



Economic Performance of Socially Responsible Industrial Firms: Evidence from US Publicly Traded Firms

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ABSTRACT

*Environmental, social, and governance (ESG) performance has become central to sustainable business conduct. Although prior studies often report positive links between ESG engagement and corporate financial performance, the evidence remains context-dependent. Industrial firms face environmental externalities, regulatory pressure, and capital-intensive operations, which may shape this relationship differently. This article examines the association between overall ESG scores, individual environmental, social, and governance pillars, and firms' profitability, measured by return on assets (ROA), while controlling for firm-specific characteristics and time effects. Using an openly available panel dataset of 72 industrial firms from 2012 to 2021, the study applies descriptive statistics, Welch's *t*-test, the Mann–Whitney *U* test, and fixed-effects panel regressions with firm-clustered standard errors. Five hypotheses concerning ESG engagement and ROA are tested. The results show that high-ESG firms are larger but, on average, less profitable than low-ESG firms. Regression findings reveal no significant association between composite ESG scores and ROA. However, the environmental pillar is positively and significantly related to profitability, whereas the social and governance pillars are not. These findings highlight the need to analyze ESG dimensions separately in practice.*

Keywords: ESG performance, Industrial firms, Financial performance, Environmental pillar, Panel regression.

Introduction

In recent years, sustainability, corporate responsibility, and ethical investment have made ESG performance a major focus in academic and managerial debates. This issue is especially important for industrial firms because of their high environmental impact and regulatory exposure. Understanding the relationship between ESG and corporate financial performance (CFP) is essential for firms, investors, and policymakers as global value chains increasingly shift toward greener, more transparent practices.

Although ESG research has expanded rapidly, findings on the ESG–CFP relationship remain mixed. While many studies report a positive relationship, results often vary across countries, industries, and ESG dimensions. A key research gap remains in understanding how ESG factors affect profitability in environmentally intensive US industrial sectors, particularly because composite ESG scores may mask the effects of individual environmental, social, and governance factors.

This article assesses the link between overall ESG scores and the three ESG pillars (environmental, social, and governance) and firms' economic performance, measured by return on assets (ROA), while controlling for firm-specific characteristics and time effects. The article evaluates both the overall ESG score and its individual pillars,

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with profitability measured through return on assets (ROA). In doing so, it provides a sector-specific contribution to the ongoing ESG–CFP debate.

The value added of this research lies in three aspects: (i) it focuses on a homogeneous set of industrial firms, reducing cross-sector variability; (ii) it distinguishes between the three ESG pillars rather than relying solely on aggregate scores; and (iii) it uses panel regression techniques that control for unobserved firm heterogeneity—an approach that many earlier studies lacked.

A brief overview of the methods is as follows: descriptive statistics outline the characteristics of the sample; group-comparison tests evaluate differences between high- and low-ESG firms; and fixed-effects panel regressions examine the association between ESG metrics and ROA while controlling for key financial determinants and time effects.

The remainder of the article is organized as follows. Section 2 provides a detailed literature review. Section 3 outlines the research methodology, including data sources, variable definitions, hypotheses, and analytical techniques. Section 4 presents empirical results, while Section 5 offers an in-depth discussion. Section 6 concludes with implications, limitations, and recommendations for future research.

Literature Review

Research on CSR and ESG performance is primarily grounded in stakeholder theory and the resource-based view of the firm. Stakeholder theory suggests that firms improve financial performance by managing relationships with stakeholders such as employees, customers, and regulators (Freeman, 1984). Similarly, the resource-based view considers ESG practices as valuable intangible resources—such as trust and legitimacy—that can create long-term competitive advantage (Wernerfelt, 1984; Barney, 1991; Tam *et al.*, 2023; Kariri *et al.*, 2024). Accordingly, stronger ESG performance is expected to enhance corporate financial performance (CFP).

The Porter hypothesis further argues that environmental regulation and pollution prevention can increase innovation and efficiency, especially in resource-intensive industries (Porter & van der Linde, 1995; Singh *et al.*, 2023; Hashem *et al.*, 2024). However, some studies note that ESG activities may also generate high costs and reduce short-term profitability if benefits emerge slowly (Barnett & Salomon, 2006; Rentková & Vartiak, 2017; Guzek *et al.*, 2023; Csep *et al.*, 2024). This trade-off has led researchers to examine whether the ESG–CFP relationship is positive, nonlinear, or context-dependent.

