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*Do Firms with High ESG Scores Have Lower Debt?
A Cross-Country and Temporal Analysis*

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Abstract

Theoretical background: The increasing emphasis on environmental, social, and governance factors is demonstrably influencing capital markets and business environment. A significant body of research has explored the impact of implementing ESG practices on both the cost of equity and the cost of debt. However, the research on the relationship between ESG and firm's leverage remains inconclusive.

Purpose of the article: This paper aims to examine how environmental, societal and governance performance impacts capital structure in corporate firms. The hypothesis is that firms with stronger ESG performance exhibit lower financial leverage.

Research methods: A panel regression model is employed on a sample of 34,513 firm-year observations from 9,560 firms across 32 countries spanning the period 2017–2022. Panel regression is used to analyze the entire sample and then investigate cross-country and temporal (pre- and post-COVID-19 outbreak) differences.

Main findings: There is a statistically significant negative relation between ESG rating and book leverage for the whole sample. However, the analysis revealed heterogeneity across countries and a temporal shift in the relationship between ESG score and capital structure. Disaggregating ESG into its environmental, social, and governance pillars yielded results consistent with the overall ESG score.

Introduction

In today's globalized business environment companies are increasingly facing pressure to consider not only their financial performance but also environmental, social, and governance (ESG) practices. Stakeholders, including investors, customers, and employees, are demanding greater transparency and accountability regarding firm's impact on the environment, its social responsibility, and its adherence to ethical governance principles. Sustainability has become a topic of rising importance across the world. The increasing emphasis on ESG factors is demonstrably influencing capital markets and the financial sector. This trend is reflected in the growing integration of ESG considerations into investment strategies. One forecast projects that ESG-focused investments will reach USD 33.9 trillion by 2026 (PwC, 2022). This significant influx of capital into sustainable assets underscores the growing importance of ESG performance for companies. As of 2020, 88% of publicly traded companies, 79% of venture and private equity-backed companies, and 67% of privately-owned companies had ESG initiatives in place.¹

The increasing focus on ESG practices has spurred a surge of research investigating the relationship between ESG performance and both company performance (e.g., profitability, growth) and risk (e.g., financial, operational). While these studies have yielded valuable insights, the impact of ESG on a firm's capital structure remains a topic of ongoing exploration. A significant body of research has explored the impact of implementing ESG practices on both the cost of equity and the cost of debt (e.g., Eliwa et al., 2021; Ferris et al., 2017; Ge & Lui, 2015; Matthiesen & Salzman, 2017). The research on the relationship between ESG and firm's leverage remains inconclusive. Some studies suggest a negative relationship, indicating that companies with strong ESG performance tend to have lower leverage (Zahid et al., 2023), while others suggest a more nuanced picture (Adeneye et al., 2023).

While the relationship between ESG performance and corporate leverage has been explored in prior studies, the existing evidence remains limited and often inconclusive, particularly within cross-country settings. Much of the literature focuses on asset pricing or the cost of capital, leaving the strategic financial decisions less examined. Furthermore, while recent studies have begun to explore the impact of systemic shocks on corporate finance, there is a lack of comprehensive empirical research that explicitly distinguishes between pre- and post-COVID-19 subperiods. This study addresses these gaps by utilizing a large multi-country dataset to simultaneously analyze regional heterogeneity and temporal shifts. This analysis provides systematic evidence of how ESG acts as a resilience factor during periods

¹ Based on survey responses from 1,250 management and senior level executives in the US, UK, France and Germany, all of whom work at companies with 500 or more employees. Source: Navex Global report, <https://www.navex.com/en-us/blog/article/environmental-social-governance-esg-global-survey-findings>

of heightened uncertainty, thereby refining the empirical understanding of ESG's role in modern corporate finance.

This paper aims to contribute to this ongoing discussion by investigating the relationship between ESG score and capital structure. The analysis examines how ESG performance impacts capital structure in corporate firms. It is hypothesized that firms with stronger ESG performance exhibit lower financial leverage. To test this hypothesis, a sample of 34,513 firm-year observations from 9,560 firms across 32 countries is employed spanning the period 2017 to 2022. Panel regressions are utilized to analyze the entire sample and then investigate cross-country and temporal (pre- and post-COVID-19 outbreak) differences.

The remainder of the paper is organized as follows. Section 2 reviews literature on capital structure and ESG. Section 3 introduces research methodology and data description. Section 4 provides estimation results, and section 5 – discussion. Section 6 concludes the paper.

Literature review

Capital structure background

Numerous studies have explored the issue of capital structure since the seminal work of Modigliani and Miller (1958), who proposed that capital structure is irrelevant to firm value under a perfect capital market conditions. Several theories have been proposed, which attempt to explain the factors that influence a firm's financial decision-making process. The trade-off theory indicates that firms compare the costs of financial distress with the expected tax benefits associated with debt when shaping capital structure (Baxter, 1967; Kraus & Litzenberger, 1973). When these costs and benefits are balanced, it results in an optimal capital structure. The pecking order theory posits that firms follow a certain order when selecting their financing sources (Myers, 1984; Myers & Majluf, 1984). This prioritization is derived from the information asymmetry between capital suppliers and management. Firms do not strive for an optimal capital structure, when faced with the need for additional funds the hierarchy of financing sources is as follows: retained earnings, debt, and equity. The information asymmetry between capital suppliers and management also gives rise to the signaling theory, which posits that managers' choices regarding capital structure can convey valuable information to the market (Ross, 1977). According to this theory, the capital structure decisions made by managers can serve as a signal to investors and other market participants about the firm's prospects and risk profile, thereby influencing their investment decisions.

ESG and capital structure

Several studies have focused on the relationship between ESG and firm's performance (e.g., Albitar et al., 2020; Alshehhi et al., 2018; Aydoğmuş et al., 2022; D'Amato et al., 2023; Whelan et al., 2021), as well as risk (Brzeszczyński et al., 2021; He et al., 2023; Izcan & Bektas, 2022; Sassen et al., 2016; Sciarelli et al., 2024). A significant body of research has explored the impact of implementing ESG practices on both the cost of equity and the cost of debt. There is no clear agreement on how sustainability performance affects the cost of capital. Cantino et al. (2017) suggest that sustainable firms benefit from a decreased information asymmetry and have better access to equity financing, thus, most research points to negative relationship between ESG performance and cost of equity (Chen et al., 2023; El Ghouli et al., 2018; Galluzzi et al., 2023; Piechocka-Kałużna et al., 2021) and negative relationship between ESG performance and cost of debt (Apergis et al., 2022; Du et al., 2017; Eliwa et al., 2021).

