from non-ESG rated to ESG rated we assess how do firms' leverage ratios alter when they get their initial ESG ratings, i.e. what happens to firms' debt structure following this shock. In this case, our key independent variable is an initial ESG rating dummy variable. If this year is the first year for a firm to be rated, this variable equals one and zero otherwise. Table 9 shows that firms redistribute their borrowing from bond debt to bank loans after they become rated for the very first time.[8]

Compared to our benchmark estimations, this result appears to be more pronounced and highly statistically significant. This indicates that firms tend to restructure their debt immediately after they become rated, alleviating partially some of the endogeneity concerns.

[8] We need to mention that our ESG data are coming only 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 that we cannot detect if the firms in our sample have also been rated by another agency. However, this is not an issue in our analysis since ESG ratings from different agencies are heterogeneous due to differences in their scope, measurement and associated weights (Berg et al., 2022). This means that firms that become ESG rated by Refinitiv can still convey significant new information to the market even if they are already rated by another agency. This is in line with the multiple credit ratings literature and the fact that every additional credit rating by another "big" agency provides additional information to the market (Bongaerts et al., 2012).

Table 8
The regression of seven specific debt ratios on ESGC (matched).

	(1) Cp_t	(2) Rc_t	(3) Tl_t	(4) Se_t	(5) Su_t	(6) Cl_t	(7) Other_t
Ln(ESGC)	−0.000	0.003	0.011*	−0.013**	−0.002	−0.003	0.004
	(−0.759)	(0.429)	(1.776)	(−2.210)	(−0.825)	(−0.706)	(1.644)
Cp(t−1)	−0.013						
	(−0.066)						
Rc(t−1)		0.372***					
		(10.609)					
Tl(t−1)			0.435***				
			(15.341)				
Se(t−1)				0.476***			
				(17.682)			
Su(t−1)					0.544***		
					(13.154)		
Cl(t−1)						0.389***	
						(6.670)	
Other(t−1)							0.237***
							(3.867)
Ln(asset)	−0.005	−0.076**	0.040	0.051	0.004	−0.029*	0.007
	(−1.456)	(−2.196)	(1.208)	(1.616)	(0.336)	(−1.801)	(0.549)
MB ratio	0.000	0.000	0.000	−0.000	−0.000	−0.000*	−0.000
	(0.578)	(1.274)	(0.490)	(−0.035)	(−0.349)	(−1.675)	(−0.677)
Ln(sale)	0.005	0.039	−0.047	0.005	−0.002	0.014	−0.008
	(1.481)	(1.116)	(−1.605)	(0.153)	(−0.118)	(0.997)	(−0.554)
Tangibility	0.006	0.119	−0.022	−0.279***	−0.022	0.104	0.087*
	(1.293)	(1.242)	(−0.205)	(−3.180)	(−0.502)	(1.499)	(1.870)
Profitability	0.002	0.113	−0.001	−0.218***	0.011	0.138**	−0.032
	(0.387)	(1.257)	(−0.010)	(−2.600)	(0.278)	(2.257)	(−0.998)
R&D expense	−0.000	−0.008	0.035**	0.042*	0.002	0.007	−0.073***
	(−0.503)	(−0.366)	(2.291)	(1.906)	(0.239)	(0.376)	(−3.393)
SGA cost	0.002	0.025	−0.031**	−0.004	0.002	0.005	−0.000
	(1.358)	(1.269)	(−2.506)	(−0.310)	(0.350)	(0.791)	(−0.067)
Dividend	0.001	−0.001	−0.006	0.003	0.010	−0.008	−0.015
	(1.033)	(−0.061)	(−0.280)	(0.176)	(1.205)	(−0.630)	(−1.301)
Sales/assets	−0.004	−0.020	−0.001	0.021	−0.014	0.001	0.015
	(−1.510)	(−0.535)	(−0.036)	(0.589)	(−1.127)	(0.088)	(1.212)
Intercept	0.011*	0.325***	0.157	−0.057	0.057	0.100	0.007
	(1.669)	(3.393)	(1.469)	(−0.517)	(1.257)	(1.573)	(0.165)
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3,205	3,205	3,205	3,205	3,205	3,205	3,205
Adjusted R^2	0.006	0.162	0.216	0.333	0.369	0.177	0.101

Notes: This table describes the regressions of seven specific debt ratios on ESG combined score and other firm controls. For each regression, we control for firm and year fixed effects. Numbers in parentheses are robust t-statistic. N denotes the number of firm-year observations. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

5.2. Two-stage least squares estimation

To further alleviate the endogeneity concerns, we perform a two-stage least squares (2SLS) estimation. In the first-stage estimation, we use the past industry's average ESG combined score. In the second-stage estimation, we apply again Eq. (4) but this time we replace the ESG rating variable with the predicted value of the ESG rating from the first-stage estimation and the other control variables. This way, the estimated coefficient is consistent because the predicted value from the first-stage estimation is not correlated with the error term of the second-stage estimation.