Evidence on CSP/ESG and Financial Performance

Early studies on the relationship between corporate social performance (CSP) and corporate financial performance (CFP) produced inconsistent results, ranging from positive to negative or insignificant effects. Later research suggested that these differences were largely due to variations in measurement methods and research designs (Griffin & Mahon, 1997; Waddock & Graves, 1997). Meta-analyses subsequently showed an overall positive relationship between CSP/ESG and financial performance, particularly when accounting-based indicators such as ROA and ROE are used (Orlitzky *et al.*, 2003; Velte, 2022; Kovalová & Vartiak, 2024).

With the growth of ESG investing, research has increasingly focused on standardized ESG ratings. Large reviews found that most studies report either positive or neutral effects of ESG on firm performance (Friede *et al.*, 2015; Necib, 2025). Recent panel-data studies across different countries, including the United States, generally confirm that stronger ESG performance improves profitability and firm value, although results vary across industries, governance systems, and time periods (Aydoğmuş, 2022; Lunawat, 2025). Some studies also suggest nonlinear or context-dependent effects (Herman, 2025). Overall, the literature indicates that ESG is usually neither harmful nor harmful to financial performance, but outcomes depend on ESG measures, financial indicators, and sector-specific conditions (Friede *et al.*, 2015; Jaseckova *et al.*, 2022; Huata-Panca *et al.*, 2025; Necib, 2025).

ESG Pillars, Nonlinearities, and Sectoral Context

Several studies criticize the use of composite ESG scores because they may hide the distinct effects of environmental, social, and governance dimensions. Research shows that the environmental and governance pillars are often more strongly associated with profitability and firm value than the social pillar, especially in environmentally sensitive industries (Aydoğmuş, 2022; Naeem *et al.*, 2022; Zhang *et al.*, 2025). In addition, some studies suggest that the ESG–



CFP relationship may be nonlinear, meaning that moderate ESG engagement can improve performance, whereas insufficient or excessive investment may reduce efficiency (Barnett & Salomon, 2006).

Sectoral differences also play an important role. Environmentally intensive industries, such as energy and manufacturing, may benefit more from ESG through innovation, compliance, and operational efficiency (Porter & van der Linde, 1995; Carpio-Vargas *et al.*, 2023; Li *et al.*, 2024). In contrast, service sectors often experience stronger effects on reputation and risk reduction than on profitability. Recent reviews further note that findings depend heavily on methodological choices, including ESG measurement and econometric methods (Velte, 2022; Necib, 2025). Therefore, researchers increasingly recommend sector-specific studies that separately examine ESG pillars and use panel-data methods to control for firm- and time-specific effects.

Materials and Methods

Research Objective and Design

The article investigates the relationship between ESG performance and the profitability of industrial firms, focusing on both overall ESG scores and the three individual pillars (environmental, social, and governance). Firm profitability is measured using return on assets (ROA), while controlling for firm-specific characteristics and time effects.

A quantitative explanatory design is applied using panel data for listed US industrial firms over 2012–2021. The analysis employs descriptive statistics, mean-comparison tests, and panel regression models, which are well-suited for accounting for unobserved firm heterogeneity and capturing both cross-sectional and time-series variation (Wooldridge, 2010; Baltagi, 2013).

Data and Sample

The study uses an open firm-level ESG and financial dataset covering 72 publicly traded US industrial firms from 2012–2021, yielding up to 720 firm-year observations (Bogomolova, 2024). The sample includes firms from industrial sectors such as transportation, machinery, aerospace, and manufacturing.

The dataset provides annual data on composite ESG scores and the environmental, social, and governance pillars, as well as financial indicators (e.g., net income, total assets, market capitalization, leverage), and non-financial variables (e.g., emissions and board characteristics). After excluding missing values, the final regression sample ranges from 634 to 711 firm-year observations, depending on the model specification.

Variables and Measurement

Economic performance is measured using return on assets (ROA), defined as net income divided by total assets, a standard accounting-based profitability indicator in CSP–CFP research (Orlitzky *et al.*, 2003; Friede *et al.*, 2015).