However, a portion of scientific literature shows mixed results. Gonçalves et al. (2022) discover that firms with better ESG score tend to have a lower cost of equity, but the relationship is positive when it comes to the cost of debt. Priem and Gabelone (2022) find evidence that companies with higher ESG score have a lower cost of capital, but this relationship holds only for firms domiciled in countries having a weaker legal environment. Furthermore ESG score does not seem to have a significant impact on the cost of equity, although it has a significant positive impact on the cost of debt. Humphrey et al. (2012) find no difference in the cost of capital of firms with high and low performance ratings. Gjergji et al. (2021) reveal that small and medium firms can expect an increase in the cost of capital as a result of environmental disclosure. Yet this pattern is reversed when the firm is a family business.

Feldhütter and Pedersen (2025) generalized MM model to an economy where investors care about ESG and proposed ESG-MM theorem, which means that issuing low-yielding green bonds does not lower the overall cost of capital because it makes the issuer's other securities browner. Thus the overall cost of capital should only depend on the overall cash flows and overall emissions, irrespective of capital structure. However they provide empirical evidence against this theorem, implying that firms can exploit inconsistent ESG attribution.

The current research on the relationship between ESG and corporate leverage is limited. Asimakopoulos et al. (2023) find that when firms become ESG rated they tend to reduce their target market and book leverage. Furthermore, ESG rated firms redistribute their financing sources from public debt to private debt. A high ESG score can serve as a signal to reduce information asymmetry between firms and investors (Cheng et al., 2014). This means that firms with strong ESG performance may have an easier time accessing capital and facing lower capital constraints, as investors have more confidence in the firm's ability to manage risks and make responsible decisions. As indicated by Zahid et al. (2023), firms with better ESG performance have improved access to stock markets and reduced reliance on debt funding, as

their ESG performance is inversely correlated with debt financing. The more socially responsible firm is, the more it relies on equity financing compared to debt financing (Pijourlet, 2015), which leads to lower debt-to-equity ratio (Girerd-Potin et al., 2011; Hsu et al., 2023).

In contrast, Adeneye et al. (2023) discover a positive relationship between ESG scores and book leverage in ASEAN firms, as ESG practices seem to reduce the cost of capital and increase access to debt financing for ESG-related activities. However, their findings also indicate a negative relationship between ESG scores and market leverage.

More recent evidence underscores the nuanced nature of the relationship between ESG and capital structure. Birindelli et al. (2025) demonstrate that the impact of ESG on leverage is moderated by the development of local financial institutions, highlighting the necessity of cross-country analyses. During periods of systemic shock, Tekin and Polat (2024) find that ESG performance serves as a vital signal for creditworthiness, a finding that is particularly relevant in the post-COVID-19 landscape. Furthermore, research by Zhu et al. (2025) suggests that superior ESG performance facilitates corporate deleveraging by reducing information asymmetry and lowering the probability of over-indebtedness.

Different inferences may be drawn on individual pillars of E, S and G, as well as the composite ESG score. For example, Limkriangkrai et al. (2017) demonstrate that high rated ESG firms tend to have higher debt. However, once examined for the individual ratings, low rated E firms and high rated G firms tend to have less debt. Ktit and Khalaf (2024) demonstrate that all three ESG pillars positively and significantly influence capital structure, when investigating the impact of ESG criteria on the capital structure of 450 companies across 10 European nations over the period 2014–2023.

Based on the discussion above, generally the firm's capital structure is related to the ESG performance. Firms with high ESG score tend to experience reduced information asymmetry, enhanced access to capital, increased issuance of equity securities, and decreased leverage. Consequently, the following hypothesis can be formulated: Firms with higher ESG performance have lower financial leverage.

Research methods

This paper examines how ESG performance impacts capital structure in corporate firms. The study considers non-financial publicly-listed firms that have ESG score for at least one year between 2017 and 2022. The sample consists of 34,513 firm-year observations of 9,560 firms in 32 countries across the world from 2017 to 2022. Panel regressions are performed on all firms and subsequently divide the sample into 6 groups: Anglo-Saxon, Western Europe, Central-Eastern Europe, Scandinavia, Asia, ASEAN (see Table 1). Furthermore, cross-country and temporal differences – specifically regarding the pre- and post-COVID-19 periods – are investigated. Annual ESG scores, as well as financial data, are obtained from the S&P Capital IQ Pro database.

The selection of the 32 countries is motivated by several criteria to ensure the robustness and global relevance of the findings. First, the sample includes countries with the highest levels of ESG disclosure and data availability within the S&P Capital IQ Pro database. Second, the chosen nations represent diverse institutional environments, ranging from bank-based to market-based financial systems, which is essential for examining how the relationship between ESG performance and capital structure varies across different regulatory frameworks. Finally, the inclusion of these countries allows for a balanced representation of both developed and emerging markets across six major geographical regions, thereby enhancing the generalizability of the results in an international context.

Table 1. Sample distribution by country and group

Country	Firms	Observations	Group
USA	2,041	8,249	Anglo-Saxon
United Kingdom	300	1,242	Anglo-Saxon
Canada	277	1,143	Anglo-Saxon
Australia	250	1,085	Anglo-Saxon
New Zealand	47	203	Anglo-Saxon
Thailand	129	505	ASEAN
Malaysia	123	487	ASEAN
Singapore	87	349	ASEAN
Indonesia	93	339	ASEAN
Philippines	49	207	ASEAN
Japan	2,057	6,279	Asia
China	1,288	3,963	Asia
South Korea	541	1,823	Asia
Taiwan	534	1,803	Asia
India	356	1,295	Asia
Poland	31	123	Central-Eastern Europe
Hungary	5	19	Central-Eastern Europe
Czechia	4	15	Central-Eastern Europe
Romania	3	6	Central-Eastern Europe
Estonia	1	3	Central-Eastern Europe
Ukraine	1	2	Central-Eastern Europe
Bulgaria	1	1	Central-Eastern Europe
Sweden	243	807	Scandinavia
Norway	59	245	Scandinavia
Finland	57	213	Scandinavia
Denmark	52	209	Scandinavia
Germany	209	830	Western Europe
France	175	721	Western Europe
Switzerland	126	530	Western Europe
Italy	92	364	Western Europe
Netherlands	67	297	Western Europe
Spain	63	289	Western Europe
Ireland	49	225	Western Europe
Belgium	44	183	Western Europe
Austria	30	136	Western Europe
Luxembourg	32	129	Western Europe

Country	Firms	Observations	Group
Greece	23	100	Western Europe
Portugal	14	66	Western Europe
Cyprus	5	21	Western Europe
Monaco	2	7	Western Europe
Total	9,560	34,513	

Source: Author's own study.