Our instrumental variable, the lagged industry-level average ESG score, is expected to affect current firm-level ESG score. Firms observe the trends of their peers within the same industry and they will more likely tend to have similar ESG considerations and approaches. In addition, the lagged industry level average ESG score is less likely to be correlated with a firm's unobservable characteristics that are also related to its leverage ratio. In addition, firm's debt structure is unlikely to affect past industry-level average ESG ratings.

Table 10 provides the results. The first-stage regressions show that the variables used to predict the firm ESG combined score perform well for both of the key debt ratios, bank loans and bonds debt.[9] We also show that the overidentification test confirms the validity of our instrumental variable. The second-stage results confirm that our key predictions regarding the debt restructuring towards more internal sources of financing remain valid. In economic terms, we find that a one standard deviation increase in the

[9] Please note that we only assess the validity of the redistribution outcome here with the use of bank loans and bonds issuing.

Table 9
Regression of debt structure on initial ESGC scores.

	(1) ML_t	(2) BL_t	(3) Bank_t	(4) Bond_t
Initial ESGC score	−0.009	−0.005	0.060***	−0.035*
	(−1.510)	(−0.608)	(2.778)	(−1.760)
Market leverage(t−1)	0.446***			
	(14.565)			
Book leverage(t−1)		0.495***		
		(14.381)		
Bank debt(t−1)			0.428***	
			(15.514)	
Bond debt(t−1)				0.468***
				(17.722)
Ln(asset)	0.056***	0.025	−0.035	0.054*
	(4.089)	(1.281)	(−0.913)	(1.855)
Market-to-Book ratio	−0.000	−0.000	0.001	−0.000
	(−0.547)	(−0.541)	(1.266)	(−0.298)
Ln(sale)	−0.016	0.005	−0.003	−0.001
	(−1.206)	(0.253)	(−0.088)	(−0.030)
Tangibility	0.107	0.063	0.085	−0.293
	(2.624)	(1.282)	(0.788)	(−3.214)
Profitability	−0.176***	−0.201***	0.102	−0.206**
	(−4.386)	(−3.820)	(1.106)	(−2.538)
R&D expense	−0.005	−0.001	0.024	0.044*
	(−0.574)	(−0.095)	(1.172)	(1.901)
SGA cost	−0.009*	−0.004	−0.005	−0.002
	(−1.650)	(−0.381)	(−0.280)	(−0.147)
Dividend	−0.001	0.010	−0.007	0.016
	(−0.103)	(1.172)	(−0.333)	(0.876)
Sales/assets	−0.004	−0.021	−0.023	0.008
	(−0.289)	(−1.233)	(−0.614)	(0.245)
Intercept	−0.168***	−0.040	0.437***	0.031
	(−4.281)	(−0.901)	(4.171)	(0.301)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	3,203	3,205	3,205	3,205
Adjusted R^2	0.361	0.343	0.226	0.302

Notes: This table examines the turnover effect of firms initial ESG ratings on debt structure. Numbers in parentheses are robust t-statistic. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

Table 10
Relationship examination for ESG and debt ratios with 2SLS-IV approach.

	Bank debt		Bond debt	
	First stage	Second stage	First stage	Second stage
Lag_Ind_Ave_Ln(ESGC)	0.646***		0.645***	
	(12.865)		(12.879)	
$Ln(\widehat{ESGC})$		0.055***		−0.031*
		(3.114)		(−1.937)
Controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	7,071	7,071	7,071	7,071
F-statistic on instrument	165.503		165.878	

Notes: This table uses the Two-Stage Least Squares (2SLS) estimation with the lag of industrial average natural logarithm of ESG rating as an instrumental variable at the first-stage. Data come from merged CRSP-Compustat, Capital IQ, and Refinitiv databases between 2002 and 2019. The full sample is used. Numbers in parentheses are robust t-statistics. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

natural logarithm of the ESG with controversies score will lead to an increase of about 15.9% in bank loans and a decrease of about 12.9% in bond issuing.

5.3. GMM estimation

In our benchmark estimations we include firm fixed effects as a way to control any omitted time-invariant firm characteristics that could lead to biased and inconsistent estimators, alleviating partially the endogeneity concerns. However, given that we do include the lagged dependent variable as an estimator, the consistency of the fixed effect estimator parameters depends on having a large number of periods.

