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ESG, Bank Debt and Firm Value: A Signaling Perspective

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ABSTRACT

This paper delves into the influence of bank debt in shaping the relationship between environmental, social, and governance (ESG) performance and a firm's value. As a result of the superior informational and monitoring functions of bank borrowers in their lending relationships, we argue that a firm's degree of bank debt might signal the genuineness of its ESG performance. We empirically test this signaling role on a sample of U.S. publicly traded companies over 2010–2018. Our results provide evidence that bank debt improves the value effect of ESG performance. We find that the signaling effect of bank debt is stronger in companies with lower tangible collateral, where the need for banks to screen and monitor them is higher. Our findings are robust to controlling for contextual factors that may affect the signaling relevance of bank debt, such as the visibility and informational asymmetries as provided by analysts' activity, or the difference between green and brown industries, as well as a series of alternative econometric specifications, including alternative ESG performance measures, endogeneity tests, and propensity score matching.

1 | Introduction

Environmental, social, and governance (ESG) measurement suffers from limitations that spark concerns about its reliability (Slager and Gond 2022) and call for complementary signals that reflect the sincerity of ESG efforts. Recent research puts forward the potential of bank debt as a signaling mechanism for the quality of ESG actions (Fuente and Velasco 2022). In their effort to achieve harmonious alignment with the United Nations Sustainable Development Goals (SDGs), banks nowadays are more concerned than ever about their borrowers' ESG practices. For example, international banking authorities such as the European Banking Authority (EBA) have released guidelines to encourage that even greater attention should be paid to ESG issues when assessing creditworthiness. Our study delves into the informational role of bank debt in signaling the genuineness of ESG performance in a context of adverse selection and moral hazard problems.

The ESG triple bottom line is regarded as a *sine qua non* condition for firms to build a durable competitive advantage and attain long-term success. Hartzmark and Sussman (2019) provide evidence that mutual fund demand depends on ESG ratings, thereby suggesting that investors positively value corporate engagement in ESG initiatives. The importance of ESG performance contrasts with the lack of any conclusive empirical evidence on the relationship between this strategy and market value. The same paper by Hartzmark and Sussman (2019) finds no evidence to suggest that high-ESG performers beat low-ESG ones. Therefore, although investors seem to show a preference for sustainable funds, this is not reflected in subsequent superior performance and higher market prices. One reasonable explanation is that investors are willing to forego superior financial performance in exchange for nonpecuniary 'prosocial' outcomes (Hart and Zingales 2017). In this situation, self-interested managers in poor-performing companies might

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have an incentive to increase (unproductive) ESG investments to disguise their inefficient decisions.

The primary motivations leading managers to engage in ESG strategy have come under scrutiny. Krüger (2015) reports that positive events associated with sustainable initiatives cause a weak yet negative reaction in stock markets. Cheng et al. (2019) find that an increase in managerial ownership and monitoring reduces corporate goodness. Relatedly, one stream of literature raises concerns about the opportunistic use of ESG practices aimed at enhancing a firm's visibility and reputation in the markets (Benlemlih 2017; Buchanan et al. 2018; Luo et al. 2018). The particular nature of ESG investments exacerbates managers' potential self-seeking behavior (e.g., greenwashing) to boost their professional prospects (Wang et al. 2008). This threat of managerial rent-seeking poses an additional challenge as regards distinguishing companies' genuine engagement in ESG from merely symbolic and window-dressing ones (Fuente and Velasco 2024; Su et al. 2016). Cuypers et al. (2016) empirically confirm that stakeholder perception of this strategy as being more substantial than symbolic enhances its positive effect on a firm's market value.

Given the potential skepticism concerning firms' motivations for embarking on ESG performance, being able to convey credible signals to stakeholders regarding the genuineness of such a policy becomes the cornerstone to prompting its legitimacy (Cuypers et al. 2016; Fuente and Velasco 2022; Godfrey et al. 2009). Mechanisms signaling the standard of ESG play a crucial certification role in this strategy (Awaysheh et al. 2020). In recent years, firms' lenders have been attaching considerable importance to the nonfinancial aspects of their potential borrower firms—such as their ESG performance—when granting credit and determining the cost of financing (Jiang et al. 2023; Lian et al. 2023; Luo et al. 2023). A firm's creditors are therefore likely to serve as a third-party endorsement of its ESG performance. However, the latest research has noted that not all types of lenders are equally effective at monitoring firms' ESG practices and shaping their ESG performance after lending to them. Newton et al. (2022) find that banks are more effective at such tasks than public bond markets. Accordingly, this earlier evidence motivates our study and encourages us to delve into whether the relevance of bank debt in a firm might serve as an informative signal about how good a firm's ESG performance is as a result of bank screening.

Given the unique nature of bank debt financing as well as its ability to gather superior information from close and long-term relationships with borrowers (Boot 2000; Fama 1985; James 1987), bank creditors are more likely to appraise the (forward-looking) value of companies' nonfinancial aspects, such as their socially responsible practices (Brogi et al. 2022). Should bank debt serve as a reliable signaling mechanism of legitimate ESG performance, such a signaling role would be expected to become more relevant in the presence of less valuable tangible collateral. This is because bank creditors are more likely to take greater account of the insurance benefits and long-term value of ESG performance when their borrowers' assets are more firm-specific (less re-deployable) and less collateralizable.

Our hypotheses are tested empirically on a sample of U.S. publicly traded companies over 2010–2018. Panel data models with firm fixed effects to address potential misspecification problems (Servaes and Tamayo 2013) show that bank debt leverage improves the influence on the relationship between ESG performance and firm value, thereby giving rise to a significant ESG premium in companies with greater levels of bank debt. In contrast, the interaction effect of non-bank debt and ESG performance on firm value displays no statistical significance. Such differences would support the notion of bank debt's distinctive ability as a third-party endorsement of the standard of a firm's ESG strategy. Our result echoes recent evidence confirming that bank lending is more sensitive to company exposure to ESG risks (e.g., Newton et al. 2022). We thus demonstrate that the relevance of a firm's bank debt in its capital structure is a signaling device that serves as a proxy of the quality of its ESG performance and, accordingly, leads to a more positive impact of this strategy on a firm's value. More importantly, such a signaling role of bank debt is weaker in companies with higher tangible collateral, where the need for screening and monitoring is lower. Additionally, complementary robustness analyses reveal several reasonable contexts that can strengthen the degree of informational content of bank debt signaling, such as greater firm visibility in capital markets (i.e., analyst coverage) and higher informational asymmetries (i.e., analyst forecast errors). In contrast, the bank debt signal no longer operates in firms belonging to sectors that are penalized by market participants owing to their poor environmental practices (i.e., brown sectors).

To our knowledge, only Fuente and Velasco (2022) consider bank debt a signal of ESG genuineness, although they focus on signal incongruence as the interplay between the favorable signal conveyed by bank debt and other signals that undermine ESG credibility. This paper differs from that previous study in terms of scope and depth –both theoretically and empirically. Fuente and Velasco (2022) adopt a signal set approach and focus on the importance of harmonizing simultaneous signals, and how incongruence can be penalized by financial markets. In contrast, this current paper employs a single-signal approach and elaborates on the theoretical arguments that explain the signaling role of bank debt for corporate performance –both in general and for ESG performance in particular. Moreover, we analyse the moderating role of tangible collateral on the signaling intensity of bank debt, which is based on the logic that weaker tangible collateral fosters banks' scrutiny and their closer monitoring of how genuine a firm's ESG performance is. We also examine contextual factors that can make bank debt an effective signal: observability, which refers to the extent to which it is visible by receivers; and its reliability, which is given by its degree of accuracy to reflect signaling quality (Connelly et al. 2011). Signal observability is explored by drawing on analyst coverage, which represents one central visibility mechanism in markets. Signal reliability is investigated, drawing on analyst forecast errors and whether a firm belongs to either a green sector or a brown one. This allows us to hypothesize that bank debt enhances the value of ESG practices. Finally, we provide a more comprehensive empirical account for the conditions under which the bank debt signaling function may be more effective, based on the signal observability and signal reliability mechanisms explored and previously mentioned. In doing so, our study not only responds to the call for a more nuanced analysis of the signaling role of bank debt (Best and

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Zhang 1993; Epure and Guasch 2020; Fuente & Velasco 2022), but it also contributes to a growing body of literature that examines the way firms strive to ensure the genuineness of their ESG strategies (Cuypers et al. 2016; Fuente and Velasco 2024; Godfrey et al. 2009).

Our contributions tie in with the SDGs in a number of ways. First, our study improves the current understanding of the relationship between ESG performance and a firm's value. This is critical for firms vis-à-vis building a sustainable competitive advantage and achieving long-term success, which lies at the heart of SDG 8 (Decent Work and Economic Growth). ESG practices are directly aimed at promoting corporate investment in the areas of labor conditions, emissions reduction, and social progress, which are part of the specific goals of SDG 8 (Decent Work and Economic Growth), SDG 13 (Climate Action), and SDG 16 (Peace, Justice, and Strong Institutions). Moreover, by shedding light on the issue of the agency problems associated with ESG practices and the mechanisms available to firms to signal the genuineness of their commitment to ESG principles, our work specifically supports SDG 12 (Responsible Consumption and Production) and SDG 16 (Peace, Justice, and Strong Institutions). Mitigating information asymmetries, restricting discretionary spending, and preventing greenwashing are aligned with SDG 12. Our research shows that third-party monitoring can be informative about the genuineness of a firm's adherence to ESG principles, which strengthens institutional integrity, as required by SDG 16.

The rest of this paper is structured as follows. Section 2 explains the relevant literature. Section 3 sets out our hypotheses. Section 4 describes our sample and methodology. Section 5 explains the main results, and Section 5 presents robustness analyses. Section 6 concludes.

2 | Literature Review

2.1 | The ESG-Firm Value Relationship Through the Agency Theory Lenses

No agreement has been reached on the trade-off between the benefits and costs of engaging in ESG, which vary over time (Amiraslani et al. 2023; Buchanan et al. 2018; Lins et al. 2017). In the relationship between ESG performance and a firm's value, the scholarly literature draws a picture that is rife with inconclusive findings by accumulating empirical evidence—on one hand, of an ESG premium (Awaysheh et al. 2020; Eccles et al. 2014; Ferrell et al. 2016; Hull and Rothenberg 2008; Li et al. 2018) and a nonlinear relationship (Sun et al. 2019; Wang et al. 2008), and on the other, of a neutral relationship (Garcia-Castro et al. 2010; McWilliams and Siegel 2000) and an ESG discount (Masulis and Reza 2015).

Such puzzling evidence of the value of ESG performance advocates revisiting the diverse nature of this strategy across companies. Many studies have alerted to several agency problems intrinsically linked to ESG strategy as a result of informational asymmetries and managerial opportunism to extract private benefits. For instance, Krüger (2015) finds that events of sustainability initiatives are received as bad news by investors, with capital markets reacting slightly negatively. Similarly, one group of studies casts doubt on the credibility and legitimacy of certain companies' engagement in ESG (Bae et al. 2021; Cespa and Cestone 2007; Cuypers et al. 2016; Fuente and Velasco 2024; Haley 1991; Masulis and Reza 2015; Surroca and Tribó 2008; Wang et al. 2008). This issue might lead to a 'lemons problem', whose costs of dishonesty might impair the legitimacy of an ESG strategy (Akerlof 1970) and, therefore, partly explain the mixed empirical evidence emerging concerning the impact of this strategy on a firm's value.

Self-interested managers can misuse engagement in ESG for several purposes. First, CEOs may follow a stakeholder-friendly behavior to collude with non-shareholder stakeholders (Haley 1991) and promote their entrenchment (Cespa and Cestone 2007; Masulis and Reza 2015; Surroca and Tribó 2008). Second, managers may overinvest in certain ESG-oriented yet inefficient investments to gain a reputation in capital markets (Benlemlih 2017; Buchanan et al. 2018). Such investments do not respond to a genuine engagement in ESG principles. Although they seek to convey an image of outward ESG engagement, they are designed to extract private benefits, such as an enhancement of managers' social prestige and career prospects (Goss and Roberts 2011; Krüger 2015; Wang et al. 2008).