In model specification book leverage (dependent variable, a proxy for capital structure) is a function of ESG score and capital structure determinants identified previously by research (Frank & Goyal, 2009; Rajan & Zingales, 1995), such as profitability, firm size, tangibility of assets, and non-debt tax shield. The measurement of variables is presented in Table 2.

The S&P Global ESG Scores measures a firm's performance and management of material ESG risks, opportunities, and impacts informed by a combination of company disclosures, media and stakeholder analysis, modeling approaches, and in-depth company engagement via the S&P Global Corporate Sustainability Assessment. Points are awarded at the question-level, with an average of 130 per firm, based on the assessment of up to 1,000 underlying data points according to pre-defined scoring frameworks that assess their availability, quality, relevance, and performance on sustainability topics. ESG Scores are measured on a scale of 0–100, where 100 represents the maximum score.² This score is the sum of the weighted scores of each of the three ESG dimensions: environmental, societal, governance.

Table 2. Variables description

Variable	Abbreviation	Description
Dependent		
Book Leverage (capital structure)	BL	$\frac{\text{total debt}}{\text{book value of assets}}$
Independent		
ESG	ESG	score in range 1–100
Environmental	E	score in range 1–100
Societal	S	score in range 1–100
Governance	G	score in range 1–100
Profitability (Return on Assets)	ROA	$\frac{\text{earnings before interest and taxes}}{\text{book value of assets}}$
Firm size	SIZE	natural logarithm of total book value of assets
Tangibility of Assets	TANG	$\frac{\text{net property plant and equipment}}{\text{book value of assets}}$
Non-debt Tax Shield	NDTS	$\frac{\text{depreciation and amortization}}{\text{book value of assets}}$

Source: Author's own study.

² More about S&P Global ESG Scores methodology: <https://www.spglobal.com/esg/documents/sp-global-esg-scores-methodology-2022.pdf>

The regression model is given as follows:

$$BL_{it} = \beta_0 + \beta_1 ESG\ Score_{it} + \beta_2 ROA_{it} + \beta_3 SIZE_{it} + \beta_4 TANG_{it} + \beta_5 NDT S_{it} + \varepsilon_{it} \quad (1)$$

This model is applied to ESG, E, S, and G scores separately to assess the effect of each rating on a firm's capital structure.

There are several methods that can be used to estimate panel data: pooled ordinary least squares (OLS) model, fixed effects, random effects (Tiwari & Krishnankutty, 2014). The first method is relevant for homogeneous samples. Using a pooled OLS firms' unobservable individual effects are not controlled, therefore heterogeneity can influence measurements of the estimated parameters (Bevan & Danbolt, 2004). This study uses the Breusch–Pagan test to detect individual effects (Breusch & Pagan, 1979). In order to identify fixed or random effects the Hausman test (Greene, 2003; Hausman, 1978) is applied. Pearson's linear correlation coefficients and variance inflation factors (VIF) are calculated to exclude any multicollinearity between the variables.

Results

Table 3 provides the results for the descriptive statistics for the whole sample. The average ESG score was 32 points, but it varied across different countries. For instance, European firms generally had higher average scores, with Spain (53 points) and Finland, Portugal, and France (49 points) leading the way. In contrast, Asian firms had lower average scores, with China (19 points), South Korea (24 points), Japan (27 points), and Indonesia (29 points) ranking among the lowest. The same conclusions can be drawn based on each pillar of the ESG. The mean book leverage, which represents the proportion of assets financed with debt, was 0.5, indicating that on average 50% of assets were financed with debt. However, this metric exhibited variation across countries, with Portugal, Spain, and Italy having the highest mean book leverage (0.65) and South Korea, Taiwan, Japan, and Australia having the lowest (0.45). These findings suggest that there are country-specific differences in capital structure.

Table 3. Descriptive statistics

	ESG	E	S	G	BL	ROA	SIZE	TANG	NDTS
Mean	32.35	32.77	29.23	34.30	0.50	0.06	16.81	0.30	0.03
Std. dev.	18.03	21.84	18.61	17.15	0.20	0.14	2.61	0.25	0.02
Min	0	0	0	0	0.00	-6.63	8.32	0.00	-0.03
25%	20	16	16	23	0.36	0.03	14.94	0.10	0.01
50%	29	27	26	33	0.51	0.06	16.60	0.24	0.02
75%	41	45	38	43	0.65	0.10	18.48	0.44	0.04
Max	94	100	98	94	1.00	2.37	26.83	1.00	0.50

Source: Author's own study.

Table 4 presents the Pearson correlation matrix. As expected, the individual pillars of ESG are highly correlated with each other and with the overall ESG score. This does not affect model estimation as individual components are considered as a single dependent variable. The correlation coefficient for the remaining variables is generally low. The book leverage exhibits a positive, however moderate, correlation with ESG score (0.22), suggesting that companies with higher levels of book leverage tend to have higher ESG scores, although the relationship is not strong enough to be considered definitive. In general, the correlation analysis results show no evidence of multicollinearity.

Table 4. Correlation matrix

	ESG	E	S	G	BL	ROA	SIZE	TANG	NDTS
ESG	1.0								
Env.	0.94***	1.0							
Soc.	0.97***	0.9***	1.0						
Gov.	0.95***	0.83***	0.88***	1.0					
BL	0.22***	0.21***	0.21***	0.22***	1.0				
ROA	0.08***	0.11***	0.09***	0.06***	-0.05***	1.0			
SIZE	0.12***	0.22***	0.19***	-0.03***	0.08***	0.14***	1.0		
TANG	0.06***	0.07***	0.06***	0.05***	0.09***	0.02***	0.08***	1.0	
NDTS	0.11***	0.13***	0.11***	0.1***	0.1***	0.02***	0.03***	0.45***	1.0

*** significance at 1% level

Source: Author's own study.

Does a firm ESG rating has a relationship with capital structure? To answer this question, panel regressions are first performed on all firms using Equation 1. Subsequently, the sample is categorized into regional groups and individual countries for further granular analysis. Table 5 presents the results for the relationship between capital structure (measured by book leverage) and ESG scores. The correlation coefficient between ESG rating and book leverage is negative and statistically significant at 1%, indicating a negative association between ESG performance and capital structure, which supports the hypothesis. This suggests that firms with higher ESG rating tend to have lower leverage. The same conclusion can be drawn for the E and S components. For all regressions fixed effects model was estimated. The control variables are significantly related to the capital structure, with profitability negatively related to the leverage, and size, tangibility, and non-deductible tax shield positively.