ESG performance is captured through a composite ESG score (0–100) and three separate pillar scores—environmental, social, and governance—also on a 0–100 scale. The analysis includes control variables commonly used in profitability studies: firm size (log of total assets), asset growth (annual change in total assets), and financial leverage (debt-to-assets ratio) (Renneboog *et al.*, 2008).

To compare firms, a High ESG dummy is constructed using a yearly median split of the composite ESG score, with firms above the median classified as high-ESG and others as low-ESG.

Research Hypotheses

The analysis is based on stakeholder theory, the resource-based view, and prior CSP–CFP research (Freeman, 1984; Barney, 1991; Orlitzky *et al.*, 2003; Friede *et al.*, 2015).

H1 proposes that high-ESG firms achieve higher ROA than low-ESG firms. H2 expects a positive relationship between overall ESG and ROA after controlling for firm characteristics and time effects. H3 predicts a positive effect of the environmental pillar on ROA, driven by cost savings and risk reduction in industrial firms (Porter & van der Linde, 1995; Naeem *et al.*, 2022). H4 and H5 hypothesize positive effects for the social and governance pillars based on stakeholder relations and governance quality (Clark *et al.*, 2015; Aydoğmuş, 2022).

These hypotheses are tested using both univariate and multivariate methods.



Methods of Data Analysis

First, descriptive statistics (mean, median, standard deviation, minimum, and maximum) are calculated for all variables, along with histograms, boxplots, and a correlation matrix to explore distributions, outliers, and initial relationships among ESG, ROA, and control variables.

To test H1, firms are divided into high-ESG and low-ESG groups based on the yearly median composite ESG score, and their average ROA is compared. Welch's t-test is applied to account for unequal variances (Gujarati & Porter, 2009), along with the Mann–Whitney U test as a nonparametric alternative (Conover, 1999). These tests assess whether profitability differs significantly between the two groups at the univariate level.

To test H2–H5 while controlling for confounding factors, a set of linear panel data models is estimated with ROA as the dependent variable. The baseline specification is a pooled ordinary least squares (OLS) model with year dummies:

$$ROA_{it} = \alpha + \beta_1 ESG_score_{it} + \beta_2 \log(Assets)_{it} + \beta_3 AssetGrowth_{it} + \beta_4 Leverage_{it} + \sum_t \gamma_t Year_t + \varepsilon_{it}, \quad (1)$$

Where i denotes the firm and t the year. However, pooled OLS does not account for unobserved, time-invariant firm characteristics that may jointly affect ESG and profitability. Therefore, the preferred specifications are firm fixed-effects (FE) models, which control for all time-invariant firm-specific heterogeneity by including firm dummies:

$$ROA_{it} = \alpha_i + \beta_1 ESG_score_{it} + \beta_2 \log(Assets)_{it} + \beta_3 AssetGrowth_{it} + \beta_4 Leverage_{it} + \sum_t \gamma_t Year_t + \varepsilon_{it}, \quad (2)$$

To obtain a more granular view of ESG performance, the composite score is decomposed into environmental, social, and governance pillars. Two additional FE models are estimated: one including only the environmental pillar,

$$ROA_{it} = \alpha_i + \beta_1 Env_score_{it} + \beta_2 \log(Assets)_{it} + \beta_3 AssetGrowth_{it} + \beta_4 Leverage_{it} + \sum_t \gamma_t Year_t + \varepsilon_{it}, \quad (3)$$

and one including all three pillars simultaneously,

$$ROA_{it} = \alpha_i + \beta_1 Env_score_{it} + \beta_2 Social_score_{it} + \beta_3 Gov_score_{it} + \beta_4 \log(Assets)_{it} + \beta_5 AssetGrowth_{it}, \quad (4)$$

In all panel regressions, robust standard errors clustered at the firm level are used to correct for heteroskedasticity and serial correlation within firms (Arellano, 1987; Wooldridge, 2010). The signs and statistical significance of the coefficients for ESG_score, Env_score, Social_score, and Gov_score are interpreted in light of H2–H5.

By combining descriptive statistics, group comparisons, and fixed-effects panel regressions, the methodology provides a coherent framework to assess whether socially responsible industrial firms in the United States outperformed their less responsible peers over the period 2012–2021, and which dimension of ESG – if any – is most closely linked to accounting profitability.