Table 11
Relationship examination for ESG and debt ratios with GMM-IV approach.

	Bank debt	Bond debt
Ln(ESGC)	0.054**	−0.038*
	(2.073)	(−1.739)
Bank debt(t−1)	0.511***	
	(8.438)	
Bond debt(t−1)		0.529***
		(8.097)
Intercept	0.443	0.156
	(0.238)	(0.114)
Firm controls	Yes	Yes
Fixed effects	Yes	Yes
Number of observations	7399	7399
m_2	0.772	0.285
J-test (p-value)	0.210	0.722
LM-test (p-value)	0.000	0.000
Cragg–Donald (p-value)	0.000	0.000
Kleibergen–Paap (p-value)	0.000	0.000

Notes: This table uses the Generalized Method of Movements approach. Lagged control variables are treated as instrumental variables with standard fixed effects. Data from merged CRSP-Compustat, Capital IQ, and Refinitiv databases between 2002 and 2019 are used under full sample. Numbers in parentheses are robust t-statistics. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

In addition, even though the 2SLS approach, performed in the previous subsection, alleviates the endogeneity concerns, the validity of the results depends on the exclusion criterion of the instrument. To make sure we alleviate that concern, we perform a Generalized Method of Moments (GMM) estimation, as suggested by Arellano and Bover (1995), using as instrumental variables past values of all our independent variables. It has been shown by Bazzi and Clemens (2013) that historical values of the independent variables is the best way to control for endogeneity.[10]

Our results, as shown in Table 11, indicate that our key conclusions, regarding the debt redistribution effects of ESG ratings, remain valid. In economic terms, we find that, when controlling for endogeneity, a one standard deviation increase in the natural logarithm of the ESG with controversies score will lead to an increase of about 15.6% in bank loans and a decrease of about 15.9% in bond issuing. This effect is almost four times higher in terms of bank borrowing and two times higher in terms of bond issuing, when compared with our benchmark estimations.

6. Robustness checks

In this section, we perform various additional tests to assess the validity of our key results.

6.1. A different ESG indicator

So far in our analysis we have used the combined ESG score as a CSR/ESG indicator. In Table 12 we replace this ESG indicator with the simple ESG score (excluding controversies).[11] The results show that our key outcomes remain consistent with our benchmark model. In particular, we still find that there is no effect on current book and market leverage ratios when firms become ESG rated and we are still observing the redistribution of financing from public to more private sources, i.e. bond debt to bank loans.

6.2. Assess the role of ESG individual components

In this subsection, we assess the role of the individual components of ESG on debt structure. Using again the matched sample we repeat our benchmark estimation of the partially adjusted model by replacing the overall ESG combined ratings with the individual ratings from the Environment (E), Social (S) and Governance (G) pillars separately.

Table 13 provides the results from bank loans in columns 1, 3 and 5, and bonds debt in columns 2, 4 and 6 for the E, S and G pillars respectively. We find that issuing bonds is consistently and significantly reduced under each pillar. Similarly, the bank borrowing channel is re-enforced under every pillar (positive sign), but it is not statistically significant under the Governance pillar.

[10] Also, given that the coefficient of the lagged dependent variable(s) in our benchmark estimations is significantly lower than 0.9, there are no weak instrument validity issues in our GMM with IVs estimation. However, we report the m2 test for lack of second-order serial correlation in the residuals, and the J-test specification test in Table 11. In addition, we follow Bazzi and Clemens (2013) and we further test for underidentification and weak instruments via Lagrange-Multiplier (LM) test using the rank-based *rk* statistic of Kleibergen and Paap (2006), and via Cragg and Donald (1993) and Kleibergen and Paap (2006) tests for weak-instruments validity. Overall, our empirical results show that instrumentation is very strong, as indicated by the tests for underidentification and weak instruments.

[11] We are still using the matching sample at this empirical analysis.

Table 12
The regression of leverage, bank and bond debt ratios on ESG.