These agency problems worsen under weak internal corporate governance mechanisms and can make ESG detrimental to firm performance (Surroca and Tribó 2008). Consistent with this, one stream of the literature supports the notion that the effect of ESG performance on firm performance improves in the presence of monitoring mechanisms such as analyst scrutiny (Luo et al. 2015), shorter debt maturity (Benlemlih 2017), long-term investors (Nguyen et al. 2020), or institutional ownership (Buchanan et al. 2018). These mechanisms help mitigate information asymmetries, restrict discretionary spending, and discipline managers.

2.2 | The Signaling Role of Bank Monitoring

Since informational asymmetries likely play a central role in terms of which financial resources they access and to what degree each firm can access them, capital structure might accurately reflect the severity of such problems. The earlier literature particularly emphasizes the role of bank lenders in monitoring corporate performance. Bank debt financing exhibits unique features that likely place bank creditors in a privileged position to gather superior information about their borrowers, beyond what is publicly available (Boot 2000; Fama 1985; James 1987; Newton et al. 2022; Petersen and Rajan 1994) and therefore mitigate informational asymmetries. Banks establish close and long-term ties with their borrowers, which frequently extend across the domain of multiple financial products (Boot 2000; David et al. 2008). These features improve banks' availability of soft information about their company borrowers during the course of the relationship (Petersen and Rajan 1994). Fama (1985) emphasizes that debtholders obtain access 'to information from an organization's decision process not otherwise available' (p. 36), and most bank loans have short-term maturity, which imposes more frequent assessment of a firm's creditworthiness.

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Existing evidence confirms this idea in a broad array of corporate contexts, such as alleviating financial misreporting (Li et al. 2025), disciplining CEOs' risk-taking incentives (Saunders and Song 2018), or forcing the turnover of an underperforming CEO to promote the appointment of an outside successor (Marshall et al. 2014). Moreover, a firm's reliance on bank debt diminishes under stringent alternative governance mechanisms to discipline managerial behavior, such as strong product market competition (Boubaker et al. 2018) or major reforms in the board of directors (Ben-Nasr et al. 2021).

Consistent with this evidence from broader aspects that shape a firm's performance, recent works investigate this issue in the particular domain of ESG and suggest that bank lenders are particularly sensitive to the information conveyed by a firm's ESG performance. In this vein, Asimakopoulos et al. (2023) confirm that ESG-rated firms shift their financing sources from public debt (bond issuing) to private debt (bank debt). This reallocation effect is more pronounced in firms with greater financial constraints, lower growth opportunities, and more specialized assets. In these cases, information concerning ESG actions likely becomes more decisive in a bank's decision to grant loans.

Bank lenders could thus become a more reliable third-party endorsement of a firm's ESG performance than other categories of lenders. Recent studies, such as Newton et al. (2022), confirm that companies with higher ESG risk borrow less from banks than from markets and that firms' ESG risk decreases after borrowing from banks but increases after bond issuance. This provides further supportive evidence that banks' monitoring role is more effective than that of public markets as a third-party endorsement of the quality of a firm's ESG performance and in shaping it after borrowing financial resources. Consistent with this idea, several works specifically look at bank creditors, given the close relationships they can forge with their borrowers. Chava (2014) notes that firms with environmental concerns display lower bank participation in loan syndicates. In a similar vein, Asimakopoulos et al. (2023) find that becoming ESG rated decreases information asymmetry, which in turn helps firms borrow from banks. Accordingly, once a firm is assigned an ESG rating, this event drives a redistribution in corporate financing structure from external sources (bonds) to internal sources (bank loans).

3 | Hypotheses Development

3.1 | The Signaling Power of Bank Debt in the Value of ESG Performance

Given the informational asymmetries between stakeholders and insiders (Akerlof 1970) and the importance of trust in the legitimizing benefits of an ESG strategy, the role of perceptible signals as not free-of-cost mechanisms (i.e., signaling costs) becomes crucial. Such signals can convey observable information about the degree of genuineness of ESG initiatives and influence outside observers' perceptions of their quality (Connelly et al. 2011; Spence 1973). Among the range of signaling mechanisms available to firms, debt may play a key role. The type of lender, the conditions of debt contracts, and firms' ability to meet their obligations convey important information to outsiders (Ross 1977). For instance, high sustainable firms shorten their debt maturity to signal their superior quality and better access to the debt market (Benlemlih 2017).

Many studies highlight the more reliable informational attributes of bank debt over other categories of debt owing to the idiosyncrasy of bank–firm relationships (Chen et al. 2020; Epure and Guasch 2020; Fama 1985; Fuente and Velasco 2022; Hadlock and James 2002; Hull and Moellenberndt 1994). Banks have specific (and frequently, proprietary) information about their borrowers, which enhances these creditors' ability to screen borrowers and monitor them more effectively (Asimakopoulos et al. 2023; Baker et al. 2024; Boot 2000; Chen et al. 2020; David et al. 2008; Epure and Guasch 2020; James 1987; Newton et al. 2022). Consistent with such informational and monitoring functions, announcements of bank debt reductions have a negative impact on company returns that is twice as great as a similar reduction in nonbank debt (Hull and Moellenberndt 1994). Such a reduction might be the result of bank creditors' response to negative inside information about borrowers. Similarly, bank loan renewals trigger positive announcement returns in capital markets (Lummer and McConnell 1989). Best and Zhang's (1993) evidence also backs this informational role of bank loan agreements, with this proving more relevant when other informational mechanisms, such as analysts' forecasts, convey more ambiguous information (i.e., analyst forecast errors).

Epure and Guasch (2020) empirically confirm that bank debt is a stronger signal to outside investors than other types of debt. Debt has a positive impact on the amount of equity injections to entrepreneurial companies made by outside investors, with this effect being more noticeable in the case of bank debt. Similarly, Hadlock and James (2002) conclude that the greater the informational asymmetry problems, the more likely a firm is to draw on bank loans. In the specific ESG domain, Asimakopoulos et al. (2024) provide evidence that bank lenders account for their borrowers' ESG rating and can facilitate access to financial resources accordingly. Newton et al. (2022) also suggest that banks can monitor borrowers' ESG reputation and detect firm misbehavior more efficiently than public debtholders. Banks possess stronger incentives to do so and will, if necessary, cut back on credit to protect their reputation and social capital. In contrast, bondholders have weaker incentives owing to diffused debt ownership (Newton et al. 2022).

From such a signaling theory perspective, bank debt likely serves as a powerful device to differentiate the quality of corporate engagement in ESG practices and, therefore, signal the genuineness of a firm's ESG performance.[1] Bank creditors have access to private information about their borrowers, including nonfinancial aspects such as corporate engagement in ESG, which can be critical in the assessment of a firm's value from a forward-looking valuation approach. Evidence shows that banks evaluate a firm's ESG practices when determining their contract terms. Goss and Roberts (2011) report that firms with poor sustainability performance are charged higher loan spreads (about between 7 and 18 basis points more than their better-performing counterparts). From a different perspective, Asimakopoulos et al. (2023) focus on a firm becoming ESG rated. Their evidence suggests that such an event leads firms to adjust the debt sources

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they use and redistribute their debt from bonds to bank loans. Such a change in debt structure might also spark alternative underlying mechanisms, which might have a final impact on a firm's value owing to the richer information that bank creditors handle for granting loans to their firms' borrowers.

Accordingly, we expect the level of bank debt leverage to signal the credibility of a firm's corporate commitment to ESG principles and, in turn, to strengthen the value impact of its ESG strategy. Hence, we propose that

Hypothesis 1. *Bank debt improves the impact of ESG performance on a firm's value.*

3.2 | Collateral Tangibility and the Signaling Role of Debt

Among the range of assets available for securing company borrowing, intangible assets are not easily collateralized, given their higher levels of risk and the more complex valuation of their prospects. Intangibles are firm-specific assets that cannot be redeployed to an alternative use cost-free and that have low liquidation value (Balakrishnan and Fox 1993; David et al. 2008), which hinders firms' access to finance. Ughetto (2008) illustrates this idea for the case of resource and development (R&D) investments and shows that the main source of financing for Italian firms is internal cash flow.

The relational nature of bank debt boosts the adoption of performance criteria based on multiple sources of value, which can be better assessed as a result of banks' access to proprietary information. Supporting this idea, David et al. (2008) find evidence that R&D intensive companies use a greater proportion of relational (i.e., loans) than transactional debt (i.e., bonds).

Based on banks' privileged position to evaluate a firm's prospects (James 1987), we expect the beneficial signaling effect of bank debt to enhance the value impact of ESG performance to a greater extent in companies with less tangible collateral, where the need for screening and monitoring is greater. In such a scenario, as the lender presents weaker collateral in terms of tangible assets, banks will devote greater attention to assessing the genuineness of a firm's ESG performance. Conversely, bank debt's moderating effect on the ESG performance-value linkage is likely to become weaker the higher the borrower's tangible collateral. Accordingly, we posit our second hypothesis:

Hypothesis 2. *The positive moderating effect of bank debt on the relationship between ESG performance and a firm's value weakens (strengthens) in the presence of more (less) tangible collateral.*

4 | Data and Empirical Strategy

4.1 | Data Sources and Sample Selection

We consider all U.S. publicly traded companies covered in the *Eikon* database from 2010 to 2018. We keep only nonfinancial companies (outside SIC codes 6000–6999) owing to the distinctive characteristics of financial companies in terms of governance structure and leverage.[2] We build a combined data set from multiple databases accessed through the *Eikon* platform by Refinitiv (formerly known as Thomson Reuters ASSET4 ESG). We gather financial accounting data from *Worldscope*, stock price data from *Datastream*, and analysts' forecasts from *I/B/E/S*. Data on ESG performance ratings also come from *Eikon Refinitiv*, which reports auditable and systematic information on ESG for publicly traded companies; this quantifies how well each firm performs according to a wide set of ESG criteria (Refinitiv 2020). We transform ESG scores from a 100-point scale to a 10-point one (Cheng et al. 2014; Fuente and Velasco 2022). Using each firm's ISIN identifier, we then match this initial sample to data on bank debt and liabilities, taken from the *ORBIS* database by Bureau van Dijk.

We then exclude observations with non-positive equity book value and check for illogical observations. In this regard, non-positive values for certain variables, such as the number of common shares outstanding, stock price, total sales, and the book value of total assets, are treated as missing values. Firm-year observations that lack information on the ESG variables, which are the focus of our empirical analyses, are omitted. Surroca et al. (2020) show no attrition bias concerns. Finally, all our continuous variables (except ESG variables) are winsorised at the first and 99% to prevent the influence of potential outliers. The final sample comprises 6479 firm-year observations, corresponding to 1,486 firms.

Table 1 summarizes the sample distribution. Panel A shows the distribution of firm-year observations by year and reflects the increasing coverage of ESG information in databases in recent years. Panel B reveals the dissimilar ESG coverage across industries, taking the Fama and French (1997) industry classification as a benchmark. The most widely represented industry groups in our sample are business services (15.96%), retail (6.74%), electronic equipment (6.24%), and petroleum and natural gas (5.06%).

4.2 | Models, Variables, and Methodology

Our baseline model investigating the effect of ESG performance on a firm's value is given by Equation [1]:

$$TOBINQ_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 X_{i,t} + \sum_{t=2010}^{2017} Year_t + \nu_i + \varepsilon_{i,t}, \quad (1)$$

where i refers to each firm; t identifies the year of observation; the dependent variable is a firm's value approximated by Tobin's Q (*TOBINQ*); $ESG_{i,t}$ is ESG performance; $X_{i,t}$ is a vector comprising a set of firm-level control variables, and $\varepsilon_{i,t}$ is the error term. We consider two types of fixed effects: $\sum_{t=2010}^{2017} Year_t$ comprises a set of year dummies to control for the time-fixed effect,[3] and ν_i is the firm effect that is assumed to be constant over time.

Table 2 presents our key variables. Tobin's Q (*TOBINQ*) is the ratio of market value to replacement costs. We compute market value as the sum of market capitalization, book value of long-

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TABLE 1 | Sample distribution.