Results and Discussion

Sample Characteristics and Descriptive Statistics

The empirical analysis is based on a balanced panel of listed US industrial firms observed over the period 2012–2021. The original dataset contains 72 firms and 720 firm-year observations. Due to missing values in some variables, the number of usable observations differs slightly across specifications, ranging from 634 to 711.

Table 1. Descriptive statistics (full sample)

Variable	Obs	Mean	SD	Min	Median	Max
ROA	698	8.217	5.597	-18.143	7.797	24.898
ESG score	666	55.029	18.097	5.718	58.044	91.715
Env score	638	51.906	25.369	0.568	57.164	96.474

Social score	666	57.134	19.178	0.265	57.628	97.394
Gov score	666	57.026	19.938	4.901	58.756	94.560
Asset growth	698	8.505	24.790	-55.911	4.680	289.633
Financial leverage	697	6.989	30.899	1.160	2.751	709.500
Log assets	711	23.284	1.189	20.356	23.261	27.253

Source: Authors' own calculations based on ESG and financial data for 72 US publicly traded industrial firms (2012–2021).

Table 1 summarises the main descriptive statistics for the variables used in the econometric models. Average profitability, measured by return on assets (ROA), amounts to approximately 8.2% (mean 8.22; SD 5.60). The distribution of ROA is relatively wide, with values ranging from about -18.1% to almost 25%, indicating that the sample includes both loss-making and very profitable firms.

The composite ESG score has a mean of 55.0 (SD 18.10), a median of 58.0, and a range of 5.7 to 91.7. The three ESG pillars are relatively balanced in terms of central tendency: the average environmental score is 51.9 (SD 25.37), the social score is 57.1 (SD 19.18), and the governance score is 57.0 (SD 19.94). However, the environmental dimension shows the greatest dispersion, suggesting that firms in the industrial sector differ substantially in their environmental practices and disclosures (**Table 2**).

Table 2. Panel regression results (dependent variable: ROA)

	(1) Pooled ESG	(2) FE ESG	(3) FE Env only	(4) FE Env+Soc+Gov
ESG_score	0.025	0.006		
	(0.029)	(0.021)		
Env_score			0.033	0.044
			(0.016)	(0.016)
Social_score				-0.033
				(0.023)
Gov_score				-0.003
				(0.012)
log_assets	-2.638	-3.117	-3.614	-3.406
	(0.406)	(1.130)	(1.142)	(1.138)
ASSET_GROWTH	0.001	0.010	0.011	0.010
	(0.007)	(0.006)	(0.006)	(0.006)
FNCL_LVRG	-0.010	-0.014	-0.013	-0.013
	(0.004)	(0.006)	(0.005)	(0.005)

Source: Authors' own calculations based on ESG scores and ROA for 72 US publicly traded industrial firms (2012–2021).

For the control variables, asset growth averages 8.5% per year but shows high variability (SD = 24.79), indicating periods of strong expansion and contraction. Financial leverage has a mean of 7.0 with extreme dispersion (SD = 30.90; range 1.16 to over 700), while firm size (log of total assets) averages 23.28 (SD = 1.19), suggesting a sample of relatively large firms.

The correlation matrix indicates a negative relationship between ROA and ESG measures: approximately -0.26 for the composite ESG score, -0.26 for environmental, -0.23 for social, and -0.10 for governance. In contrast, ESG pillars are strongly positively correlated with each other and with the composite score (0.36–0.89). This suggests systematic differences between high- and low-ESG firms, supporting the need for multivariate panel analysis rather than simple correlations (Orlitzky *et al.*, 2003; Friede *et al.*, 2015).

The distributions show that ESG scores are broadly spread, mostly between 40 and 80, while ROA is concentrated between 0% and 15%, including both loss-making and highly profitable observations.



Bivariate Comparisons: High-ESG Versus Low-ESG Firms (H1)


To test the first hypothesis, the sample is divided each year into high-ESG and low-ESG firms using the median ESG score for that year. Observations with missing ESG data are excluded from this classification. This procedure yields 335 firm-year observations in the low-ESG group and 331 in the high-ESG group.