Table 5. ESG and capital structure – results for all firms

	All companies			
	(1)	(2)	(3)	(4)
ESG	-0.00014***			
	(0.00004)			
E		-0.00012***		
		(0.00004)		
S			-0.00011**	
			(0.00005)	
G				-0.00007
				(0.00005)
ROA	-0.178***	-0.178***	-0.178***	-0.177***
	(0.005)	(0.005)	(0.005)	(0.005)
SIZE	0.033***	0.033***	0.033***	0.032***
	(0.001)	(0.001)	(0.001)	(0.001)
TANG	0.250***	0.250***	0.250***	0.250***
	(0.009)	(0.009)	(0.009)	(0.009)
NDTS	0.164***	0.166***	0.161***	0.159***
	(0.050)	(0.050)	(0.050)	(0.050)
R Squared	10.1%	10.1%	10.1%	10.1%
Effects	fixed	fixed	fixed	fixed
Observations	34,513	34,513	34,513	34,513

*** significance at 1% level; ** significance at 5% level

Source: Author's own study.

Since there are country-specific differences in capital structure as well as ESG scores, panel regression for groups of countries (as presented in Table 1) are performed, using Equation 1. Table 9 (Appendix) presents the results of these estimations.

For countries in Scandinavia, ASEAN, and Asia there is a significant, negative relationship between ESG score and capital structure. Moreover, each of the pillars of ESG also has negative relation with the capital structure. These findings confirm the results for the sample consisting of all firms. In contrast, it does not appear to be any significant relationship between ESG rating and capital structure for countries in Anglo-Saxon sphere, Western and Central-Eastern Europe.

Next step involves estimating Equation 1 for each country in the sample, thereby generating a country-specific estimate.³ Table 6 presents only the beta coefficients for ESG score and its components, the control variables are not reported. The results for Scandinavia reveal a negative relationship between ESG score and capital structure across all countries in the group. Conversely, only firms in two ASEAN countries, Indonesia and Malaysia, exhibited a significant relationship between ESG rating and capital structure. This is despite a significant negative relationship observed for the entire ASEAN group (Table 9). Within the group of Asian economies, three countries

³ Portugal, Cyprus, Hungary, Czechia, Monaco, Romania, Estonia, Ukraine and Bulgaria were excluded in this step due to the limited data availability.

exhibit a significant relationship between ESG ratings and capital structure. In contrast, no significant relationship is observed between ESG ratings and capital structure among Anglo-Saxon economies, which is consistent with the findings in Table 9. Among firms in Western Europe three countries (France, Italy, and Spain) exhibit a significant relationship between ESG ratings and capital structure. Interestingly, Spain is the only country where the beta coefficients for ESG ratings are positive. This suggests that firms with higher ESG ratings in Spain tend to have higher leverage.

Table 6. Beta coefficients (only for ESG scores) within countries

Country	Group	ESG	E	S	G
Denmark	Scandinavia	-0.00186**	-0.00173**	-0.00103	-0.00149
Finland	Scandinavia	-0.00211***	-0.00064	-0.00219***	-0.00146**
Norway	Scandinavia	-0.00131	0.00028	-0.00152**	-0.0016**
Sweden	Scandinavia	-0.00095**	-0.00092***	-0.00058	-0.0007**
Indonesia	ASEAN	-0.00086**	-0.00093**	-0.00048	-0.00053
Malaysia	ASEAN	-0.00043	-0.00021	-0.00018	-0.00053
Philippines	ASEAN	-0.00022	-0.00001	-0.00036	0.00011
Singapore	ASEAN	-0.00019	-0.00001	-0.00019	-0.00021
Thailand	ASEAN	-0.00061**	-0.00061**	-0.00062**	-0.00055**
China	Asia	-0.00021	-0.00036***	-0.00015	-0.00006
India	Asia	-0.00053**	-0.00029	-0.00055**	-0.00049**
Japan	Asia	-0.00033***	-0.00033***	-0.00023***	-0.0002**
South Korea	Asia	-0.00011	-0.00017	-0.00009	0.0001
Taiwan	Asia	-0.00015	-0.00001	-0.00014	-0.00018
Australia	Anglo-Saxon	-0.00048	-0.00009	-0.00048	-0.0003
Canada	Anglo-Saxon	0.00006	0.00016	0.00011	-0.00004
New Zealand	Anglo-Saxon	0.00055	0.00032	-0.00011	0.00058
United Kingdom	Anglo-Saxon	-0.00052	-0.00075***	-0.00022	-0.00021
USA	Anglo-Saxon	0.00023	0.00013	0.00021	0.00033**
Austria	Western Europe	0.00038	0.00012	0.00023	0.00042
Belgium	Western Europe	-0.00041	-0.00044	-0.00026	-0.00051
France	Western Europe	-0.00071**	-0.00048**	-0.00055**	-0.00065**
Germany	Western Europe	-0.00043	-0.00029	-0.00025	-0.00031
Greece	Western Europe	0.00071	0.00033	0.00037	0.00048
Ireland	Western Europe	-0.00041	-0.00064	-0.00032	0.0003
Italy	Western Europe	-0.00126***	-0.00081***	-0.00109***	-0.00073**
Luxembourg	Western Europe	0.00035	0.00033	0.00024	0.00036
Netherlands	Western Europe	-0.0003	-0.00023	-0.00043	0.00032
Spain	Western Europe	0.00122***	0.00047	0.00106***	0.00141***
Switzerland	Western Europe	0.00006	-0.00022	0.00041	0.00003
Poland	Central-Eastern Europe	0.00067	0.00122	-0.00072	0.00058

*** significance at 1% level; ** significance at 5% level

Source: Author's own study.

To conclude the analysis of the relationship between capital structure and ESG potential temporal differences are investigated. This final step involves exploring whether the relationship between these variables changed before and after the COVID-19 pandemic. While an interaction term could be utilized to test the differential effects of ESG across periods, this study employs a subsample analysis to allow for the full relaxation of coefficient constraints across all control variables. This approach provides a more granular view of how the determinants of capital structure shifted in response to the COVID-19 pandemic.

Table 7 presents regression results using Equation 1 for the entire sample, i.e., firms from all countries. The results confirm a significant relationship between ESG score and capital structure. However, the direction of this relationship exhibits a temporal shift. Prior to the COVID-19 pandemic, a positive association was observed. Conversely, a negative relation was detected following the outbreak.