Panel A: Sample distribution by year		
Year	**No. Obs.**	**% Obs.**
2010	332	5.12
2011	334	5.16
2012	389	6.00
2013	455	7.02
2014	463	7.15
2015	788	12.16
2016	1163	17.95
2017	1298	20.03
2018	1258	19.41
Total	**6479**	**100**

Panel B: Sample distribution by Fama & French's industries			
F&F industries		**No. Obs.**	**% Obs.**
1	**Agriculture**	11	0.17
2	**Food products**	144	2.26
3	**Candy and Soda**	27	0.42
4	**Alcoholic beverages**	28	0.44
5	**Tobacco products**	2	0.03
6	**Recreational products**	50	0.78
7	**Entertainment**	50	0.78
8	**Printing & publishing**	77	1.21
9	**Consumer goods**	164	2.57
10	**Apparel**	74	1.16
11	**Healthcare**	116	1.82
12	**Medical equipment**	244	3.83
13	**Pharmaceutical products**	281	2.84
14	**Chemicals**	233	3.66
15	**Rubber and plastic products**	57	0.89
16	**Textiles**	20	0.31
17	**Construction materials**	167	2.62
18	**Construction**	162	2.54
19	**Steel Works**	109	1.71
20	**Fabricated products**	10	0.16
21	**Machinery**	268	4.20
22	**Electrical equipment**	73	1.14
23	**Miscellaneous**	3	0.05
24	**Automobiles and trucks**	185	2.90
25	**Aircraft**	35	0.55
26	**Shipbuilding, railroad eq.**	24	0.38
27	**Defense**	17	0.27
28	**Precious metals**	26	0.41
29	**Non-metallic mining**	64	1.00
30	**Coal**	34	0.53
31	**Petroleum and natural gas**	323	5.06
32	**Utilities**	260	4.08
33	**Telecommunications**	133	2.08
34	**Personal services**	90	1.41
35	**Business services**	1018	15.96
36	**Computers**	139	2.18
37	**Electronic equipment**	398	6.24
38	**Measuring and control equipment**	178	2.79
39	**Business supplies**	71	1.11
40	**Shipping containers**	48	0.75
41	**Transportation**	213	3.34
42	**Wholesale**	225	3.53
43	**Retail**	430	6.74
44	**Restaurants, hotel, motel**	198	3.10
45	**Banking**	—	—
46	**Insurance**	—	—
47	**Real Estate**	—	—
48	**Trading**	—	—
Total		**6479**	**100**

Note: This table summarizes the sample distribution by year (Panel A) and by Fama and French's industries (Panel B). Firms operating in financial sectors (45–48) are excluded from the initial sample.

term debt, and current liabilities. Replacement costs are proxied by the sum of the book value of inventory and the net value of property, plant, and equipment (Dowell et al. 2000; Morck and Yeung 1991).[4] Our core explanatory variable is ESG performance, for which two proxies are used. First, we build *ESGeq* as the equally weighted average of the three pillars' scores (Cheng et al. 2014; Fuente et al. 2022; Mervelskemper and Streit 2017). Alternatively, to also account for potential irresponsible company action and reach a more comprehensive picture of corporate engagement in ESG practices, we take the ESG combined score (*ESGcomb*) directly from *Eikon*, which is calculated as the average of the ESG score and ESG controversies score when controversies arise during the fiscal year. When the controversies

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TABLE 2 | Variable description.

Variable	Description	Source	Label
Dependent variable			
Firm value	Tobin's Q, is defined as the ratio of market value to replacement costs. We compute market value as the sum of market capitalization, the book value of long-term debt, and current liabilities. Replacement costs are proxied by the sum of the book value of inventory and the net value of property, plant, and equipment (Dowell et al. 2000; Morck and Yeung 1991).	Worldscope, Datastream	*TOBINQ*
Variables of interest			
ESG performance	The equally weighted average of the scores of the three individual pillars: environmental, social, and governance (Cheng et al. 2014; Fuente et al. 2022; Mervelskemper and Streit 2017).	Refinitiv	*ESGeq*
	The average of the ESG score and the ESG controversies score when controversies arise during the fiscal year. When the controversies score is higher than the ESG score, the ESG score equals the ESG controversies score (Refinitiv 2020).	Refinitiv	*ESGcomb*
Type of debt	The ratio of bank debt to the book value of assets (Azofra et al. 2020; González 2016).	Orbis	*BANK_TA*
	The ratio of bank debt to total liabilities (Demiroglu and James 2015).	Orbis	*BANK_LIAB*
	The ratio of non-bank debt to the book value of assets (Azofra et al. 2020; González 2016).	Orbis	*NONBANK_TA*
Relevance of tangible collateral	A binary variable which equals 1 if a firm's asset tangibility (*TANG*) is above or equal to the yearly sample median, and 0 otherwise.	Worldscope	*dumTANG*
Control variables			
Firm size	The natural logarithm of the book value of total assets.	Worldscope	*SIZE*
Firm asset tangibility	The ratio of net property, plant, and equipment divided by the book value of assets.	Worldscope	*TANG*
Firm profitability	The ratio of EBIT to total sales.	Worldscope	*PROFIT*
Firm cash holdings	Total cash divided by the book value of assets.	Worldscope	*CASH*
Firm age	Natural logarithm of the difference between the current year and each firm's founding year.	Worldscope	*AGE*
Additional tests and channel analyses			
Environmental performance	Individual score in the environmental pillar of ESG engagement.	Refinitiv	*ENV*
Social performance	Individual score in the social pillar of ESG engagement.	Refinitiv	*SOC*
Governance performance	Individual score in the governance pillar of ESG engagement.	Refinitiv	*GOV*
Instrumental variables for ESG performance	The average ESG score of a firm's industry peers.	Refinitiv	*indESG*
	A binary variable which equals 1 if a firm has ESG-based compensation for managers, and 0 otherwise.	Refinitiv	*dumESGCompensation*
Analyst coverage	The natural logarithm of the number of financial analysts who follow a firm's stocks in the capital market (Harjoto and Jo 2015).	I/B/E/S	*ANALYSTCOVER*
Analyst accuracy	Mean forecast error calculated based on the mean value of earnings per share forecasts and the actual earnings per share (Benson et al. 2020; Best and Zhang 1993).	I/B/E/S	*FORERROR*

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score is higher than the ESG score, the ESG score equals the ESG controversies score (Refinitiv 2020).

Additionally, we add a set of firm-level control variables, which prior studies consider as driving a firm's value (Buchanan et al. 2018; Li et al. 2018): firm size (*SIZE*), defined as the natural logarithm of the book value of total assets; asset tangibility (*TANG*), approximated as net property, plant and equipment divided by the book value of assets; profitability (*PROFIT*), as defined by the ratio of EBIT to total sales; cash holdings (*CASH*), calculated as total cash divided by the book value of assets; and firm age (*AGE*), proxied by the natural logarithm of the difference between the current year and each firm's founding year.

To test Hypothesis 1, we include how bank debt leverage shapes the influence of ESG performance on a firm's value by signaling the relative standard and genuineness of this strategy:

$$TOBINQ_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 ESG_{i,t} \times BANK_{i,t} + \beta_3 BANK_{i,t} + \beta_4 X_{i,t} + \sum_{t=2010}^{2017} Year_t + \nu_i + \varepsilon_{i,t}, \quad (2)$$

where *BANK* denotes a firm's reliance on bank debt, as measured by two alternative proxies. First, we use *BANK_TA*, which is the ratio of bank debt to the book value of assets (Azofra et al. 2020; González 2016). Second, we conduct robustness analyses by alternatively taking the proxy *BANK_LIAB*, which is defined as the ratio of total bank debt divided by total liabilities (Demiroglu and James 2015).

Moreover, in further robustness analyses, we extend this model by incorporating non-bank debt simultaneously, as indicated in Equation [2]:

$$TOBINQ_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 ESG_{i,t} \times BANK_{i,t} + \beta_3 BANK_{i,t} + \beta_4 ESG_{i,t} \times NONBANK_{i,t} + \beta_5 NONBANK_{i,t} + \beta_6 X_{i,t} + \sum_{t=2010}^{2017} Year_t + \nu_i + \varepsilon_{i,t} \quad (2')$$

where *NONBANK* captures a firm's reliance on non-bank debt, as measured by the ratio of non-bank debt to the book value of assets (*NONBANK_TA*).

To test Hypothesis 2, we extend Equation [2] by incorporating the interaction of the relevance of tangible collateral on the signaling role of bank debt regarding the quality of ESG performance:

$$TOBINQ_{i,t} = \alpha + \beta_1 ESG_{i,t} + \beta_2 ESG_{i,t} \times BANK_{i,t} + \beta_3 ESG_{i,t} \times BANK_{i,t} \times dumTANG_{i,t} + \beta_4 BANK_{i,t} + \beta_5 X_{i,t} + \sum_{t=2010}^{2017} Year_t + \nu_i + \varepsilon_{i,t}, \quad (3)$$

where *dumTANG* identifies a firm's ability to pledge tangible asset collateral against bank loans. *dumTANG* is a binary variable equaling 1 if a firm's asset tangibility (*TANG*) is above or equal to the yearly sample median, and 0 otherwise.

Consistent with prior studies (e.g., Fabrizi et al. 2014; Servaes and Tamayo 2013), we rely on fixed-effect regression analyses with panel data.[5] This estimation methodology allows us to account for the presence of unobserved, time-invariant heterogeneity across firms, which might also play a part in determining ESG decisions and corporate value (i.e., TMT's characteristics). Moreover, our models could be affected by reverse causality, as outperforming companies might be more prone to implement ESG practices. To deal with such potential endogeneity, which might bias our ordinary least squares (OLS) results, we conduct complementary analyses by applying the two-step least squares (2SLS) estimator with instrumental variables and obtaining the Durbin-Wu-Hausman statistic, which provides a test for the endogeneity of our instrumented variable (ESG performance).

5 | Empirical Results

5.1 | Descriptive Statistics

Table 3 summarizes the sample descriptive statistics. Panel A contains the summary statistics of the key variables. Our sample firms exhibit a medium ESG score. On average, our firms show greater reliance on bank debt (mean *BANK_TA* equals 0.27) than on non-bank debt (mean *NONBANK_TA* is 0.03). For the average firm in the sample, bank debt represents 43.15% of total liabilities. Panel B reports the correlation matrix. The ESG proxies display positive and statistically significant correlations with *TOBINQ*. *BANK_TA* and *BANK_LIAB* display a positive and strong correlation (above 0.86), which confirms their appropriateness as alternative proxies for a firm's reliance on bank debt. Better ESG performers are larger, more profitable, and older. Conversely, ESG performance (*ESGeq* and *ESGcomb*) is negatively correlated with *CASH*. Finally, correlations among the independent variables do not raise concerns as regards multicollinearity problems.[6]

5.2 | Baseline Regression

Table 4 provides the baseline regressions of Equation [1] on the relationship between ESG performance and a firm's value. Panel A shows OLS fixed-effects estimations with panel data. Only *ESGcomb* displays statistical significance, presenting a positive sign ($\beta = 0.0432$, $p < 0.05$). This finding suggests the existence of an ESG premium in a firm's value when ESG controversies are also accounted for, as jointly considering responsible and irresponsible issues undertaken by companies likely drives a more favorable perception of ESG performance genuineness. For example, in column (2), if the *ESGcomb* varies upward by one standard deviation, the *TOBINQ* increases by 6.75% points.

Panel B reports the 2SLS fixed-effects panel data regressions to handle the potential endogeneity problem associated with the ESG strategy. We use two variables as instruments for ESG

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TABLE 3 | Descriptive statistics.