	(1) ML_t	(2) BL_t	(3) Bank_t	(4) Bond_t
Ln(ESG)	−0.003	−0.003	0.013*	−0.016***
	(−1.348)	(−0.946)	(1.939)	(−2.822)
Market leverage(t−1)	0.444***			
	(14.616)			
Book leverage(t−1)		0.494***		
		(14.557)		
Bank debt(t−1)			0.427***	
			(15.408)	
Bond debt(t−1)				0.464***
				(17.448)
Intercept	−0.173***	−0.046	0.461***	−0.000
	(−4.376)	(−1.006)	(4.273)	(−0.002)
Firm controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	3,203	3,205	3,205	3,205
Adjusted R^2	0.361	0.344	0.225	0.304

Notes: This table describes the regressions of the market and book leverage ratios, and bank-bonds debt ratios on ESG scores. The matched sample for the period 2002–2019 is used. Dependent variables are market leverage, book leverage, bank debt, and bonds debt for our four columns respectively. For each regression, we also control firm and year fixed effects. Numbers in parentheses are robust t-statistics. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

Table 13
The regression of bank and bond debt ratios on E-S-G pillar score.

	Environment		Social		Governance	
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(EP)	0.012*	−0.020***				
	(1.907)	(−3.374)				
Ln(SP)			0.014**	−0.016***		
			(2.006)	(−2.867)		
Ln(GP)					0.009	−0.012**
					(1.477)	(−2.245)
Bank debt(t−1)	0.428***		0.427***		0.428***	
	(15.536)		(15.411)		(15.406)	
Bond debt(t−1)		0.465***		0.465***		0.466***
		(17.632)		(17.479)		(17.466)
Intercept	0.448***	0.008	0.461***	0.001	0.453***	0.007
	(4.187)	(0.083)	(4.288)	(0.012)	(4.195)	(0.071)
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	3,205	3,205	3,205	3,205	3,205	3,205
Adjusted R^2	0.225	0.305	0.225	0.304	0.224	0.303

Notes: This table describes the regressions of bank/bonds debt ratios on E-S-G pillar scores under the matched sample. Numbers in parentheses are robust t-statistic. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

6.3. Firm heterogeneity

Firms' characteristics also play a role in the relationship between ESG ratings and debt structure. Hence, we test if the redistribution effect is more pronounced for a certain type of ESG rated firms, where the firm characteristics are financial pressure, the Market-to-Book ratio, firms' alternative uses of assets, and firm size.

Firstly, financial pressure, which is proxied by cash flow over interest payments. We divide ESG rated firms into a low and high financial pressure groups. If the ratio of cash flow to interest payments is below the median, then this firm is classified into low financial pressure group. For simplicity, we only report key coefficients and t-statistics in Table 14 even though we do control for other factors as well as firm and year fixed effects, as in our benchmark estimations. The results in Panel A suggest that ESG-rated firms with high financial pressure engage mainly in redistributing their borrowing from external to internal sources, i.e. from bonds to bank debt. The reason for this behaviour is that low financial pressure firms have adequate funding and they do not require altering their financing sources. However, high financial pressure firms are in need of raising more funding. The use of ESG ratings helps them take advantage of the lower information asymmetry and borrow from banks instead of issuing bonds.

Secondly, we use the Market-to-Book ratio to proxy for firms' growth opportunities. Growth opportunities indicate the potential future ability to earn money. Results in Table 14 Panel B suggest that only firms with low growth opportunities substitute bonds for bank loans. This result is in line with Myers (1977) model suggesting that high growth firms limit their use of debt to avoid the underinvestment issues that might arise from high leverage position.

Table 14
The effect of firm characteristics.

Firm characteristics	Bank debt	Bond debt
Panel A: Financial pressure		
Low	−0.000	−0.006
	(−0.054)	(−0.826)
High	0.022**	−0.020**
	(2.320)	(−2.346)
Panel B: Growth opportunities		
Low	0.020**	−0.024***
	(1.979)	(−2.747)
High	0.007	−0.012
	(0.709)	(−1.387)
Panel C: Alternative uses of assets		
Low	0.016*	−0.015**
	(1.885)	(−2.029)
High	0.010	−0.019**
	(0.929)	(−1.996)
Panel D: Firm size		
Small	−0.018	0.011
	(−0.710)	(0.554)
Large	0.017**	−0.020***
	(2.392)	(−3.334)
Control variables	Yes	Yes
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes

Notes: This table examines the effects of firm characteristics on the relationship between ESG ratings and debt structure. Financial pressure is proxied by cash flow over interest payment; growth opportunities is proxied by the Market-to-Book ratio; Alternative uses of assets are proxied by research expenses over the number of employees. Firm size is proxied by the book value of assets. Also, firms are divided into low (small) and high (large) characteristics groups around the median. This table only reports coefficients and robust t statistics, but we control for other factors and firm and year fixed effects. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

Table 15
T-test of optimal leverage ratio using lagged controls.

	Before rated	After rated	T-test
Market leverage	0.173	0.125	5.822***
Book leverage	0.274	0.235	7.739***

Notes: This table reports t-statistics of firms' target market and book leverage ratios before and after becoming ESG rated. The optimal leverage ratio is the predicted value (residuals) of regressing leverage ratios on last period's firm characteristics.