Table 7. ESG and capital structure – results for subperiods, for all firms in the sample

	Before COVID (2017, 2018, 2019)				COVID (2020, 2021, 2022)			
ESG	0.00027***				-0.00023***			
	(0.00009)				(0.00008)			
E		0.00001				-0.00014**		
		(0.00008)				(0.00006)		
S			0.00027***				-0.00017***	
			(0.00007)				(0.00007)	
G				0.0003***				-0.00017**
				(0.00007)				(0.00008)
ROA	-0.140***	-0.140***	-0.141***	-0.140***	-0.177***	-0.176***	-0.177***	-0.177***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.006)	(0.006)	(0.006)	(0.006)
SIZE	0.057***	0.055***	0.058***	0.058***	0.032***	0.031***	0.032***	0.031***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)
TANG	0.203***	0.203***	0.203***	0.202***	0.226***	0.227***	0.226***	0.226***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.012)	(0.012)	(0.012)	(0.012)
NDTS	0.488***	0.479***	0.497***	0.498***	0.014	0.011	0.012	0.011
	(0.099)	(0.099)	(0.099)	(0.099)	(0.064)	(0.064)	(0.064)	(0.064)
R Sqr.	11.0%	10.8%	11.0%	11.1%	8.6%	8.6%	8.6%	8.6%
Effects	fixed	fixed	fixed	fixed	fixed	fixed	fixed	fixed
No. obs.	10,483	10,483	10,483	10,483	24,030	24,030	24,030	24,030

*** significance at 1% level; ** significance at 5% level

Source: Author's own study.

To identify the main drivers of this temporal shift, group-level variations in the relationship between ESG scores and capital structure are analyzed. Table 8 presents the results, disaggregated by country groups, for the pre- and post-COVID-19 periods. Notably, the pre-pandemic positive relation and the pandemic negative relation between ESG ratings and capital structure were concentrated mainly in Asia and Scandinavia. Additionally, firms in ASEAN countries also demonstrate a negative relationship after the outbreak.

Table 8. ESG and capital structure – beta coefficients (only ESG scores) for subperiods, for groups

Period	Group	ESG	E	S	G
Before COVID	Anglo-Saxon	-0.00009	-0.00015	-0.00006	-0.00002
COVID	Anglo-Saxon	-0.00008	-0.00012	0.00004	0.00009
Before COVID	ASEAN	0.00039	0.00003	0.00021	0.00051*
COVID	ASEAN	-0.00053**	-0.00025	-0.0004**	-0.00046**
Before COVID	Asia	0.0008***	0.00017	0.00078***	0.00078***
COVID	Asia	-0.00027***	-0.00011	-0.00026***	-0.00029***
Before COVID	Central-Eastern Europe	-0.00067	-0.00014	-0.00078	-0.00047
COVID	Central-Eastern Europe	-0.00045	-0.00029	-0.00324***	0.00028
Before COVID	Scandinavia	0.00053**	0.00033	0.00047	0.00045
COVID	Scandinavia	-0.00119**	-0.00106***	-0.00084**	-0.00073
Before COVID	Western Europe	-0.00021	-0.00022	-0.00002	-0.00016
COVID	Western Europe	-0.0005	-0.00033	-0.00024	-0.00019

*** significance at 1% level; ** significance at 5% level

Source: Author's own study.

Overall, the empirical analysis reveals a statistically significant relationship between ESG performance and corporate capital structure, specifically indicating that firms with higher ESG scores tend to exhibit lower financial leverage. These results remain consistent across the examination of individual ESG pillars, though the magnitude of the impact varies across different geographical regions and institutional settings. Furthermore, the temporal comparison demonstrates that the role of ESG as a resilience factor became more pronounced during the post-COVID-19 period, suggesting that ESG performance helps mitigate financial risk during times of heightened systemic uncertainty.

Discussion

The primary findings reveal a significant negative relationship between capital structure and ESG rating. This suggests that firms with higher environmental, social, and governance performance, on average, exhibit lower leverage. The observed negative relationship between ESG performance and leverage can be interpreted through the lens of signaling theory (Ross, 1977). High ESG ratings serve as a credible signal to capital markets regarding a firm's long-term viability and lower idiosyncratic risk. By signaling superior non-financial performance, firms may reduce information asymmetry with lenders, thereby gaining access to more favorable equity financing or choosing lower debt levels to maintain financial flexibility. Furthermore, the results can be interpreted through the stakeholder theory. By addressing the concerns of a range of stakeholders firms reduce their exposure to legal, reputational, and operational shocks. This "insurance-like" effect of ESG performance leads to more stable cash flows, which in turn reduces the necessity for high leverage as a disciplinary mechanism.

Better ESG performance reduces information asymmetry (Asimakopoulos et al., 2023) and facilitates access to equity financing through the stock market, potentially leading to a reduced reliance on debt funding (Cheng et al., 2014; Zahid et al., 2023). There may be other reasons for negative relation between capital structure and ESG score. As sustainable investing grows, companies with high ESG scores become more attractive to investors who prioritize these factors. This increased investor demand allows them to raise capital through equity offerings, reducing reliance on debt. Strong ESG practices can lead to cost savings, which improves profitability, reducing the need for external debt financing, which is in line with pecking order theory.

Analysis by disaggregating the ESG rating into its environmental, social, and governance pillars reveals a negative relationship between each pillar score and capital structure across the entire sample. However, there is heterogeneity across countries. Notably, the negative association appears more pronounced in firms located in Scandinavia, ASEAN, Asia, as well as France, Italy, and Spain. These countries might have stricter regulations or social pressures promoting sustainable practices, which can incentivize firms to prioritize ESG performance. Some governments in these regions might offer subsidies or tax breaks for companies with strong ESG practices. This can make it more attractive for firms to invest in ESG improvements and potentially reduce their reliance on debt financing. The observed heterogeneity across countries might be also attributable to other factors, including differences in financial systems or cultural preferences. Firms operating in regions with a more bank-centric financing model might experience a stronger influence of ESG performance on leverage, as banks may consider ESG factors during loan assessments. Additionally, cultural preferences for long-term investment horizons in some regions could incentivize firms to prioritize sustainable practices and potentially reduce reliance on short-term debt financing. However, further research is necessary to definitively identify the factors that explain cross-country variations.

Further temporal analysis revealed a significant positive association between capital structure and ESG rating prior to the COVID-19 pandemic. However, this relationship shifted to a negative following the outbreak. There might be several reasons for this temporal shift. The pandemic highlighted the potential risks associated with unsustainable practices. Firms with strong ESG practices might have been better positioned to navigate disruptions in supply chains, social unrest, and changing consumer preferences. This could have led to view high ESG scores as a sign of resilience, reducing the need for high leverage. The pandemic might have caused investors to prioritize social responsibility factors alongside traditional financial metrics. Firms with strong ESG performance could have become more attractive investment options, allowing them to raise capital through equity markets and reduce reliance on debt. The pandemic might have prompted some companies to re-evaluate their long-term strategies, prioritizing long-term sustainability and responsible practices. This could lead them to reduce debt and focus on building a more resilient financial foundation aligned with strong ESG performance.