As expected, there is a marked difference in ESG performance between the two groups. High-ESG firms reach an average composite ESG score of 69.78 (SD 8.63), whereas low-ESG firms have an average of 40.46 (SD 12.25). The same pattern appears for each pillar: for example, the mean environmental score increases from 32.61 in the low-ESG group to 69.81 in the high-ESG group (**Table 3**).

Table 3. Means (SD) by ESG group (yearly median split)

	Low ESG (0)	High ESG (1)
ROA	9.61 (5.76)	6.65 (4.97)
ESG score	40.46 (12.25)	69.78 (8.63)
Env score	32.61 (19.49)	69.81 (14.90)
Social score	43.55 (13.92)	70.88 (12.97)
Gov score	46.45 (17.89)	67.73 (15.77)
Asset growth	11.31 (28.74)	5.34 (18.95)
Financial leverage	4.19 (11.38)	10.15 (43.28)
Log assets	22.63 (0.93)	24.03 (1.00)

Source: Authors' own calculations.



However, the results run counter to H1. Low-ESG firms have a higher mean ROA (9.64%) than high-ESG firms (6.65%), with a statistically significant difference confirmed by both Welch's t-test ($t \approx 7.09$; $p < 0.001$) and the Mann-Whitney U test ($p < 0.001$). This economically meaningful gap suggests lower profitability among high-ESG firms. High-ESG firms are also larger (mean log assets 24.03 vs. 22.70; $p < 0.001$) and more leveraged (10.15 vs. 4.28), indicating systematic structural differences between groups. Overall, the bivariate evidence does not support H1, but these comparisons do not control for firm heterogeneity or time effects, motivating the subsequent panel regression analysis (Barnett & Salomon, 2012).

Panel Regression with Overall ESG Score (H2)

To examine the ESG–profitability relationship while controlling for confounders, panel regressions are estimated with ROA as the dependent variable. The main explanatory variables are the composite ESG score and its three pillars, along with controls for firm size, asset growth, and financial leverage. Year fixed effects are included, and standard errors are clustered at the firm level.

In the pooled OLS model (662 observations), which includes year dummies but no firm fixed effects, the model explains 28% of the variation in ROA ($R^2 = 0.284$). The coefficient on the ESG score is positive but statistically insignificant (0.025; $p = 0.40$), indicating no robust association between ESG and profitability after controlling for observable factors (**Table 4**).

Table 4. Panel regression results (dependent variable: ROA)

	(1) Pooled ESG	(2) FE ESG	(3) FE Env only	(4) FE Env+Soc+Gov
ESG_score	0.025 (0.029)	0.006 (0.021)		
Env_score			0.033 (0.016)	0.044 (0.016)
Social_score				-0.033 (0.023)
Gov_score				-0.003

				(0.012)
log_assets	-2.638	-3.117	-3.614	-3.406
	(0.406)	(1.130)	(1.142)	(1.138)
ASSET_GROWTH	0.001	0.010	0.011	0.010
	(0.007)	(0.006)	(0.006)	(0.006)
FNCL_LVRG	-0.010	-0.014	-0.013	-0.013
	(0.004)	(0.006)	(0.005)	(0.005)

Source: Authors' own calculations.

Control variables behave as expected in the corporate finance literature. Firm size (log assets) has a strong negative and significant effect on ROA (-2.64 ; $p < 0.001$), suggesting lower profitability among larger firms, while leverage is also negatively related to ROA (-0.01 ; $p < 0.02$). Asset growth is positive but not statistically significant.

To account for unobserved time-invariant firm characteristics, a second specification introduces firm fixed effects, alongside year dummies (Wooldridge, 2010). The model's explanatory power increases substantially ($R^2 = 0.67$), indicating that firm-specific factors and time effects account for a large share of the variation in profitability.

Importantly, in this fixed-effects specification, the coefficient on ESG_score remains small and statistically insignificant (0.006 ; $p = 0.79$). In other words, changes in a firm's overall ESG score over the sample period are not systematically associated with changes in ROA, even after controlling for size, leverage, growth, and time effects. The negative relationship between firm size and profitability persists (coefficient on log assets = -3.12 ; $p < 0.01$), as does the adverse impact of leverage (-0.014 ; $p < 0.02$). Asset growth becomes marginally significant and positive (0.010 ; $p < 0.08$), suggesting that expanding firms can temporarily achieve higher profitability. This insignificant coefficient is consistent with the weak unconditional association between ROA and the composite ESG score shown in **Figure 1**.