Panel A: Summary statistics

	Number of observations	Mean	Median	Standard deviation	Minimum	First quartile	Third quartile	Maximum
TOBINQ	4733	5.0838	3.9952	3.6163	0.6076	2.1534	7.3084	14.311
ESG performance								
ESGeq	6479	4.7127	4.4803	1.6469	0.7400	3.4373	5.9130	9.2927
ESGcomb	6479	4.3043	4.0030	1.5636	0.7310	3.1720	5.2680	9.3140
Bank/non-bank debt								
BANK_TA	5397	0.2672	0.2539	0.1601	0	0.1512	0.3655	0.7372
BANK_LIAB	5403	0.4315	0.4459	0.2033	0	0.2910	0.5808	0.8840
NONBANK_TA	5315	0.0300	0.0106	0.0521	0	0.0012	0.0372	0.4146
Control variables								
SIZE	6479	14.772	14.862	1.2286	10.497	13.949	15.718	16.772
TANG	6479	0.5451	0.1791	1.0124	0.0007	0.0991	0.3997	6.2940
PROFIT	6479	0.0677	0.0974	0.2914	−2.4639	0.0393	0.1650	0.6848
CASH	6479	0.1159	0.0810	0.1189	0	0.0285	0.1631	0.9785
AGE	6479	3.2506	3.2581	1.0231	0	2.7080	3.9512	4.8978
Additional tests and channel analyses								
ENV	6479	4.4260	4.0010	2.1401	0.4080	2.7060	5.9950	9.7910
SOC	6479	4.7139	4.4740	1.8809	0.3760	3.2630	5.9580	9.7740
GOV	6479	4.9983	4.9600	2.1054	0.3390	3.3300	6.6420	9.9050
indESG	6479	4.7027	4.6436	0.5547	1.8490	4.4743	4.9729	7.6205
dumESGCompensation	6479	0.1961	0	0.3971	0	0	0	1
ANALYSTCOVER	6368	2.3638	2.4849	0.7598	0	1.9459	2.9444	3.8918
FORERROR	6341	0.5311	0.4772	0.4449	0.0139	0.2116	0.6931	2.7114

Panel B: Pairwise correlation matrix

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1. TOBINQ	1.0000																	
2. ESGeq	0.0582***	1.0000																
3. ESGcomb	0.0605***	0.8392***	1.0000															
4. BANK_TA	−0.0776***	0.0263*	0.0208	1.0000														
5. BANK_LIAB	−0.0695***	−0.0271**	−0.0102	0.8602***	1.0000													
6. NONBANK_TA	−0.0070	0.0216	0.0242*	−0.0641***	−0.1797***	1.0000												
7. SIZE	−0.1507***	0.4915***	0.3254***	0.1975***	0.1376***	0.0326**	1.0000											
8. TANG	−0.4221***	−0.0190	-0.0123	0.1523***	0.2114***	−0.0354***	0.2006***	1.0000										
9. PROFIT	0.0833***	0.0834***	0.0594***	0.0307***	0.0353***	−0.0129	0.2545**	−0.0141	1.0000									
10. CASH	0.3296***	−0.0864***	−0.0678***	−0.2386***	−0.2247***	−0.0224	−0.3415***	−0.2398***	−0.1580***	1.0000								

(Continues)

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TABLE 3 | (Continued)

Panel B: Pairwise correlation matrix

11. AGE	0.0368**	0.2640***	0.2017***	−0.1250***	−0.1303***	0.0192	0.1942***	−0.0255**	0.1314***	−0.1191***	1.0000							
12. ENV	0.0749***	0.8594***	0.7123***	0.0213	−0.0318**	0.0319**	0.4240***	−0.0390***	0.0468***	−0.0326***	0.1827***	1.0000						
13. SOC	0.1208***	0.8320***	0.6913***	−0.0032	−0.0544***	0.0319**	0.4497***	−0.0774***	0.0851***	−0.0512***	0.1961***	0.6883***	1.0000					
14. GOV	−0.0479***	0.7299***	0.6277***	0.0431***	0.0171	−0.0102	0.3208***	0.0642***	0.0720***	−0.1239***	0.2586***	0.3853***	0.3595***	1.0000				
15. indESG	0.0671***	0.3338***	0.234***	−0.0233*	−0.0535***	0.0576***	0.1686***	−0.0256**	0.0296**	−0.0432***	0.1721***	0.3129***	0.3003***	0.1971***	1.0000			
16. dumESG Compensation	−0.1071***	0.2732***	0.2002***	0.0204	0.0069	0.0224	0.2870***	0.1149***	0.0721***	−0.1033***	0.0979***	0.1917***	0.1948***	0.2722***	0.1924***	1.0000		
17. ANALYST COVER	0.0381***	0.3571***	0.2245***	0.0045	0.0055	0.0133	0.5601***	0.0684***	0.0698***	−0.0245*	0.0108	0.3297***	0.3623***	0.1790***	0.1341***	0.1587***	1.0000	
18. FORERROR	−0.1265***	−0.1159***	−0.1303***	0.0077	0.0417***	−0.0230*	−0.0529***	0.1534***	−0.1919***	0.0637***	−0.1543***	−0.0817***	−0.0926***	−0.1061***	−0.0495***	0.0149	0.0842***	1.0000

Note: This table presents the descriptive statistics of our sample. Panel A summarizes the main descriptive statistics. Panel B reports the Pearson pairwise correlation matrix. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

performance: the average ESG score of a firm's industry peers (*indESG*) and a dummy variable indicating the existence of ESG-based compensation for managers in each company (*dumESGCompensation*). Similar instruments are applied in previous works (e.g., Eccles et al. 2014; Garcia-Castro et al. 2010). While these variables motivate companies to engage in ESG performance, both are exogenous to a firm's value and, therefore, not correlated with the error term of our outcome equations. Moreover, as emphasized by Lu et al. (2018), demonstrating that the instruments can strongly predict the corresponding explanatory variable is also essential. To verify this, Columns (3) and (5) report the first-stage 2SLS estimations. Consistent with our predictions, both instrumental variables display a positive and statistically significant impact on the alternative proxies for ESG performance. For instance, the inclusion of ESG-based compensation in managerial compensation packages (*dumESGCompensation*) enhances a firm's ESG performance by some 31–39 percentage points. Additionally, the Cragg-Donald-Wald statistic and Sargan test of overidentifying restrictions, respectively, support the strength and exogeneity of our chosen instruments. However, the Durbin-Wu-Hausman statistic does not reject the null hypothesis that the instrumented ESG variable (*ESGeq* or *ESGcomb*) is exogenous with respect to *TOBINQ*.[7] These results reveal a positive but non-statistically significant relationship between ESG performance and *TOBINQ*. In this empirical setting, both OLS and 2SLS estimations with panel data are consistent, although OLS is more efficient (Greene 2018). In view of this result, OLS estimations will be applied hereinafter.

5.3 | Bank Debt as a Signaling Mechanism of the Standard of ESG Performance

Table 5 reports the results of the baseline model, including the moderating effect of bank debt (Panel A) and non-bank debt (Panel B), separately. We display the results when both are computed in relative terms over total assets. However, the results remain similar when we use *BANK_LIAB* and *NON-BANK_LIAB* as alternative proxies. When we enter the moderating effect of bank debt leverage, the individual impact of ESG performance on a firm's value changes. Thus, bank debt is an effective signal for ESG genuineness. Although when all firms were considered together, the ESG coefficients in Table 4 showed either a statistically insignificant (*ESGeq*) or a statistically significant positive (*ESGcomb*) value effect, Table 5 reveals that this effect is either statistically significantly negative (*ESGeq*) or statistically insignificant (*ESGcomb*) for firms with no bank debt. Across all regressions, the interaction term between ESG performance and bank debt can mitigate the initial discount and even flip the former negative sign of the ESG performance–value relationship. For instance, as columns (1) and (2) suggest, a 1% increase in bank debt leverage enhances the value effect of a certain level of ESG engagement by 0.21–0.37 percentage points, *ceteris paribus*. These empirical findings strongly support Hypothesis 1.

As observed in column (1), the estimated coefficient of *ESGeq* is negative and statistically significant ($\beta = -0.1077$, $p < 0.05$), which implies that a standard deviation increase of 1 in *ESGeq* causes a reduction in *TOBINQ* of about 17.74 percentage points

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TABLE 4 | The impact of ESG performance on firm value (baseline model).

	Dependent variable: *TOBINQ*					
	Panel A: Fixed-effects estimations		Panel B: 2SLS estimations			
			First-stage estimation	Second-stage estimation	First-stage estimation	Second-stage estimation
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.3994*** (1.4979)	5.3674*** (1.4971)				
ESG performance						
ESGeq	−0.0179 (0.0348)			0.1486 (0.1508)		
ESGcomb		0.0432** (0.0221)				0.0985 (0.0959)
Control variables						
SIZE	−0.0269 (0.0929)	−0.0405 (0.0923)	0.3048*** (0.0428)	−0.0803 (0.1043)	0.1718** (0.0676)	−0.0505 (0.0938)
TANG	−0.4270*** (0.0687)	−0.4233*** (0.0687)	−0.0795** (0.0320)	−0.4159*** (0.0695)	−0.0778 (0.0504)	−0.4200*** (0.0688)
PROFIT	0.7485*** (0.1228)	0.7511*** (0.1227)	−0.0296 (0.0572)	0.7651*** (0.1238)	0.0384 (0.0900)	0.7521*** (0.1226)
CASH	6.1704*** (0.4247)	6.1424*** (0.4246)	0.2095 (0.1971)	6.1328*** (0.4265)	0.6843** (0.3111)	6.1117*** (0.4273)
AGE	-0.0989 (0.1678)	−0.1158 (0.1673)	0.3151*** (0.0777)	−0.1630 (0.1772)	0.1511 (0.1226)	−0.1286 (0.1685)
Instrumental variables						
indESG			0.2809*** (0.0341)		0.6646*** (0.0527)	
dumESGCompen-sation			0.3891*** (0.0354)		0.3118*** (0.0537)	
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	4733	4733	4627	4627	4627	4627
F-statistic	50.68***	50.99***	102.32***	47.31***	101.02***	50.70***
Cragg-Donald Wald F-statistic	—	—	—	102.32***	—	101.02***
Sargan overidentification test *p* value	—	—	—	0.6838	—	0.8608
Durbin-Wu-Hausman test *p* value	—	—	—	0.2549	—	0.5533

Note: This table shows the estimation results of the baseline model of the impact of ESG performance on firm value (Equation [2]). Panel A presents the OLS fixed effects panel data results. Panel B contains the 2SLS fixed effects panel data results with instrumental variables to control for endogeneity. Columns (3) and (5) report first-stage estimation results, and columns (4) and (6) the second-stage estimations corresponding to each one. Instruments for ESG performance: the average ESG score of a firm's industry peers (*indESG)*, and a binary variable of the existence of ESG-based compensation for managers in each company (*dumESGcompensation)*. The dependent variable is a firm's market value (*TOBINQ*). The key explanatory variable is ESG performance, which is measured either by the equally weighted average of the individual pillar scores (*ESGeq*) or the ESG combined score (*ESGcomb*). Control variables: firm size (*SIZE*), a firm's asset tangibility (*TANG*), firm profitability (*PROFIT*), cash holdings (*CASH*), and firm age (*AGE*). All regressions control for year-fixed effects. The F-statistic evaluates the null hypothesis of no joint significance of the explanatory variables. The Cragg-Donald-Wald statistic assesses instrument strength. The Sargan test examines the null hypotheses of no correlation between the instruments and the error term. The Durbin-Wu-Hausman statistic provides a test for the endogeneity of the instrumented variable (ESG performance). Standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

in companies with zero bank debt leverage. However, the interaction term $ESGeq \times BANK\_TA$ has a positive sign and displays statistical significance ($\beta = 0.3704$, $p < 0.05$). Such a moderating effect is large enough in magnitude to substantially counterbalance the negative individual impact of the ESG variable, which could even lead to a positive combined effect of *ESGeq* on *TOBINQ* in companies with sufficiently high bank debt leverage.

We then use non-bank debt to compute the previous moderating effects to rule out the possibility that all types of debt might play a signaling function in the ESG strategy. In line with our

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TABLE 5 | ESG performance, firm value, and debt type (bank debt vs. nonbank debt).