Thirdly, we use firms' alternative uses of assets, which are proxied by R&D intensity. On the one hand, specific assets need more R&D expenses to innovate. On the other hand, because of their limited functions, these assets are not used as collateral to borrow from banks. Therefore, firms with fewer alternative uses of assets are in need to increase their borrowing. Table 14 Panel C verifies this intuition showing that firms with relatively lower alternative uses of assets tend to engage more to debt restructuring towards more internal sources of financing when they become ESG rated.

Finally, we show that larger firms are the ones that are able to fully exploit the acquired ESG rating and redistribute their debt from bond issuing to bank loans in Table 14 Panel D.

Overall, we find that our key debt redistribution outcome is more pronounced for ESG rated firms with high financial pressure, low growth opportunities, assets with limited alternative uses and larger firms.

6.4. Re-define the optimal leverage ratio equation

Some related studies have implemented the partial adjustment model using firm's controls lagged by one period instead of being contemporaneous. In our benchmark estimation we only incorporated contemporaneous firm characteristics to measure firms' target and current leverage ratios. At this robustness check we use one period lagged firm characteristics to assess if our key results regarding the target leverage ratio and debt structure for ESG rated firms are affected.

Therefore, in this case we estimate target (optimal) leverage ratio using Eq. (5):

$$d_{i,t}^{*} = \alpha + B'\mathbf{X}_{i,t-1} + \eta_i \tag{5}$$

Table 15 shows that even if we use past values of firm characteristics, firms' target (optimal) market and book leverage ratios still decrease after the firms become ESG rated and this result is statistically significant.

Following up from the above, the partial adjustment model becomes Eq. (6):

$$d_{i,t} = \beta_0 + \beta_1 d_{i,t-1} + B_2'\mathbf{X}_{i,t-1} + \gamma_t + \theta_i + \nu_{i,t} \tag{6}$$

Table 16
The regression of leverage and debt structure using lagged controls.

	(1) ML_t	(2) BL_t	(3) Bank_t	(4) Bond_t
Ln(ESGC)	−0.002	−0.002	0.015**	−0.014**
	(−0.725)	(−0.587)	(2.256)	(−2.538)
Market leverage(t−1)	0.450***			
	(14.845)			
Book leverage(t−1)		0.488***		
		(14.268)		
Bank debt(t−1)			0.433***	
			(15.598)	
Bond debt(t−1)				0.475***
				(17.881)
Ln(asset)(t−1)	0.033***	0.021**	−0.054**	0.069***
	(3.707)	(2.236)	(−2.232)	(3.401)
Market-to-Book ratio(t−1)	−0.000***	−0.000**	−0.000**	0.000
	(−3.947)	(−2.373)	(−2.110)	(1.104)
Ln(sale)(t−1)	−0.004	−0.000	−0.001	−0.004
	(−0.498)	(−0.030)	(−0.052)	(−0.209)
Tangibility(t−1)	0.056	0.060	0.090	−0.131*
	(1.246)	(1.360)	(0.969)	(−1.679)
Profitability(t−1)	−0.009	−0.032	−0.020	−0.001
	(−0.504)	(−1.091)	(−0.703)	(−0.039)
R&D expense(t−1)	0.014**	0.089***	−0.066*	0.080**
	(2.011)	(5.203)	(−1.691)	(2.433)
SGA cost(t−1)	0.000	0.000	0.000	−0.000
	(0.197)	(0.284)	(0.102)	(−0.191)
Dividend(t−1)	0.001	0.001	0.015	−0.005
	(0.189)	(0.182)	(0.839)	(−0.351)
Sale/assets(t−1)	0.000	−0.001	−0.021	0.043
	(0.043)	(−0.136)	(−0.622)	(1.562)
Intercept	−0.109***	−0.027	0.524***	−0.126
	(−3.265)	(−0.746)	(5.191)	(−1.482)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	3,187	3,189	3,189	3,189
Adjusted R^2	0.315	0.326	0.236	0.306

Notes: This table describes the regressions of the market and book leverage ratios, and bank and bonds debt on ESG combined score and firm controls under the matched sample. In this case the independent variables. apart from ln(ESGC), are lagged by one period. Numbers in parentheses are robust t-statistic. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

In this case, all independent variables, excluding the ESG combined score, are lagged by one period. The results in Table 16 show that the ESG rating has a negative effect on firms' market and book leverage ratios but this is not statistically significant (columns 1 and 2), similar to our benchmark estimations. Assessing the redistribution effect from issuing bonds to bank loans, we still find that this remains valid, statistically significant and of the same economic magnitude as in our benchmark estimations.