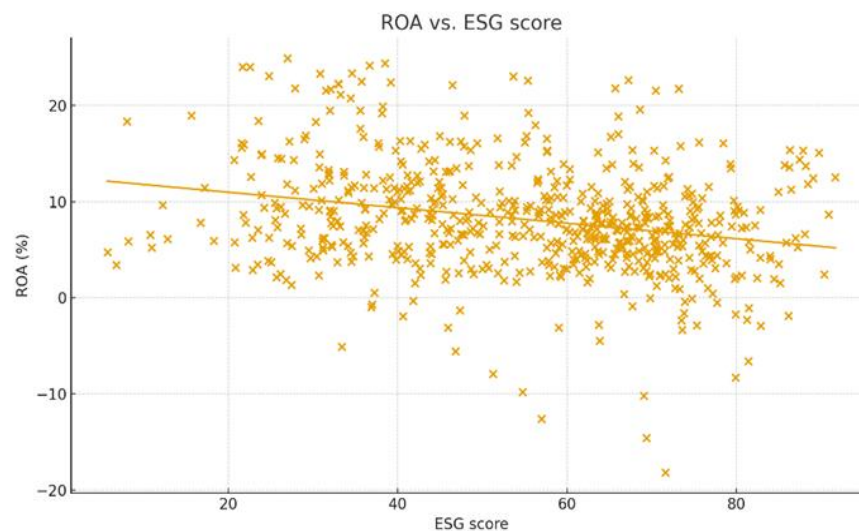


Figure 1. ROA versus composite ESG score

Source: Authors' own calculations based on ESG and financial data for 72 US publicly traded industrial firms (2012–2021).

The scatter plot of ROA and the composite ESG score ($N = 666$) shows a weak, slightly negative unconditional relationship, suggesting the need for a multivariate panel analysis with firm- and time-level controls.

Overall, panel regressions using the composite ESG score do not support H2, which predicted a positive relationship between ESG and ROA. This contrasts with meta-analyses that generally find a small positive association between CSR/ESG and financial performance (Margolis & Walsh, 2003; Orlitzky *et al.*, 2003; Friede *et al.*, 2015). A possible



explanation is that ESG implementation costs in capital-intensive industrial firms may outweigh short- to medium-term benefits when performance is measured using accounting indicators like ROA.

Panel Regressions with ESG Pillars (H3–H5)

The composite ESG score is decomposed into environmental, social, and governance pillars to assess whether specific dimensions drive profitability more than the aggregate index. Two fixed-effects models are estimated using 634 firm-year observations: one that includes only the environmental score and another that includes all three pillars.

In the environmental-only model, Env_score is positive and statistically significant (0.033; $p < 0.04$), indicating that a 10-point increase in environmental performance is associated with a 0.33 percentage-point rise in ROA. This supports H3 and suggests that environmental improvements may enhance efficiency and risk management in industrial firms (Porter & van der Linde, 1995). Control variables behave consistently: size and leverage are negatively related to ROA, and asset growth is slightly positively related to ROA. The model shows strong explanatory power ($R^2 = 0.668$), and the positive relationship is also reflected in the scatter plot (**Figure 2**).