	Dependent variable: *TOBINQ*					
	Panel A: Moderating effects of bank debt		Panel B: Moderating effects of nonbank debt		Panel C: All moderating effects included (bank-debt and nonbank debt)	
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	5.4960***	5.2625***	4.6943***	4.7156***	5.0873***	4.9008***
	(1.5758)	(1.5728)	(1.5746)	(1.5735)	(1.5942)	(1.5908)
ESG performance						
ESGeq	−0.1077**		−0.0068		−0.1060*	
	(0.0526)		(0.0372)		(0.0549)	
ESGcomb		−0.0199		0.0453*		−0.0148
		(0.0416)		(0.0250)		(0.0437)
Interaction effects with bank debt						
ESGeq × BANK_TA	0.3704**				0.38614**	
	(0.1457)				(0.1472)	
ESGcomb × BANK_TA		0.2119*				0.2144*
		(0.1256)				(0.1277)
Interaction effects with non-bank debt						
ESGeq × NONBANK_-TA			−0.4354		−0.3633	
			(0.3833)		(0.3843)	
ESGcomb × NONBAN-K_TA				−0.2986		−0.2855
				(0.3581)		(0.3581)
$\sum_1$	0.2627**	0.1919**			0.2554**	0.1995**
	(0.1122)	(0.0930)			(0.1130)	(0.0951)
$\sum_2$			−0.4421	−0.2532	−0.4693	−0.3003
			(0.3736)	(0.3472)	(0.3737)	(0.3484)
Type of debt						
BANK_TA	−1.7146**	-0.8252			−1.8619**	−1.0339*
	(0.7802)	(0.6295)			(0.7956)	(0.6452)
NONBANK_TA			1.8646	0.9589	1.4520	0.8704
			(2.1404)	(1.8565)	(2.1605)	(1.8699)
Control variables						
SIZE	−0.0463	−0.0635	−0.0388	−0.0525	−0.0238	−0.0437
	(0.0979)	(0.0973)	(0.0973)	(0.0968)	(0.0993)	(0.0987)
TANG	−0.3779***	−0.3753***	−0.3870***	−0.3839***	−0.3834***	−0.3811***
	(0.0698)	(0.0697)	(0.0703)	(0.0702)	(0.0703)	(0.0703)
PROFIT	0.8093***	0.8121***	0.8239***	0.8226***	0.8209***	0.8209***
	(0.1302)	(0.1301)	(0.1308)	(0.1306)	(0.1323)	(0.1321)
CASH	6.0459***	6.0175***	6.2161***	6.1818***	6.1968***	6.1602***
	(0.4521)	(0.4523)	(0.4553)	(0.4552)	(0.4553)	(0.4555)
AGE	0.0314	0.0436	0.0931	0.0752	0.0604	0.0669
	(0.1714)	(0.1706)	(0.1730)	(0.1725)	(0.1734)	(0.1726)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	4180	4180	4116	4116	4116	4116
F-statistic	43.95***	43.91***	43.53***	43.66***	39.08***	38.98***

Note: This table shows the OLS fixed effects panel data results of the extended model of the moderating effect of debt on the relationship between ESG performance and firm value. Panel A estimates the moderating effect of bank debt (Equation [2]). Panel B presents robustness analyses by alternatively estimating the moderating effect of non-bank debt. Panel C includes all previous moderating effects (those with bank debt and with non-bank debt) altogether in the same regression. The dependent variable is a firm's market value (*TOBINQ*). The explanatory variable of ESG performance is measured either by the equally weighted average of the individual pillar scores (*ESGeq*) or the ESG combined score (*ESGcomb*). The type of debt measure included in the interaction effects of each regression is then entered individually: the ratio of bank debt to the book value of assets (*BANK_TA*), and the ratio of non-bank debt to the book value of assets (*NONBANK_TA*). $\sum_1$ denotes the linear effect that tests the joint significance of the ESG performance variable plus the interaction effect of ESG performance and bank debt leverage. $\sum_2$ represents the linear effect that tests the joint significance of the ESG performance variable plus the interaction effect of ESG performance and non-bank debt leverage. Control variables: firm size (*SIZE*), a firm's asset tangibility (*ASSET*), firm profitability (*PROFIT*), cash holdings (*CASH*), and firm age (*AGE*). All regressions control for year-fixed effects. The F-statistic evaluates the null hypothesis of no joint significance of the explanatory variables. Standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

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expectations, the interaction terms *ESGeq* × *NONBANK_TA* and *ESGcomb* × *NONBANK_TA* display negative coefficients, yet no statistical significance. Therefore, non-bank debt plays no role in shaping the impact of ESG performance on a firm's value. These latter results agree with our theoretical arguments that non-bank creditors are in a less-privileged position to access information about their borrowing firms and, as a result, have a more constrained ability to distinguish the standard of their ESG investment activity. Overall, the value-enhancing effect of leverage on ESG strategy only emerges in the case of bank debt financing but does not persist in other types of debt. This further empirically confirms the unique informative nature of bank debt. Finally, Panel C estimates Equation [2], in which we enter the interaction effects based on bank debt and non-bank debt simultaneously. Our main results remain similar. Only bank debt can enhance the value impact of ESG, which supports Hypothesis 1 about the signaling effect from bank debt.[8] Again, ceteris paribus, an increase of 1 percentage point in bank debt leverage increases the effect of a certain level of ESG performance by 0.21–0.39 percentage points.

5.4 | Bank Debt Signaling and Tangible Collateral

Table 6 reports the results of Equation [3], which extends our previous regression estimates by adding the relevance of tangible collateral in the interaction effects between ESG performance and bank debt. The estimated coefficients of the triple interaction terms of ESG performance, bank debt leverage, and tangible collateral relevance are negative and statistically significant beyond the 1% level. *Ceteris paribus*, the enhancing effect of bank debt leverage on the value effects of ESG performance decreases by 0.28–0.34 percentage points in above-median asset tangibility firms compared to their below-median asset tangibility counterparts. This evidence supports Hypothesis 2. The positive moderating effect of bank debt signaling is lower in companies with higher tangible collateral relevance. For example, as column (1) reports, *ESGeq* has a negative and significant impact on *TOBINQ* ($\beta = -0.1830$, $p < 0.01$), whilst bank debt leverage can reduce and offset this value detrimental effect of ESG performance. The economic significance of the moderating effect *ESGeq*×*BANK_LIAB* is stronger for below-median asset-tangible companies ($\beta = 0.5890$, $p < 0.01$) than for above-median asset-tangible ones ($\beta = 0.5890 - 0.2774 = 0.3116$, $p < 0.01$). Results appear to be robust across the alternative proxies for ESG and bank debt reliance.

6 | Robustness Checks

We check the robustness of our findings through a battery of additional tests. First, we examine whether the signaling effect of bank debt is sensitive depending on a firm's ESG performance, relative to its industry peers. To do so, we repeat the estimations of Equation [2] by subsamples: firm-year observations with ESG performance above or equal to the yearly industry average, and firm-year observations with ESG performance below the yearly industry average. The moderating effect of bank debt retains statistical significance in the subsample of industry ESG underperformers, which confirms the greater need these firms may have to signal the quality of their ESG actions.[9]

Second, we re-estimate the moderating effect of bank debt (Equation [2]) for the individual scores in the environmental (*ENV*), social (*SOC*), and governance (*GOV*) pillars. Results are tabulated in Table A1 of the Appendix. As observed, the moderating effect of bank debt is statistically significant and enhances the value impact of ESG strategy in the case of the environmental and governance pillars. $\sum_1$ captures the linear combined effect of the ESG performance variable plus the interaction effect of ESG performance and bank debt leverage. The economic significance of the moderating effect of bank debt is large enough to reverse the negative effects of *ENV* and *GOV* individually, thereby turning these sustainability pillar actions into value-enhancing for companies. As columns (1) and (3) display, an increase in bank debt leverage of 1 percentage point raises the value effect of sustainability performance in the environmental and governance pillars by 0.26 and 0.23 percentage points, respectively, ceteris paribus. This confirms the well-known, specialized role of banks in monitoring firms' engagement in environmental and governance issues (Wang 2023)—a role which does not seem as efficient with regard to prosocial practices.

To account for potential selection bias endogeneity due to the potential nonrandom distribution of the use of bank debt financing across firms, we re-run our main estimations using the propensity score matching (PSM) procedure.[10] This econometric technique is broadly implemented in the earlier literature to address endogeneity concerns associated with functional form misspecification (Shipman et al. 2017; Wolfolds and Siegel 2019). While the use of bank debt financing is not randomly distributed, propensity score matching allows us to create a counterfactual sample. As the treatment group, we consider firms with an above-median bank debt ratio. We also create a control group consisting of firms that have nearly the same likelihood of using high (above median) levels of bank debt but who decide to use low (below median) levels of bank debt. The propensity score (ex-ante probability of maintaining high levels of bank debt) is calculated by drawing on a probit estimation of the treatment dummy on the covariates of ESG performance, *SIZE*, *TANG*, *PROFIT*, *CASH*, and *AGE*. We then match treat and control observations by using the nearest neighbor matching method without replacement and a maximum propensity score distance (caliper) of 0.01. Untabulated results show that the treatment and control groups present no significant differences in means of any of the covariates. We then re-estimate our regressions on matched samples. The results displayed in Table A2. of the Appendix confirm that our previous findings are not driven by systematic differences in the covariates between firms that rely heavily on bank debt and those that do not.[11]

Fourth, we re-estimate the moderating effect of bank debt (Equation [2]) by subsamples based on a firm's visibility and informational asymmetries, as provided by analysts' activity. These supplementary analyses further examine the underlying mechanisms driving the usefulness of bank debt as a signaling device. We consider two characteristics to divide our sample: on one hand, the degree of analyst coverage, which likely affects

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TABLE 6 | ESG performance and firm value: The signaling effect of bank debt by tangible collateral.

	Dependent variable: *TOBINQ*			
	(1)	**(2)**	**(3)**	**(4)**
Constant	44.59***	5.4887***	5.7085***	5.4597***
	(1.5736)	(1.5693)	(1.5708)	(1.5669)
ESG performance				
ESGeq	−0.1830***		−0.1148**	
	(0.0605)		(0.0524)	
ESGcomb		−0.0555		−0.0254
		(0.0487)		(0.0414)
Interaction effects with bank debt				
ESGeq × BANK_LIAB	0.5890***			
	(0.1198)			
ESGcomb × BANK_LIAB		0.4110***		
		(0.1063)		
ESGeq × BANK_TA			0.5915***	
			(0.1521)	
ESGcomb × BANK_TA				0.4565***
				(0.1337)
Type of debt				
BANK_LIAB	−1.8944***	−0.9362*		
	(0.5967)	(0.4927)		
BANK_TA			−1.7831**	−0.9162
			(0.7777)	(0.6272)
Interaction effects with tangibility				
ESGeq × BANK_LIAB × dumTANG	−0.2774***			
	(0.0432)			
ESGcomb × BANK_ LIAB × dumTANG		−0.2904***		
		(0.0446)		
ESGeq × BANK_TA × dumTANG			−0.3120***	
			(0.0640)	
ESGcomb × BANK_TA × dumTANG				−0.3448***
				(0.0664)
$\sum_1$	0.4059***	0.3555***	0.4766***	0.4311***
	(0.0806)	(0.0691)	(0.1201)	(0.1035)
$\sum_2$	0.1285*	0.0651	0.1647	0.0863
	(0.0752)	(0.0622)	(0.1135)	(0.0948)
Control variables				
SIZE	−0.0490	−0.0607	−0.0565	−0.0721
	(0.0975)	(0.0970)	(0.0975)	(0.0969)
TANG	−0.3593***	−0.3582***	−0.3629***	−0.3618***
	(0.0694)	(0.0694)	(0.0696)	(0.0695)
PROFIT	0.7730***	0.7665***	0.7845***	0.7778***
	(0.1292)	(0.1293)	(0.1298)	(0.1298)
CASH	6.0195***	5.9797***	6.0120***	5.9839***
	(0.4483)	(0.4485)	(0.4505)	(0.4505)
AGE	0.0088	0.0203	0.0274	0.0357
	(0.1702)	(0.1696)	(0.1708)	(0.1699)
Year dummies	Yes	Yes	Yes	Yes

(Continues)

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TABLE 6 | (Continued)

	Dependent variable: *TOBINQ*			
	(1)	**(2)**	**(3)**	**(4)**
No. Obs.	4184	4184	4180	4180
F-statistic	44.59***	44.41***	43.05***	43.25***

Note: This table shows the OLS fixed effects panel data results of the moderating effect of bank debt on the relationship between ESG performance and firm value, depending on the relevance of tangible collateral (Equation [3]). The dependent variable is a firm's market value (*TOBINQ*). The explanatory variable of ESG performance is measured either by the equally weighted average of the individual pillar scores (*ESGeq*) or the ESG combined score (*ESGcomb*). The type of debt measure included in the interaction effects of each regression is then entered individually: the ratio of bank debt to total liabilities and debt (*BANK_LIAB*) and the ratio of bank debt to the book value of assets (*BANK_TA*). *dumTANG* is a binary variable which equals 1 if a firm's asset tangibility (TANG) is above or equal to the yearly sample median, and 0 otherwise. $\sum_1$ denotes the linear effect which tests the joint significance of the ESG performance variable plus the interaction effect of ESG performance and leverage (either bank or non-bank debt leverage). $\sum_2$ denotes the linear effect which tests the joint significance of the combined effects of ESG performance, the two-way interaction between ESG performance and leverage and the three-way interaction between ESG performance, leverage and asset tangibility. Control variables: firm size (*SIZE*), a firm's asset tangibility (*TANG*), firm profitability (*PROFIT*), cash holdings (*CASH*), and firm age (*AGE*). All regressions control for year-fixed effects. The F-statistic evaluates the null hypothesis of no joint significance of the explanatory variables. Standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

the scope of the signaling effects in capital markets; and on the other, analyst forecast accuracy, which is an indirect indicator of the degree of informational asymmetries between managers and outsiders and determines the usefulness of corporate signaling practices.