Negative relationship between ESG score and leverage has potential implications for investors and firms. Findings suggest that companies with strong ESG practices might be potentially less reliant on debt. Investors seeking lower-risk investments may prioritize companies with high ESG scores, potentially leading to a greater focus on ESG integration into investment strategies. While lower leverage might be associated with strong ESG scores, companies still need to manage their capital structure effectively. They may need to strike a balance between maintaining a healthy debt level for growth and prioritizing ESG initiatives. Overall companies with high ESG scores may be more attractive, as they tend to have lower leverage levels, which can contribute to long-term sustainability and financial stability.

The relationship between ESG score and leverage may not be universal and vary across industries. Factors like economic conditions, firm size, and other firm characteristics, both financial and non-financial, can influence this dynamic. While these are potential explanations, further research is needed to fully understand the causal mechanisms at play. It is crucial to acknowledge the potential influence of the chosen ESG scoring methodology on the observed results. Chatterji et al. (2016) document the lack of agreement across ratings from six well-established raters. Similarly, Berg et al. (2022) demonstrate that ESG rating divergence is not merely a matter of varying definitions but a fundamental disagreement about the underlying data. These findings highlight the importance of considering the limitations and potential biases inherent in any particular ESG scoring approach.

Conclusions

This study investigated the relationship between ESG performance and capital structure in a sample of 34,513 firm-year observations from 9,560 firms across 32 countries spanning 2017–2022. The hypothesis was that firms with stronger ESG scores would exhibit lower leverage. The findings support this hypothesis for the entire sample, with a statistically significant negative relation between ESG rating and book leverage. However, the analysis also revealed heterogeneity across countries. For firms located in Scandinavia, ASEAN, and Asia, a significant negative relationship exists between ESG score and capital structure. Conversely, no significant relationship was observed for firms in the Anglo-Saxon sphere, Western Europe, or Central-Eastern Europe. Disaggregating ESG into its environmental, social, and governance pillars yielded consistent results with the overall ESG score. Further analysis revealed a temporal shift in the relationship between ESG score and capital structure. Prior to the COVID-19 pandemic, a positive association was observed, particularly in Asia and Scandinavia. Strong ESG performance might have been associated with easier access to debt financing before the crisis. Conversely, a negative relation was detected following the outbreak, concentrated in the same regions.

Findings suggest that investors and lenders in some regions might place a higher value on strong ESG performance when making financial decisions. Firms in some regions might benefit from prioritizing ESG practices to potentially access lower-cost debt financing and manage their capital structure more effectively. Further research is necessary to understand the specific factors driving the observed heterogeneity across countries.

For corporate executives and financial officers, the results demonstrate that ESG performance is not merely a matter of compliance but a determinant of capital structure. The evidence suggests that firms with robust ESG profiles can leverage their sustainability performance to signal lower risk and higher resilience to creditors. Consequently, managers should prioritize the integration of environmental and social considerations into their core financial strategies to optimize leverage, particularly during periods of economic volatility where the “resilience factor” of ESG is most pronounced.

Overall, this paper contributes to the ongoing discussion on ESG and capital structure by highlighting the potential impact of ESG performance on financing strategies and the importance of considering regional variations. While this study provides comprehensive evidence on the relationship between ESG performance and capital structure, several limitations must be acknowledged. First, the analysis relies on ESG ratings from a single provider. Given the divergence among rating agencies, the results may vary if alternative ESG metrics are applied. Second, although panel regressions with fixed effects were employed, the study does not fully account for all potential causal channels or time-varying unobserved factors that could influence both ESG scores and financing decisions. Finally, the findings are based on a specific six-year window, and while this captured the impact of the COVID-19 pandemic, the long-term persistence of these effects remains to be seen.

Future research could extend these findings by utilizing instrumental variable (IV) approaches or natural experiments to more rigorously address endogeneity concerns. Additionally, further investigation is needed to explore the specific economic mechanisms – such as cost of debt or investor preferences – through which different ESG pillars influence capital structure in emerging versus developed markets. Subsequent studies might also consider how the evolving regulatory landscape regarding green finance and sustainability reporting impacts corporate leverage strategies over a longer temporal horizon.

References

- Adeneye, Y.B., Fasihi, S., Kammoun, I., & Albitar, K. (2023). Does earnings management constrain ESG performance? The role of corporate governance. *International Journal of Disclosure and Governance*, 21(1), 69–92. <https://doi.org/10.1057/s41310-023-00181-9>
- Albitar, K., Hussainey, K., Kolade, N., & Gerged, A.M. (2020). ESG disclosure and firm performance before and after IR. *International Journal of Accounting and Information Management*, 28(3), 429–444. <https://doi.org/10.1108/IJAIM-09-2019-0108>
- Alshehhi, A., Nobanee, H., & Khare, N. (2018). The impact of sustainability practices on corporate financial performance: Literature trends and future research potential. *Sustainability*, 10(2), 494. <https://doi.org/10.3390/su10020494>
- Apergis, N., Poufinas, T., & Antonopoulos, A. (2022). ESG scores and cost of debt. *Energy Economics*, 112, 106186. <https://doi.org/10.1016/j.eneco.2022.106186>
- Asimakopoulos, P., Asimakopoulos, S., & Li, X. (2023). The role of environmental, social, and governance rating on corporate debt structure. *Journal of Corporate Finance*, 83, 102488. <https://doi.org/10.1016/j.jcorpfin.2023.102488>
- Aydoğmuş, M., Gülay, G., & Ergun, K. (2022). Impact of ESG performance on firm value and profitability. *Borsa Istanbul Review*, 22(Suppl. 2), 119–127. <https://doi.org/10.1016/j.bir.2022.11.006>
- Baxter, N.D. (1967). Leverage, risk of ruin and the cost of capital. *Journal of Finance*, 22(3), 395–403. <https://doi.org/10.2307/2978892>
- Berg, F., Kölbel, J., & Rigobon, R. (2022). Aggregate confusion: The divergence of ESG ratings. *Review of Finance*, 26(6), 1315–1344. <https://doi.org/10.1093/rof/rfac033>
- Bevan, A.A., & Danbolt, J. (2004). Testing for inconsistencies in the estimation of UK capital structure determinants. *Applied Financial Economics*, 14, 55–66. <https://doi.org/10.1080/0960310042000164220>
- Breusch, T.S., & Pagan, A.R. (1979). A simple test for heteroscedasticity and random coefficient variation. *Econometrica*, 47(5), 1287–1294. <https://doi.org/10.2307/1911963>
- Birindelli, G., Quas, A., Rancan, M., & Vandone, D. (2025). How important are ESG ratings for financial institutions? Evidence from corporate leverage ratios across Europe. *International Review of Economics & Finance*, 102, 104398. <https://doi.org/10.1016/j.iref.2025.104398>
- Brzeszczyński, J., Gajdka, J., & Schabek, T. (2021). How risky are the socially responsible investment (SRI) stocks? Evidence from the Central and Eastern European (CEE) companies. *Finance Research Letters*, 42, 101939. <https://doi.org/10.1016/j.frl.2021.101939>
- Cantino, V., Devalle, A., & Fiandrino, S. (2017). ESG sustainability and financial capital structure: Where they stand nowadays. *International Journal of Business and Social Science*, 8(5), 116–126.
- Chatterji, A., Durand, R., Levine, D., & Touboul, S. (2016). Do ratings of firms converge? Implications for managers, investors and strategy researchers. *Strategic Management Journal*, 37(8), 1597–1614. <https://doi.org/10.1002/smj.2407>
- Chen, Y., Li, T., Zeng, Q., & Zhu, B. (2023). Effect of ESG performance on the cost of equity capital: Evidence from China. *International Review of Economics & Finance*, 83, 348–364. <https://doi.org/10.1016/j.iref.2022.09.001>
- Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance. *Strategic Management Journal*, 1, 1–23. <https://doi.org/10.1002/smj.2131>
- D'Amato, V., D'Ecclesia, R., & Levantesi, S. (2023). Firms' profitability and ESG score: A machine learning approach. *Applied Stochastic Models in Business and Industry*, 1–19. <https://doi.org/10.1002/asmb.2758>
- Du, X., Weng, J., Zeng, Q., Chang, Y., & Pei, H. (2017). Do lenders applaud corporate environmental performance? Evidence from Chinese private-owned firms. *Journal of Business Ethics*, 143, 179–207. <https://doi.org/10.1007/s10551-015-2758-2>
- El Ghouli, S., Guedhami, O., Kim, H., & Park, K. (2018). Corporate environmental responsibility and the cost of capital: International evidence. *Journal of Business Ethics*, 149, 335–361. <https://doi.org/10.1007/s10551-015-3005-6>