6.5. High vs. Low ESG score

In our analysis so far we only relied on whether firms had an ESG rating or not. This means that we did not pay attention to the level of that ESG score and its corresponding effect on debt structure. In this subsection, we split our firms to those that received an ESG rating above the median of our sample within a given year (High ESG rated firms) and to those that received an ESG score below the median value (Low ESG rated firms). After introducing a dummy variable that captures the quality of the ESG score, we add interaction terms of ESG rating with these dummy variables and we repeat our benchmark estimations.

Table 17 shows that the firms that obtain an ESG score above the median are in a better position to raise funds from banks. Even though the low ESG rated firms still increase their bank loans position, that increase does not appear to be statistically significant. Furthermore, we find that the level of ESG rating is irrelevant in the decrease of bonds debt since both high and low ESG rated firms significantly reduce that source of financing.[12] These results support the fact that ESG rating acts as a way of conveying information to the public and thus reduce the asymmetric information issues leading to better access to internal sources of financing.[13]

6.6. Full sample analysis

Our empirical analysis has been focusing mainly on our matched sample to avoid any conclusions being reached due to the heavily unbalanced panel of ESG and non-ESG rated firms. In this robustness check we revert back to our full sample and we assess if we are still able to uncover the redistribution effect, from bonds debt to bank loans, for ESG rated firms.

[12] Comparing the ESG score of the firms with their industry average, we find that our benchmark results remain valid irrespective of the level of their ESG score.

[13] We have also performed a similar analysis for the effect of the level of ESG rating on target (optimal) market and book leverage ratios. Our findings are in line with our benchmark estimations and similar to the results provided in this subsection, showing that highly rated firms reduce more their target market and book leverage ratios compared to low ESG rated firms.

Table 17
The role of high and low ESG score on debt and bank debt.

	Bank debt	Bond debt
$Ln(ESGC)^{HIGH}$	0.015**	−0.017***
	(2.170)	(−2.676)
$Ln(ESGC)^{LOW}$	0.011	−0.015**
	(1.368)	(−2.337)
Bank debt(t−1)	0.427***	
	(15.419)	
Bond debt(t−1)		0.465***
		(17.439)
Controls	Yes	Yes
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
N	3,205	3,205
Adjusted R^2	0.225	0.304

Notes: This table assessed the role of high vs. low ESG score on debt structure. Data come from merged CRSP-Compustat, Capital IQ, and Refinitiv databases between 2002 and 2019. The full samples is used. Numbers in parentheses are robust t-statistics. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

The results provided in Table A.1 show once again that our key redistribution outcome remains valid even under the full sample and the relatively small share of ESG rated firms.

7. Conclusions

In this paper, we focus on the impact of ESG rating on firm leverage ratios and debt components using a comprehensive dataset from various sources, such as CRSP-Compustat, Capital IQ and Refinitiv, for U.S. firms for the period 2002–2019.

We initially test how ESG ratings influence firms' target market and book leverage ratios. We find that when firms become ESG rated they tend to reduce their target (optimal) market and book leverage ratios. We also find that this result is more pronounced for firms that received an above average ESG rating. We further show that the ESG rating act as a signalling mechanism to reduce information asymmetry.

Next we assess if obtaining an ESG rating can lead to a lower current leverage ratio and debt restructuring. We find that, on average, ESG rated firms do not significantly alter their current market and book leverage ratios. However, delving deeper into the corporate debt structure, we find that ESG rated firms redistribute their funding towards more internal sources (according to pecking order theory), from bonds debt to bank loans. Specifically, a one standard deviation increase in Ln (ESGC) leads to an increase of about 3.8% in bank loans and a decrease of about 6.7% in bond issuing. This result is more pronounced for firms with high financial pressure, low growth opportunities, and fewer alternative uses of assets. Furthermore, we find that Environmental and Social pillars are the ones that drive this result. These results appear to hold under various robustness and endogeneity checks.

Overall, these results support the fact that an ESG rating conveys information to the public leading to lower information asymmetry between the lender and the owner. It also appears that the higher is the obtained ESG rating the better would be the access to "safer" sources of financing. Finally, these results support the trade-off and pecking order theories of capital structure.