Analyst coverage (*ANALYSTCOVER*) is measured by the natural logarithm of the number of financial analysts following a firm's stocks in the capital market (Harjoto and Jo 2015). Analyst accuracy is approximated by forecast errors. Following prior works (Benson et al. 2020; Best and Zhang 1993), we apply this formula to calculate the mean forecast error (*FORERROR*) for each firm i and year t:

$$FORERROR_{i,t} = \log\left(1 + \frac{|Mean(analyst_{forecast})_{i,t} - EPS_{i,t}|}{|Mean(analyst_{forecast})_{i,t}|}\right), \quad (4)$$

where $Mean(analyst\_forecast)_{i,t}$ is the mean value of earnings per share forecasts, and $EPS_{i,t}$ denotes actual earnings per share. We re-estimate the moderating effects of bank debt (Equation [2]) by subsamples of firm-year observations with above-median and below-median values for *ANALYSTCOVER* and *FORERROR*.[12] Table A3 of the Appendix displays these results. The positive moderating effect of bank debt on the relationship between ESG performance and a firm's value only keeps its economic and statistical significance across all regressions for the subsample of firm-year observations subject to greater analyst coverage. In these cases of stronger analyst coverage, *ceteris paribus*, an increase in bank debt leverage of 1 percentage point leads to the value effect of ESG performance becoming 0.37–0.66 percentage points larger. One reason is that closer analyst scrutiny increases company visibility in capital markets and, as a result, corporate signaling has a stronger impact on investors. Although analyst coverage reduces informational asymmetries in firms, this does not seem to impair the power of the bank debt signal. Our result may be explained on the grounds that third-party endorsements (such as analyst following) complement other corporate monitoring mechanisms, such as that provided by bank debt highlighted in our study. This finding ties in with earlier studies about the mutual reinforcement between congruent signals when they display congruence (Courtney et al. 2016; Fuente and Velasco 2022).[13] Moreover, the moderating effect of bank debt on the influence of ESG performance on a firm's value is more economically meaningful in the subsample with above-median values of *FORERROR*. More specifically, ceteris paribus, an increase in bank debt leverage of 1 percentage point makes the value effect of ESG performance increase by 0.33–0.47 percentage points. Thus, the underlying mechanism explaining the positive signaling role of debt stems from its potential to transmit relevant and credible information about the standard of companies' engagement with ESG. Therefore, such a signal effect should become more prominent in contexts with higher information asymmetries between insiders (managers) and outsider investors. These results persist when analyst accuracy is measured by median forecast errors.[14]

Finally, we conduct an additional sample-split analysis and re-run the estimations of the moderating effect of bank debt (Equation [2]) by subsamples of brown and green industries.[15] We implement two alternative approaches to identify brown sectors.[16] First, we follow Choi et al. (2020a, 2020b), who draw on the major emissions sectors provided by the Intergovernmental Panel on Climate Change (IPCC). Choi et al. (2020b) provide a list of high-emission industries matched with their 4-digit SIC codes and the Fama and French (1997) industry classification. Second, we identify brown sectors based on their environmental performance (Jung et al. 2023). We assign a firm-year observation to the brown industry subsample if it belongs to an industry whose yearly median performance in the environmental pillar is below the yearly sample median; otherwise, a firm-year observation enters the green industry subsample. Tables A4 and A5 in the Appendix tabulate these analyses. Findings with the alternative classifications for brown and green sectors run in the same direction. Consistent with our logic, the bank debt signal only retains statistical significance in the green industry subsample in all cases. In contrast, such a bank-debt signaling device does not generally work in brown industries, since the firm operates in an environment penalized by market participants, and the intrinsic nature of these sectors impairs the credibility of its ESG efforts.

7 | Conclusions

7.1 | Discussion

To date, the literature has provided mixed evidence on the value of ESG performance, with this study field as yet being unable to

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make further progress in explaining the diverse outcomes of companies embracing ESG performance. By applying the signaling theory lens to ESG strategy, the present study identifies a powerful new mechanism to signal the standard of ESG performance: bank debt financing. We challenge the widespread paradigm of 'doing well by doing good' by emphasizing a firm's need to provide investors with credible signals about the quality of the ESG practices in which they are involved. This seems to be an essential accompanying element to reap the benefits of this corporate strategy. Our study joins the live debate concerning the need to discern the genuineness of a firm's engagement in ESG (Cuypers et al. 2016; Fuente and Velasco 2024; Su et al. 2016).

Our results show that bank debt enhances the influence of ESG performance on a firm's value, making it more value-enhancing in companies that are more reliant on bank financing. This supports the view that bank loans play a certification role in the quality of the ESG strategy implemented by firms' borrowers, as a result of bank creditors' advantageous position in terms of gaining access to superior information about them. Our evidence extends earlier studies (e.g., Asimakopoulos et al. 2023; Newton et al. 2022) by theorizing and empirically testing alternative mechanisms that improve bank creditors' ability to legitimize the ESG actions of their borrowers. Such mechanisms are connected to some banks' intrinsic characteristics as creditors, such as their greater access to private information (Boot 2000; Fama 1985; James 1987; Newton et al. 2022; Petersen and Rajan 1994), which provides them with an advantage in terms of discerning the quality of the ESG investments compared to other types of creditors. Additionally, such a signaling role of debt weakens in the presence of higher tangible collateral in the borrowing companies, since bank creditors likely devote less attention to assessing ESG performance genuineness when securing their loans. This agrees with studies suggesting the superiority of tangible assets as collateral because the value of intangible assets is firm-specific and lower in the event of company liquidation (Balakrishnan and Fox 1993; David et al. 2008). Complementarily, additional robustness analyses suggest that the signaling role of debt is stronger in highly visible companies (i.e., those under greater analyst coverage) and companies with higher informational asymmetries (i.e., higher analyst forecast errors), while this signal disappears in brown sectors. This highlights that the usefulness of company signals depends on the visibility and informational context in which each firm conducts each business activity.

Overall, our investigation suggests that an ESG strategy per se is not enough to create value in companies but needs to be accompanied by certification devices that stimulate stakeholder perception of the genuineness of ESG-oriented practices. This echoes earlier works emphasizing the importance for firms of legitimating their ESG actions (Cuypers et al. 2016; Fuente and Velasco 2022, 2024; Godfrey et al. 2009), especially for outsiders. Our evidence supports the idea that bank debt financing can be an effective means of legitimizing ESG performance. In this way, this study further contributes to refining our understanding of identifying genuine ESG programs and revisiting the dissimilar association of this strategy with firm value across companies.

7.2 | Contributions and Theoretical Implications

This study makes several contributions. First, it responds to the call by recent works aimed at promoting a far-reaching understanding of the sources of value to emerge from ESG (Fuente et al. 2022; Wang et al. 2020) and the effectiveness of signals as complements for ESG scoring. It focuses on the need to discern its degree of genuineness, which is critical in this strategy's success (Fuente and Velasco 2024; McShane and Cunningham 2012). We add to previous studies identifying certain characteristics of ESG performance that can shape its credibility and trustworthiness, such as interdomain consistency (Wang and Choi 2013), misalignment between internal and external ESG actions (Hawn and Ioannou 2016), and unequal distribution of ESG performance across pillars (Fuente and Velasco 2024). Given the asymmetric information problems surrounding ESG performance genuineness, bank debtors' superior incentives and ability to monitor their borrowers' decisions grant signaling power. Our evidence confirms that not only achieving superior ESG performance but also providing stakeholders and outsiders with credible signals about its genuineness is important. Both the standard of ESG performance and a firm's signaling efforts might explain why the relationship between ESG performance and firm value is not universal across companies.

Second, we bring together capital structure and ESG studies. Bukit et al. (2018) examine how debt monitoring can interact with environmental performance in its influence on a firm's value. Other works document that ESG engagement influences a firm's capital structure by reducing the cost of equity (El Ghoul et al. 2011; Sharfman and Fernando 2008), decreasing the cost of debt (Francis et al. 2018; Goss and Roberts 2011), shortening debt maturity (Benlemlih 2017), or leading to financing redistribution across debt sources (Asimakopoulos et al. 2023). Our study represents a step forward by unveiling the influence of a firm's debt composition on the value of ESG. We advance recent studies in this regard, such as that of Asimakopoulos et al. (2023), who focus on the event of a firm being rated in ESG by exploring the mechanisms through which a firm's ESG scoring can impact its value differently depending on its debt structure composition (in particular, its reliance on bank debt). We provide valuable insights on the vital need to match ESG performance with an adequate capital structure. Signaling theory offers a fresh perspective on how borrowing firms can take advantage of the more informative and long-term relationships they forge with their bank creditors, since they convey information about unobservable features associated with ESG performance, such as their degree of genuineness, and can have a greater impact on their stakeholders.

7.3 | Managerial Implications

Our investigation also carries relevant managerial implications/recommendations for business practice. We recommend that managers provide outsiders with credible and visible signals. Such signals can help assess the quality of a firm's ESG performance and, therefore, improve the value effect of this strategy. Implementing ESG actions per se does not seem to convey value benefits directly in all cases because outsiders are

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becoming more aware of the dissimilar sincerity of firms' ESG strategy. Signals may help firm managers convey their genuine commitment to ESG policies and prevent stakeholders from casting doubt on their potential opportunistic interest. Additionally, our research shows managers the importance of preserving and strengthening their borrowing relationships with creditors, as their continuity over time could be considered a sign of good management. Likewise, the decision concerning which financing source a firm should rely on to finance ESG initiatives is by no means trivial. Creditors' financing conditions and their degree of access to private information can turn their granting of credit into an indirect signal of a creditor's trust in the standard of ESG performance. Consequently, managers should pay particular attention to which financing options they choose for their firms, as this may have far-reaching implications for the success of their investment strategies.

7.4 | Limitations and Future Lines of Research

Our research presents several limitations that open up avenues for future research. First, we account for a single signaling device, as represented by the relevance of bank debt in each firm. Further contributions might seek to identify additional signaling mechanisms on the relative standard of ESG performance, such as those connected with the composition and operation of the board of directors, as well as with owners' stewardship and time horizon (Kavadis and Thomsen 2023). Second, our analysis is restricted to the U.S. context and might be replicated on an international sample of companies to test the consistency of our results and further analyse the influence of legal and institutional factors, such as the protection of creditors' rights or bank concentration. Similarly, since our work focuses on a noncrisis time period,[17] future studies should investigate potential time trends in the ESG performance–firm value relationship (comparing crisis and noncrisis periods) and evaluate whether the signaling need for the quality of a firm's ESG performance operates in the same way depending on market sentiment. Accounting for more granular data on ESG within pillars and drawing on data on ESG rating agencies would also be insightful. This should be done in the future once ESG disclosure has been harmonized to a greater extent, since recent works alert to the 'rater effect' that might bias results (Berg et al. 2022). Controlling for further ESG characteristics of each firm, such as the date since when the firm became ESG rated, could also be useful. Its track record in ESG might also be informative about its ESG strategy, as suggested by recent works (Asimakopoulos et al. 2023). Additionally, accounting for alternative proxies for a firm's market performance will be interesting. Third, whilst we use the type of ESG data that is widely accepted in academia for measuring ESG practices, moving beyond these summary metrics to incorporate explicit information on wrongful business conduct (Fiaschi et al. 2020) might provide a further attractive test for the signaling efficiency of mechanisms such as bank debt.