- Eliwa, Y., Aboud, A., & Saleh, A. (2021). ESG practices and the cost of debt: Evidence from EU countries. *Critical Perspectives on Accounting*, 79, 102097. <https://doi.org/10.1016/j.cpa.2019.102097>
- Ferris, S., Javakhadze, D., & Rajkovic, T. (2017). The international effect of managerial social capital on the cost of equity. *Journal of Banking and Finance*, 74, 69–84. <https://doi.org/10.1016/j.jbankfin.2016.10.001>
- Frank, M., & Goyal, V. (2009). Capital structure decisions: Which factors are reliably important?. *Financial Management*, 38(1), 1–37. <https://doi.org/10.1111/j.1755-053X.2009.01026.x>
- Feldhütter, P., & Pedersen, L.H. (2025). Is capital structure irrelevant with ESG investors?. *The Review of Financial Studies*, Society for Financial Studies, 38(8), 2362–2385. <https://doi.org/10.1093/rfs/hhae059>
- Galluzzi, A., O'Donnell, F., & Reuben, S. (2023). The cost of being green: How ESG ratings affect a firm's cost of equity. *SSRN*. <https://ssrn.com/abstract=4495822>; <https://doi.org/10.2139/ssrn.4495822>
- Ge, W., & Lui, M. (2015). Corporate social responsibility and the cost of corporate bonds. *Journal of Accounting and Public Policy*, 34, 597–624. <https://doi.org/10.1016/j.jaccpubpol.2015.05.008>
- Girerd-Potin, I., Jimenez-Garcés, S., & Louvet, P. (2011). The link between social rating and financial capital structure. *Finance*, 32, 9–52. <https://doi.org/10.3917/fina.322.0009>
- Gjergji, R., Vena, L., Sciascia, S., & Cortesi, A. (2021). The effects of environmental, social and governance disclosure on the cost of capital in small and medium enterprises: The role of family business status. *Business Strategy and the Environment*, 30, 683–693. <https://doi.org/10.1002/bse.2647>
- Gonçalves, T.C., Dias, J., & Barros, V. (2022). Sustainability performance and the cost of capital. *International Journal of Financial Studies*, 10(3), 63. <https://doi.org/10.3390/ijfs10030063>
- Greene, W.H. (2003). *Econometric Analysis*. Prentice Hall.
- Hausman, J.A. (1978). Specification tests in econometrics. *Econometrica*, 46(6), 1251–1271. <https://doi.org/10.2307/1913827>
- He, G., Liu, Y., & Chen, F. (2023). Research on the impact of environment, society, and governance (ESG) on firm risk: An explanation from a financing constraints perspective. *Finance Research Letters*, 58(A), 104038. <https://doi.org/10.1016/j.frl.2023.104038>
- Hsu, S.C., Wu, K.T., Wang, Q., & Chang, Y. (2023). Is capital structure associated with corporate social responsibility?. *International Journal of Corporate Social Responsibility*, 8, article 6. <https://doi.org/10.1186/s40991-023-00081-9>
- Humphrey, J.E., Lee, D.D., & Shen, Y. (2012). Does it cost to be sustainable?. *Journal of Corporate Finance*, 18(3), 626–639. <https://doi.org/10.1016/j.jcorpfin.2012.03.002>
- Izcan, D., & Bektas, E. (2022). The relationship between ESG scores and firm-specific risk of eurozone banks. *Sustainability*, 14(14), 8619. <https://doi.org/10.3390/su14148619>
- Kraus, A., & Litzenberger, R.H. (1973). A state-preference model of optimal financial leverage. *Journal of Finance*, 28(4), 911–922. <https://doi.org/10.2307/2978343>
- Ktit, M., & Khalaf, B. (2024). Assessing the environmental, social, and governance performance and capital structure in Europe: A board of directors' agenda. *Corporate Board: Role, Duties and Composition*, 20(3), 139–148. <https://doi.org/10.22495/cbv20i3art13>
- Limkriangkrai, M., Koh S., & Durand, R.B. (2017). Environmental, social, and governance (ESG) profiles, stock returns, and financial policy: Australian evidence. *International Review of Finance*, 17(3), 461–471. <https://doi.org/10.1111/irfi.12101>
- Matthiesen, M., & Salzmänn, A. (2017). Corporate social responsibility and firms cost of capital: Does culture matter?. *Cross Cultural and Strategic Management*, 24, 105–124. <https://doi.org/10.1108/CCSM-11-2015-0169>
- Modigliani, F., & Miller, M.H. (1958). The cost of capital corporation finance and the theory of investment. *American Economic Review*, 48, 261–297.
- Myers, S.C. (1984). The capital structure puzzle. *Journal of Finance*, 39(3), 574–592. <https://doi.org/10.1111/j.1540-6261.1984.tb03646.x>
- Myers, S.C., & Majluf, N.S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), 187–221. [https://doi.org/10.1016/0304-405X\(84\)90023-0](https://doi.org/10.1016/0304-405X(84)90023-0)