Our analysis shows that the acquisition of an ESG rating plays an important role in the corporate capital structure, providing not only the option of debt re-structuring but also serves as a vehicle of minimizing asymmetric information offering a direct and easy way for investors to assess corporate sustainability and compliance with relevant regulations. Therefore, the ESG rating enables companies to convey a transparent and visible signal of their non-financial information to the capital markets, which can help investors make more informed decisions. ESG conscious investors are increasingly incorporating environmental, social and governance, i.e. non-financial factors, into their processes to identify material risks and growth opportunities. As a result, the need for informed ESG ratings along with a dynamic ESG regulatory framework, keeping up with the growing demand and changing challenges, is essential as such ratings reduce the asymmetric information between managers and investors, provide a more transparent view of the company's ESG responsibility, reveal the future prospects of the company in favour of ESG compliance and affect borrowing constraints.

Additional implications exist for stakeholders and policymakers. In terms of the stakeholders, the decrease in information asymmetry, due to being rated, might urge firms to engage in more socially responsible activities, such as improving employees' working environment and reducing pollution. The intuition is that firms gain more attention towards their ESG engagement after they become rated, leading to improved transparency and higher scrutiny towards their sustainability reputation, which affects their social image. In terms of the policymakers, the benefits of debt redistribution for ESG rated firms provide attractive evidence for policymakers to incentivize corporations to disclose more ESG-related information.

This study can be extended to several aspects for future work. First, while we investigate the disaggregated environmental, social, and governance pillar scores (E-S-G) on the redistribution effects, it would be interesting to delve deeper and discover which specific elements within these three pillars might drive the results or might matter the most when materiality is taken into account. Second,

future research could study whether the findings persist over time in the face of shifting social and economic conditions, or even during high uncertainty periods. Finally, it would be worthwhile to expand the empirical application of this study towards different countries with different institutional setups.

Declaration of competing interest

None.

Data availability

The authors do not have permission to share data.

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Appendix

See Tables A.1–A.3.

Table A.1
The regression of leverage and bank (bond) debt ratios on ESGC (unmatched).

	(1) ML_t	(2) BL_t	(3) Bank_t	(4) Bond_t
Ln(ESGC)	−0.006***	−0.004	0.010*	−0.012**
	(−2.878)	(−1.299)	(1.666)	(−2.248)
Market leverage(t−1)	0.371***			
	(16.667)			
Book leverage(t−1)		0.396***		
		(16.412)		
Bank debt(t−1)			0.370***	
			(20.907)	
Bond debt(t−1)				0.385***
				(20.687)
Ln(sale)	0.044***	0.019*	−0.053***	0.056***
	(6.168)	(1.955)	(−2.906)	(3.329)
Market-to-Book ratio	−0.000	−0.000	0.000	0.000
	(−0.651)	(−0.144)	(0.292)	(0.243)
Ln(sale)	−0.006	0.003	0.026	−0.018
	(−0.902)	(0.305)	(1.593)	(−1.142)
Tangibility	0.133***	0.101***	−0.006	−0.074
	(4.657)	(3.000)	(−0.096)	(−1.309)
Profitability	−0.050***	−0.054**	0.058**	−0.087***
	(−4.896)	(−2.467)	(2.055)	(−2.721)
R&D expense	0.000	−0.000	−0.012	0.027*
	(0.179)	(−0.009)	(−1.218)	(1.685)
SGA cost	−0.004	0.004	0.011	−0.012
	(−1.604)	(1.123)	(1.549)	(−1.579)
Dividend	−0.013	−0.002	−0.008	0.006
	(−1.621)	(−0.178)	(−0.506)	(0.526)
Sales/assets	−0.008	−0.020*	−0.027	0.016
	(−1.048)	(−1.886)	(−1.567)	(0.942)
Intercept	−0.152***	−0.008	0.479***	0.015
	(−6.011)	(−0.249)	(6.766)	(0.240)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	7,389	7,399	7,399	7,399
Adjusted R^2	0.256	0.207	0.160	0.195

Notes: This table describes the regressions of the market (book) leverage and bank (bonds) debt on ESG combined score for full samples. The dependent variables are market leverage, book leverage, bank debt ratio and bond debt ratio. The main independent variable is the natural logarithm of the ESG combined score. Other independent variables are the lag of dependent variables and firm characteristics. For each regression, we also control firm and year fixed effects. Numbers in parentheses are robust t-statistic. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

Table A.2
The regression of leverage and bank (bond) debt ratios on ESGC (matching all controls).