Finally, our study only distinguishes between two types of debt: bank and non-bank debt. We encourage future works to explore each firm's optimal level of leverage as well as more granular types of debt: namely, bank debt, such as revolving credit and term loans; and non-bank debt, debt with covenants and debt with different maturities). Accounting for how the length of the borrowing relationship and the lending bank's characteristics (e.g., bank size, bank reputation, and bank engagement in ESG) might also, per se, have further signaling power about the quality of a firm's engagement in ESG actions may also be enlightening. The bank debt signal may acquire greater intensity in certain contexts over others. Therefore, further work might overcome this limitation by, for example, accounting for institutional characteristics. Additionally, evaluating whether the power of the signaling devices of ESG genuineness might change based on the contextual circumstances in which firms operate, such as economic uncertainty or crisis shocks,[18] would be useful. Lins et al. (2017) suggest that stakeholders display greater awareness of a firm's ESG initiatives during crisis shocks. Greater stakeholder sensitivity to those actions could also lead to a shift in the signaling mechanisms they pay greater attention to and consider as more reliable in such adverse contexts. Moreover, exploring the role of informational asymmetries in the signaling and ESG domain in greater depth may also provide useful insights. To achieve this, studies might look at alternative specific models in this regard, such as those based on the intensity of private information trading using the volume-return coefficient (C2), as proposed in Llorente et al. (2002).

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

Data cannot be made publicly available due to licence restrictions from the commercial database used

Endnotes

[1] Complementarily, a firm's ESG performance can also be particularly useful for bank borrowing. Better ESG performance alleviates a firm's litigation risk exposure perceived by its bank creditors, which in turn can decrease borrowing costs and bank monitoring, thus inducing firms to rely on bank debt to a greater extent (Baker et al. 2024). We acknowledge an anonymous reviewer for raising this interesting alternative perspective about why the joint effect of ESG performance and bank debt leverage can be beneficial for companies.

[2] This is common practice in previous research (e.g., Eccles et al. 2014; Lins et al. 2017).

[3] To avoid falling into the dummy variable trap, in the year fixed effects, we enter the total number of categories minus one; therefore, 8 year dummies.

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[4]Our results prove to be robust when relying on an alternative proxy for a firm's value, as defined by the sum of market capitalization, preferred stock and total debt, divided by the book value of total assets (Lo and Sheu 2007). These results are available upon request.

[5]We test between fixed and random effects within a panel data by conducting the Hausman (1978) test. The Hausman test statistic is statistically significant beyond the 1% level (170.71, $p < 0.001$), which indicates that fixed-effect estimations are preferable to random-effect ones.

[6]The variance inflation factors (VIF) are below the acceptable maximum threshold of 10 (Chatterjee and Hadi 2006).

[7]For robustness purposes, we re-estimate the 2SLS results by implementing alternative instrumental variables for ESG performance: on one hand, the median ESG score of a firm's industry peers and the median ESG score in a firm's state, and on the other hand, the percentage of firms in the industry which have ESG-based compensation for managers, and the average ESG score in a firm's state. Again, the exogeneity hypothesis cannot be rejected. These results are available upon request.

[8]In further analyses, we re-estimate this equation by splitting the sample into two groups: firm-year observations with above-mean leverage, and firm-year observations with below-mean leverage, taking the yearly industry average as a reference in both cases. The interaction effect of ESG performance and bank debt loses statistical significance when *ESGeq* is used. Results are available upon request. This finding echoes the fact that overborrowed firms may struggle to exploit the signaling benefits of bank debt as a result of their more restricted ability to further extend their borrowing. We thank an anonymous reviewer for this insight.

[9]We thank an anonymous reviewer for proposing this robustness analysis. These results are available upon request.

[10]We thank an anonymous reviewer for proposing this robustness analysis.

[11]These results are robust to several matching specifications, including using a logit instead of a probit estimation, fixed effects or a wider caliper distance of 0.05.

[12]We performed an F-test to determine whether the coefficients estimated by OLS fixed effects are statistically different between the two subsamples. As regards our coefficients of interest (namely, those associated with ESG performance and its interaction effect with bank debt), their difference between median-based subsamples displays joint statistical significance for the analyses based on *ANALYSTCOVER* ($p < 0.05$). When a more stringent criterion to split the subsamples is applied – such as that based on comparing the top and bottom terciles of *ANALYSTCOVER* and *FORERROR* – the coefficient difference gains joint statistical significance in all cases ($p < 0.05$), except the regression of *ESGcomb*, when the sample is split based on *FORERROR*. These results are available upon request. We thank an anonymous reviewer for this suggestion.

[13]We thank an anonymous reviewer for encouraging us to clarify this point and reconcile it with the fact that analyst activity also curbs informational asymmetries in companies.

[14]Results are available upon request.

[15]We thank an anonymous reviewer for suggesting this robustness check.

[16]The distribution of firm-year observations across green and brown industries holds similar when using the two alternative approaches. Using the IPCC classification, 52.30% of observations belong to green industries and 47.70% to brown industries. Based on the environmental performance, such distributions equal 52.42% and 47.58%, respectively.

[17]Our sample spans 2010–2018 to avoid potential crisis effects (e.g. the 2008–2009 financial crisis and COVID-19 crisis), which may introduce noise in our findings. The earlier literature suggests that ESG strategies pay off particularly under crisis shocks because stakeholders simply reward all of them to a greater extent as a result of their market sentiment (e.g. Amiraslani et al. 2023; Lins et al. 2017). Accordingly, such crisis periods have usually been the subject of separate study. We thank an anonymous reviewer for encouraging us to clarify this issue.

[18]We thank the anonymous reviewers for providing insights about all these future research paths.

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Appendix

TABLE A1 | ESG performance, firm value, and debt type (bank debt vs. non-bank debt): Robustness analyses by pillars of ESG.

	Dependent variable: *TOBINQ*								
	Panel A: Moderating effects of bank debt			Panel B: Moderating effects of nonbank debt			Panel C: All moderating effects included (bank-debt and non-bank debt)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Constant	5.2249***	5.4571***	5.4616***	4.7004***	5.0692***	4.7862***	4.9275***	5.1607***	5.0095***
	(1.5752)	(1.5735)	(1.5708)	(1.5737)	(1.5698)	(1.5748)	(1.5868)	(1.5906)	(1.5911)
ESG performance									
ENV	−0.1102***			−0.0321			−0.1162***		
	(0.0413)			(0.0280)			(0.0437)		
SOC		0.0728			0.1111***			0.0838	
		(0.0446)			(0.0296)			(0.0837)	
GOV			−0.1051***			−0.0434*			−0.0993***
			(0.0327)			(0.0219)			(0.0344)
Interaction effects with bank debt									
ENV × BANK_TA	0.2579**						0.2905**		
	(0.1135)						(0.1157)		
SOC × BANK_TA		0.1205						0.0968	
		(0.1282)						(0.0967)	
GOV × BANK_TA			0.2288**						0.2092**
			(0.0975)						(0.0992)
Interaction effects with non-bank debt									
ENV × NONBANK_TA				−0.1741			−0.0887		
				(0.2970)			(0.2987)		
SOC × NONBANK_TA					−0.3455			−0.3180	
					(0.3536)			(0.3559)	
GOV × NONBANK_TA						−0.3609			−0.3134
						(0.2804)			(0.2812)
$\sum_1$	0.1477	0.1933**	0.1237*				0.1743**	0.1805*	0.1098
	(0.0858)	(0.0968)	(0.0747)				(0.0868)	(0.0987)	(0.0759)
$\sum_2$				−0.2062	−0.2344	−0.4043	−0.2049	−0.2342	−0.4127
				(0.2893)	(0.3437)	(0.2734)	(0.2892)	(0.3449)	(0.2733)
Type of debt									
BANK_TA	−1.0654	−0.4804	−1.1083*				−1.4101**	−0.5396	−1.2209**
	(0.6068)	(0.6954)	(0.6035)				(0.6257)	(0.7171)	(0.6215)

(Continues)

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TABLE A1 | (Continued)

	Dependent variable: *TOBINQ*								
	Panel A: Moderating effects of bank debt			**Panel B: Moderating effects of nonbank debt**			**Panel C: All moderating effects included (bank-debt and non-bank debt)**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
NONBANK_TA				0.4784	1.3523	1.4938	0.0608	1.1569	1.1697
				(0.4784)	(1.9967)	(1.6667)	(1.7119)	(2.0347)	(1.6814)
Control variables									
SIZE	−0.0330	−0.1024	−0.0491	−0.0309	−0.0963	−0.0376	−0.0142	−0.0903	−0.0252
	(0.0979)	(0.0978)	(0.0972)	(0.0973)	(0.0973)	(0.0967)	(0.0993)	(0.0994)	(0.0987)
TANG	−0.3822***	−0.3735***	−0.3816***	−0.3884***	−0.3792***	−0.3909***	−0.3872***	−0.3779***	−0.3873***
	(0.0697)	(0.0696)	(0.0697)	(0.0702)	(0.0701)	(0.0701)	(0.0702)	(0.0701)	(0.0701)
PROFIT	0.8025***	0.8052***	0.8066***	0.8160***	0.8237***	0.8156***	0.8107***	0.8172***	0.8172***
	(0.1301)	(0.1299)	(0.1302)	(0.1307)	(0.1304)	(0.1306)	(0.1322)	(0.1320)	(0.1322)
CASH	6.0375***	6.0463***	6.0915***	6.1974***	6.1968***	6.2466***	6.1603***	6.1878***	6.2492***
	(0.4521)	(0.4513)	(0.4518)	(0.4547)	(0.4540)	(0.4550)	(0.4549)	(0.4545)	(0.4550)
AGE	0.0484	0.0278	0.0682	0.0926	0.0639	0.1261	0.0714	0.0556	0.1003
	(0.1706)	(0.1706)	(0.1714)	(0.1724)	(0.1722)	(0.1731)	(0.1726)	(0.1726)	(0.1734)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	4180	4180	4180	4116	4116	4116	4116	4116	4116
F-statistic	44.00***	44.68***	44.24***	43.58***	44.50***	44.05***	39.15***	39.57***	39.44***

Note: This table shows the OLS fixed effects panel data results of the extended model of the moderating effect of debt on the relationship between ESG performance by pillars and firm value. Panel A estimates the moderating effect of bank debt (Equation [2]). Panel B presents robustness analyses by alternatively estimating the moderating effect of non-bank debt. Panel C includes all previous moderating effects (those with bank debt and with non-bank debt) altogether in the same regression. The dependent variable is a firm's market value (*TOBINQ*). The explanatory variable of ESG performance by individual pillars: the scores in the environmental (*ENV*), social (*SOC*), and governance (*GOV*) pillars. The type of debt measure included in the interaction effects of each regression is then entered individually: the ratio of bank debt to the book value of assets (*BANK_TA*) and the ratio of non-bank debt to the book value of assets (*NONBANK_TA*). $\sum_1$ denotes the linear effect which tests the joint significance of the ESG performance variable plus the interaction effect of ESG performance and bank debt leverage. $\sum_2$ represents the linear effect which tests the joint significance of the ESG performance variable plus the interaction effect of ESG performance and non-bank debt leverage. Control variables: firm size (*SIZE*), a firm's asset tangibility (*TANG*), firm profitability (*PROFIT*), cash holdings (*CASH*), and firm age (*AGE*). All regressions control for year-fixed effects. The F-statistic evaluates the null hypothesis of no joint significance of the explanatory variables. Standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

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TABLE A2 | Additional robustness results implementing the PSM procedure.