- Piechocka-Kaluźna, A., Tłuczak, A., & Łopatka, P. (2021). The impact of CSR/ESG on the cost of capital: A case study of US companies. *European Research Studies Journal*, 24(3), 536–546. <https://doi.org/10.35808/ersj/2510>
- Pijourlet, G. (2015). Does corporate social responsibility have an impact on financing decisions?. *Bankers, Markets & Investors*, 136–137, 5–19.
- Priem, R., & Gabellone, A. (2022). The impact of a firm's ESG score on its cost of capital: Can a high ESG score serve as a substitute for a weaker legal environment?. *Sustainability Accounting, Management and Policy Journal*, 15(3), 676–703. <https://doi.org/10.1108/SAMPJ-05-2023-0254>
- PwC. (2022). *PwC's Asset and Wealth Management Revolution 2022 report*. <https://www.pwc.com/bm/en/press-releases/asset-wealth-management-revolution-2022-report.html>
- Rajan, R.G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *The Journal of Finance*, 50(5), 1421–1460. <https://doi.org/10.1111/j.1540-6261.1995.tb05184.x>
- Ross, S.A. (1977). The determination of financial structure: The incentive-signalling approach. *The Bell Journal of Economics*, 8(1), 23–40. <https://doi.org/10.2307/3003485>
- Sassen, R., Hinze, A.K., & Hardeck, I. (2016). Impact of ESG factors on firm risk in Europe. *Journal of Business Economics*, 86, 867–904. <https://doi.org/10.1007/s11573-016-0819-3>
- Sciarelli, M., Landi, G., Turriziani, L., & Prisco, A. (2024). Does corporate sustainability mitigate firm risk? An empirical analysis on S&P 500 controversial companies. *Social Responsibility Journal*, 20(1), 38–58. <https://doi.org/10.1108/SRJ-09-2021-0388>
- Tekin, H., & Polat, A.Y. (2025). Does corporate sustainability matter for the capital structure puzzle in OIC countries? Evidence from the COVID-19 pandemic. *Journal of Asian Business and Economic Studies*, 32(1), 2–14. <https://doi.org/10.1108/JABES-01-2024-0029>
- Tiwari, A.K., & Krishnankutty, R. (2014). Determinants of capital structure: Comparison of empirical evidence for the use of different estimators. *Theoretical and Applied Economics*, 21(12/601), 63–82.
- Whelan, T., Atz, U., Holt, T.V., & Clark, C. (2021). *ESG and financial performance: Uncovering the relationship by aggregating evidence from 1,000 plus studies published between 2015–2020*. NYU Stern Center for Sustainable Business, Rockefeller Asset Management.
- Zahid, R.M.A., Saleem, A., & Maqsood, U. (2023). ESG performance, capital financing decisions, and audit quality: Empirical evidence from Chinese state-owned enterprises. *Environmental Science and Pollution Research*, 30, 44086–44099. <https://doi.org/10.1007/s11356-023-25345-6>
- Zhu, T., Liu, D., & Zhang, L. (2025). Does ESG performance help corporate deleveraging? Based on an analysis of excessive corporate debt. *Sustainability*, 17(3), 1274. <https://doi.org/10.3390/su17031274>

Appendix

Table 9. ESG and capital structure – results for groups

	Scandinavia		ASEAN		Asia	
ESG	-0.00141*** (0.00036)		-0.0005*** (0.00018)		-0.00023*** (0.00007)	
E	-0.00084*** (0.00025)		-0.00037** (0.00016)		-0.00023*** (0.00005)	
S		-0.00115*** (0.0003)		-0.00046*** (0.00016)		-0.00018*** (0.00006)
G						
		-0.00118*** (0.00034)				-0.00043** (0.00018)
ROA	-0.164*** (0.021)	-0.164*** (0.021)	-0.134*** (0.024)	-0.133*** (0.024)	-0.216*** (0.011)	-0.216*** (0.011)
SIZE	0.027*** (0.006)	0.025*** (0.006)	0.057*** (0.007)	0.058*** (0.007)	0.034*** (0.002)	0.034*** (0.002)
TANG	0.222*** (0.038)	0.228*** (0.038)	0.169*** (0.034)	0.169*** (0.034)	0.207*** (0.014)	0.207*** (0.014)
NDTS	-0.014 (0.167)	0.011 (0.167)	0.770*** (0.208)	0.759*** (0.208)	0.337*** (0.080)	0.335*** (0.080)
R Sqr.	11.2% fixed	10.8% fixed	10.1% fixed	10.2% fixed	10.3% fixed	10.3% fixed
Effects	1,474	1,474	1,887	1,887	15,163	15,163
No. obs.	1,474	1,474	1,887	1,887	15,163	15,163

*** significance at 1% level; ** significance at 5% level; in parentheses standard error

Source: Author's own study.

Table 9. Continued

ESG	Anglo-Saxon			Western Europe			Central-Eastern Europe		
	0.0007 (0.00013)		-0.0001 (0.00016)				0.00106 (0.00086)		
E	0.00003 (0.0001)		-0.00013 (0.00012)					0.00146** (0.00061)	
S		0.00008 (0.0001)			0.000 (0.00014)				-0.00047 (0.0007)
G				0.00016 (0.00012)					
ROA	-0.157*** (0.008)	-0.157*** (0.008)	-0.157*** (0.008)	-0.157*** (0.008)	-0.311*** (0.019)	-0.310*** (0.019)	-0.237** (0.098)	-0.210** (0.097)	-0.238** (0.098)
SIZE	0.020*** (0.002)	0.020*** (0.002)	0.020*** (0.002)	0.020*** (0.002)	0.064*** (0.004)	0.063*** (0.004)	0.095*** (0.018)	0.085*** (0.018)	0.100*** (0.018)
TANG	0.304*** (0.015)	0.304*** (0.015)	0.304*** (0.015)	0.304*** (0.015)	0.117*** (0.032)	0.118*** (0.032)	-0.288** (0.112)	-0.255** (0.111)	-0.323*** (0.111)
NDTS	-0.137 (0.086)	-0.136 (0.086)	-0.137 (0.086)	-0.140 (0.086)	1.005*** (0.161)	0.986*** (0.160)	2.333*** (0.607)	2.13*** (0.604)	2.35*** (0.610)
R Sqr.	9.8% fixed	9.8% fixed	9.8% fixed	9.8% fixed	16.7% fixed	16.6% fixed	31.2% fixed	33.6% fixed	30.9% fixed
No. obs.	11,922	11,922	11,922	11,922	3,898	3,898	169	169	169

*** denotes significance at 1% level; ** denotes significance at 5% level; in parentheses standard error

Source: Author's own study.