	(1) ML_t	(2) BL_t	(3) Bank_t	(4) Bond_t
Ln(ESGC)	−0.003	−0.002	0.014**	−0.015**
	(−1.158)	(−0.783)	(2.150)	(−2.522)
Market leverage(t−1)	0.448***			
	(14.514)			
Book leverage(t−1)		0.488***		
		(15.912)		
Bank debt(t−1)			0.441***	
			(15.387)	
Bond debt(t−1)				0.485***
				(18.511)
Ln(asset)	0.056***	0.021	−0.021	0.051
	(2.943)	(0.898)	(−0.534)	(1.540)
Market-to-Book ratio	−0.001**	0.001	0.002	−0.000
	(−2.415)	(0.664)	(1.509)	(−0.004)
Ln(sale)	−0.018	0.009	−0.025	0.013
	(−0.943)	(0.375)	(−0.610)	(0.366)
Tangibility	0.115***	0.061	0.033	−0.215**
	(2.603)	(1.217)	(0.286)	(−2.350)
Profitability	−0.207***	−0.135***	0.235**	−0.336***
	(−4.611)	(−2.954)	(2.220)	(−3.503)
R&D expense	−0.035	−0.003	0.066	−0.073
	(−0.616)	(−0.030)	(0.242)	(−0.286)
SGA cost	−0.028	−0.040	−0.014	−0.013
	(−0.789)	(−0.896)	(−0.262)	(−0.299)
Dividend	−0.005	−0.000	−0.001	0.013
	(−0.679)	(−0.027)	(−0.062)	(0.764)
Sales/assets	0.001	−0.029	0.022	−0.008
	(0.061)	(−1.342)	(0.588)	(−0.201)
Intercept	−0.162***	−0.035	0.424***	−0.028
	(−3.555)	(−0.671)	(3.671)	(−0.236)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	3,040	3,042	3,042	3,042
Adjusted R^2	0.367	0.336	0.246	0.331

Notes: This table describes the regressions of the market and book leverage ratios, and bank and bonds debt ratios on ESG combined score and various controls under matched samples where all the controls are matched in the PSM approach. Data from merged CRSP-Compustat, Capital IQ, and Refibitiv databases between 2002 and 2019 are used. The dependent variables are market leverage, book leverage, bank debt and bonds debt in columns (1) to (4) respectively. For each regression, we also control firm and year fixed effects. Numbers in parentheses are robust t-statistics. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

Table A.3
The regression of leverage and bank (bond) debt ratios on ESGC using entropy matching.

	(1) ML_t	(2) BL_t	(3) Bank_t	(4) Bond_t
Ln(ESGC)	−0.005***	−0.003	0.011**	−0.012**
	(−3.057)	(−1.306)	(1.996)	(−2.520)
Market leverage(t−1)	0.407***			
	(15.256)			
Book leverage(t−1)		0.484***		
		(18.814)		
Bank debt(t−1)			0.438***	
			(17.719)	
Bond debt(t−1)				0.476***
				(18.802)
Ln(asset)	0.054***	0.018	−0.046*	0.061**
	(5.305)	(1.350)	(−1.790)	(2.417)
Market-to-Book ratio	−0.000	0.000	0.000	0.000
	(−0.426)	(0.045)	(1.195)	(0.801)
Ln(sale)	−0.013	0.012	0.016	−0.010
	(−1.286)	(0.971)	(0.613)	(−0.402)
Tangibility	0.113***	0.073**	−0.051	−0.114
	(3.737)	(2.162)	(−0.644)	(−1.577)
Profitability	−0.125***	−0.146***	0.085	−0.175***
	(−3.856)	(−3.722)	(1.481)	(−3.383)
R&D expense	0.006	0.014	−0.000	0.064***
	(0.605)	(0.709)	(−0.008)	(2.701)
SGA cost	−0.010**	0.002	0.008	−0.010
	(−2.034)	(0.344)	(0.447)	(−0.577)
Dividend	−0.008	0.007	0.005	0.000
	(−1.364)	(1.083)	(0.308)	(0.015)
Sales/assets	−0.007	−0.024*	0.001	−0.006
	(−0.738)	(−1.951)	(0.025)	(−0.231)
Intercept	−0.194***	−0.050	0.491***	−0.085
	(−5.412)	(−1.106)	(4.849)	(−0.921)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Number of observations	7,063	7,071	7,071	7,071
Adjusted R^2	0.784	0.803	0.689	0.737

Notes: This table describes the regressions of the market and book leverage ratios, and bank and bonds debt ratios on ESG combined score and various controls under an entropy matching approach. Data from merged CRSP-Compustat, Capital IQ, and Refibitiv databases between 2002 and 2019 are used. The dependent variables are market leverage, book leverage, bank debt and bonds debt in columns (1) to (4) respectively. For each regression, we also control firm and year fixed effects. Numbers in parentheses are robust t-statistics. 1%, 5% and 10% significance levels are denoted by ***, ** and * respectively.

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