	Dependent variable: *TOBINQ*					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Constant	8.2119***	8.1935***	8.4407***	8.3367***	8.7319***	8.6397***
	(2.0080)	(2.0071)	(2.0181)	(2.0185)	(2.0152)	(2.0142)
ESG performance						
ESGeq	−0.0160		−0.1288**		−0.1346**	
	(0.0431)		(0.0642)		(0.0641)	
ESGcomb		0.0383		−0.0396		-0.0409
		(0.0269)		(0.0508)		(0.0506)
Interaction effects with bank debt						
ESGeq × BANK_TA			0.4362**		0.5945***	
			(0.1837)		(0.1894)	
ESGcomb × BANK_TA				0.2894*		0.4687***
				(0.1601)		(0.1669)
Type of debt						
BANK_TA			−2.5831***	−1.6618**	−2.5630***	−1.6488**
			(1.0028)	(0.8049)	(1.0004)	(0.8025)
Interaction effects with tangibility						
ESGeq × BANK_TA × dumTANG					−0.2583***	
					(0.0782)	
ESGcomb × BANK_TA × dumTANG						−0.2949***
						(0.0802)
Control variables						
SIZE	−0.2642**	−0.2762**	−0.2291*	−0.2550**	−0.2423*	−0.2713**
	(0.1240)	(0.1232)	(0.1252)	(0.1244)	(0.1250)	(0.1241)
TANG	−0.4556***	−0.4523***	−0.4583***	−0.4514***	−0.4438***	−0.4400***
	(0.1033)	(0.1033)	(0.1032)	(0.1032)	(0.1030)	(0.1030)
PROFIT	1.1297***	1.1312***	1.0883***	1.0960***	1.0785***	1.0717***
	(0.1995)	(0.1994)	(0.2005)	(0.2005)	(0.2001)	(0.1999)
CASH	6.0696***	6.0527***	6.0418***	6.0179***	5.9785***	5.9631***
	(0.5658)	(0.5656)	(0.5654)	(0.5658)	(0.5644)	(0.5643)
AGE	0.1075	0.0880	0.0846	0.0860	0.0697	0.0762
	(0.2331)	(0.2330)	(0.2331)	(0.2329)	(0.2326)	(0.2321)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	2,976	2976	2976	2976	2976	2976
F-statistic	35.84***	36.01***	31.85***	31.81***	30.76***	30.91***

Note: This table shows the robustness analyses of our main findings through the PSM procedure. As the treatment group, we consider firms with above-median bank debt ratios, while firms displaying below-median levels of bank debt ratios are considered the control group. The explanatory variable of ESG performance is measured either by the equally weighted average of the individual pillar scores (*ESGeq*) or the ESG combined score (*ESGcomb*). The type of debt measure included in the interaction effects of each regression is then entered individually: the ratio of bank debt to the book value of assets (*BANK_TA*). *dumTANG* captures the relevance of tangible collateral and is a binary variable that equals 1 if a firm's asset tangibility (TANG) is above or equal to the yearly sample median, and zero otherwise. Control variables: firm size (*SIZE*), a firm's asset tangibility (*ASSET*), firm profitability (*PROFIT*), cash holdings (*CASH*), and firm age (*AGE*). All regressions control for year-fixed effects. The F-statistic evaluates the null hypothesis of no joint significance of the explanatory variables. Standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

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TABLE A3 | ESG performance and firm value: The signaling role of bank debt and analyst activity.

Dependent variable: *TOBINQ*								
	PANEL A: Subsamples by analyst coverage				**PANEL B: Subsamples by the mean analysts' forecast error**			
	Above-median *ANALYSTCOVER* subsample		**Below-median *ANALYSTCOVER* subsample**		**Above-median *FORERROR* subsample**		**Below-median *FORERROR* subsample**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Constant	10.4223***	9.8448***	−3.3301	−3.7291	5.2505**	4.7647**	10.8096***	10.1368***
	(2.2902)	(2.2941)	(2.6998)	(2.6949)	(2.3341)	(2.3253)	(2.6342)	(2.6319)
Overall ESG								
ESGeq	−0.3802***		0.1659		−0.1948*		−0.2169***	
	(0.0805)		(0.1038)		(0.1086)		(0.0831)	
ESGcomb		−0.1734***		0.2276***		−0.0780		-0.0436
		(0.0610)		(0.0843)		(0.0909)		(0.0617)
Interaction effects with bank debt								
ESGeq × BANK_LIAB	0.6658***		−0.2028		0.4735**		0.4358***	
	(0.1551)		(0.1959)		(0.1941)		(0.1639)	
ESGcomb × BANK_LIAB		0.3731***		−0.3501**		0.3318*		0.1878
		(0.1281)		(0.1720)		(0.1792)		(0.1321)
BANK_LIAB	−3.5055***	−1.7201**	0.3453	0.8799	−1.8621*	−1.0641	−1.9741**	−0.6882
	(0.8990)	(0.7006)	(0.9055)	(0.7726)	(0.9697)	(0.8279)	(0.8759)	(0.6872)
∑	0.2856***	0.1997**	-0.0369	-0.1225	0.2787**	0.2538**	0.2189**	0.1442*
	(0.1017)	(0.0781)	(0.1235)	(0.1051)	(0.1260)	(0.1051)	(0.1033)	(0.0810)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Obs.	2111	2111	2012	2012	1859	1859	2252	2252
F-statistic	24.85***	23.75***	21.17***	21.56***	17.27***	17.34***	28.88***	28.58***

Note: This table shows the robustness analyses (OLS fixed effects panel data) of the moderating effect of bank debt on the relationship between ESG performance and firm value (Equation [2]) by subsamples of *ANALYSTCOVER* (the natural logarithm of the number of financial analysts who follow a firm's stock) and *FORERROR* (mean analyst forecast error). The explanatory variable of ESG performance is measured either by the equally weighted average of the individual pillar scores (*ESGeq*) or the ESG combined score (*ESGcomb*). The type of debt measure included in the interaction effects of each regression is then entered individually: the ratio of bank debt to total liabilities and debt (*BANK_LIAB*). ∑ denotes the linear effect which tests the joint significance of the ESG performance variable plus the interaction effect of ESG performance and bank debt leverage (*BANK_LIAB*). Control variables: firm size (*SIZE*), a firm's asset tangibility (*ASSET*), firm profitability (*PROFIT*), cash holdings (*CASH*), and firm age (*AGE*). All regressions control for year-fixed effects. The F-statistic evaluates the null hypothesis of no joint significance of the explanatory variables. Standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

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TABLE A4 | ESG performance and firm value: The signaling role of bank debt by brown and green industries – Classification based on the IPCC.

	Dependent variable: *TOBINQ*			
	Panel A		Panel B	
	Brown industries subsample	**Green industries subsample**	**Brown industries subsample**	**Green industries subsample**
Constant	6.5090***	2.8346	6.1307***	2.4077
	(6.5089)	(2.9930)	(1.7896)	(2.9699)
Overall ESG				
ESGeq	−0.1919***	−0.1437		
	(0.0744)	(0.0993)		
ESGComb			−0.0115	−0.0533
			(0.0625)	(0.0765)
Interaction effects with bank debt				
ESGeq × BANK_LIAB	0.3639**	0.3540*		
	(0.1446)	(0.1835)		
ESGComb × BANK_LIAB			0.0597	0.2796*
			(0.1312)	(0.1548)
BANK_LIAB	−1.4479*	−2.1819**	0.0212	−1.7099**
	(0.7487)	(0.9593)	(0.6365)	(0.7702)
∑	0.1720*	0.2103*	0.0482	0.2263**
	(0.0936)	(0.1181)	(0.0798)	(0.0939)
Control variables				
SIZE	−0.1546	0.3239*	−0.1883*	0.3120*
	(0.1117)	(0.1845)	(0.1109)	(0.1844)
TANG	−0.3356***	−1.5322***	−0.3321***	−1.5135***
	(0.0671)	(0.2946)	(0.0672)	(0.2942)
PROFIT	0.5443***	4.4399***	0.5505***	4.3994***
	(0.1258)	(0.5288)	(0.1260)	(0.5286)
CASH	5.9355***	4.6343***	5.9012***	4.5587***
	(0.5087)	(0.8503)	(0.5097)	(0.8492)
AGE	0.1764	−0.4611	0.1788	−0.4198
	(0.1929)	(0.3181)	(0.1927)	(0.3158)
Year dummies	Yes	Yes	Yes	Yes
No. Obs.	2443	1741	2443	1741
F-statistic	32.90***	21.83***	32.37***	22.09***

Note: This table shows the robustness analyses (OLS fixed effects panel data) of the moderating effect of bank debt on the relationship between ESG performance and firm value (Equation [2]) by subsamples depending on the type of industry: sample firm-year observations are split into brown and green industries based on the major emissions sectors provided by the Intergovernmental Panel on Climate Change (IPCC). The explanatory variable of ESG performance is measured either by the equally weighted average of the individual pillar scores (*ESGeq*) or the ESG combined score (*ESGcomb*). The type of debt measure included in the interaction effects of each regression is then entered individually: the ratio of bank debt to total liabilities and debt (*BANK_LIAB*). ∑ denotes the linear effect, which tests the joint significance of the ESG performance variable plus the interaction effect of ESG performance and bank debt leverage (*BANK_LIAB*). Control variables: firm size (*SIZE*), a firm's asset tangibility (*ASSET*), firm profitability (*PROFIT*), cash holdings (*CASH*), and firm age (*AGE*). All regressions control for year-fixed effects. The F-statistic evaluates the null hypothesis of no joint significance of the explanatory variables. Standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

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TABLE A5 | ESG performance and firm value: The signaling role of bank debt by brown and green industries – Classification based on the environmental pillar score.

	Dependent variable: *TOBINQ*			
	Panel A		Panel B	
	Brown industries subsample	**Green industries subsample**	**Brown industries subsample**	**Green industries subsample**
Constant	9.4497***	2.5131	9.3934***	1.5325
	(2.4173)	(2.4226)	(2.4106)	(2.4015)
Overall ESG				
ESGeq	0.0455	−0.2532***		
	(0.1028)	(0.0871)		
ESGComb			0.1303	−0.1133*
			(0.0796)	(0.0685)
Interaction effects with bank debt				
ESGeq × BANK_LIAB	−0.1232	0.5586***		
	(0.1905)	(0.1710)		
ESGComb × BANK_LIAB			−0.1718	0.2906**
			(0.1607)	(0.1453)
BANK_LIAB	0.5075	−2.8859***	0.6356	−1.3311*
	(0.9158)	(0.9461)	(0.7509)	(0.7448)
∑	−0.0777	0.3054***	−0.0415	0.1773**
	(0.1264)	(0.1093)	(0.0998)	(0.0876)
Control variables				
SIZE	−0.4398***	0.2997**	−0.4531***	0.3108**
	(0.1540)	(0.1449)	(0.1516)	(0.1447)
TANG	−0.3817***	−0.5703***	−0.3665***	−0.5707***
	(0.1073)	(0.1104)	(0.1070)	(0.1106)
PROFIT	1.3956***	1.2637***	1.4003***	1.2809***
	(0.2676)	(0.2245)	(0.2672)	(0.2248)
CASH	6.2519***	6.0061***	6.2021***	5.9835***
	(0.7107)	(0.6338)	(0.7100)	(0.6353)
AGE	0.3264	−0.2715	0.2989	−0.2670
	(0.2527)	(0.2674)	(0.2496)	(0.2668)
Year dummies	Yes	Yes	Yes	Yes
No. Obs.	1786	2398	1786	2398
F-statistic	15.08***	29.86***	15.29***	29.33***

Note: This table shows the robustness analyses (OLS fixed effects panel data) of the moderating effect of bank debt on the relationship between ESG performance and firm value (Equation [2]) by subsamples depending on the type of industry: sample firm-year observations are split into brown and green industries based on the environmental pillar score. The explanatory variable of ESG performance is measured either by the equally weighted average of the individual pillar scores (*ESGeq*) or the ESG combined score (*ESGcomb*). The type of debt measure included in the interaction effects of each regression is then entered individually: the ratio of bank debt to total liabilities and debt (*BANK_LIAB*). ∑ denotes the linear effect which tests the joint significance of the ESG performance variable plus the interaction effect of ESG performance and bank debt leverage (*BANK_LIAB*). Control variables: firm size (*SIZE*), a firm's asset tangibility (*ASSET*), firm profitability (*PROFIT*), cash holdings (*CASH*), and firm age (*AGE*). All regressions control for year-fixed effects. The F-statistic evaluates the null hypothesis of no joint significance of the explanatory variables. Standard errors are in parentheses. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

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