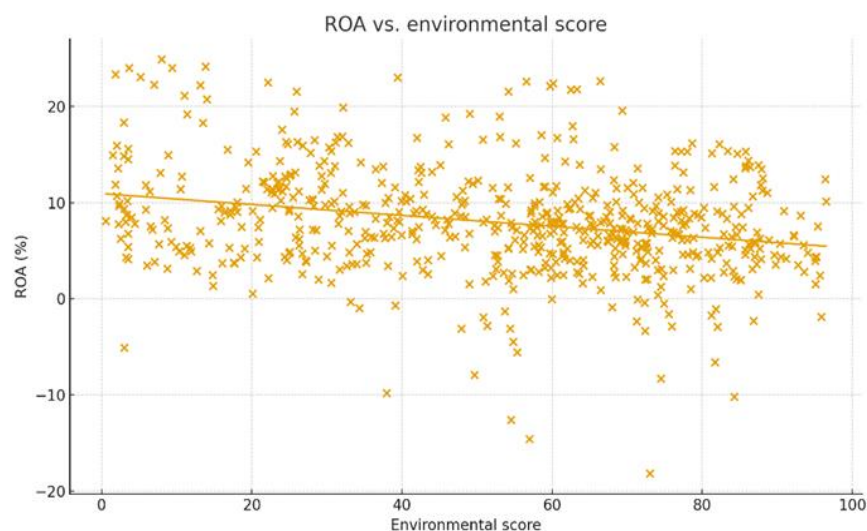


Figure 2. ROA versus environmental score

Source: Authors' own calculations based on ESG and financial data for 72 US publicly traded industrial firms (2012–2021).

The scatter plot shows ROA against the environmental pillar score ($N = 638$ firm-year observations). The bivariate relationship appears weak and noisy, but panel regressions reveal a small yet statistically significant positive association between environmental performance and ROA after controlling for firm and year effects.

In the full model, including all ESG pillars, the environmental score remains positive and significant (coefficient = 0.044; $p < 0.01$), suggesting that a 10-point increase is associated with about a 0.44 percentage-point increase in ROA. In contrast, the social (-0.033 ; $p = 0.14$) and governance (-0.003 ; $p = 0.79$) pillars are not statistically significant. The results therefore support H3, while H4 and H5 are rejected, highlighting that only environmental performance shows a robust link with profitability, likely through cost-efficiency and risk-reduction mechanisms.

Summary of Hypothesis Testing

Table 5 summarises the empirical support for the research hypotheses. The first hypothesis (H1), which predicted that high-ESG firms would outperform low-ESG firms in terms of ROA, is rejected. In simple group comparisons, high-ESG firms are significantly less profitable, although they are larger and have higher ESG scores as intended by construction.

Table 5. Model statistics

Model	Observations	R_squared
(1) Pooled ESG	662	0.2843
(2) FE ESG	662	0.6742
(3) FE Env only	634	0.6678
(4) FE Env+Soc+Gov	634	0.6702

Source: Authors' own calculations.

Hypothesis H2 is not supported, as no significant relationship is found between the overall ESG score and ROA in either pooled OLS or fixed-effects models after controlling for firm characteristics and time effects. In contrast, H3 is supported: environmental performance is positively and consistently associated with ROA, although the economic effect is small.

H4 and H5 are not confirmed, as the social and governance pillars show no significant relationship with ROA. Overall, the results indicate that ESG–financial performance is multidimensional, with only the environmental pillar showing clear economic relevance in US industrial firms. This supports earlier evidence that aggregated ESG measures can mask important differences across components and that results are highly context-dependent (Waddock & Graves, 1997; Barnett & Salomon, 2012; Friede *et al.*, 2015).

The results show a more complex ESG–performance relationship in US industrial firms. Overall, the study does not support a strong “business case” for ESG, as higher composite ESG scores are associated with lower ROA in simple comparisons, and this relationship becomes statistically insignificant once firm- and year-fixed effects are included.

This contrasts with meta-analyses that report a generally small positive ESG–financial performance link (Orlitzky *et al.*, 2003; Friede *et al.*, 2015; Necib, 2025). A possible explanation is that earlier studies often use cross-sectional data or do not fully control for firm-specific characteristics. By applying fixed effects, this study focuses on within-firm changes over time, which may reflect short-term costs of ESG implementation rather than long-term benefits suggested by stakeholder and resource-based theories (Freeman, 1984; Barney, 1991).

The descriptive results indicate that high-ESG firms are generally larger and more leveraged than low-ESG firms, suggesting structural differences within the sample. Larger industrial firms may face stronger regulatory and reputational pressure to adopt ESG practices, while their capital-intensive nature may be associated with lower ROA despite high absolute profits. This pattern is consistent with the negative relationship between firm size and profitability observed in the regressions (Renneboog *et al.*, 2008).

When ESG is separated into its components, only the environmental pillar shows a positive, statistically significant relationship with ROA, while the social and governance pillars are not significant. This supports evidence that ESG dimensions have different economic effects (Naeem *et al.*, 2022; Buchetti *et al.*, 2025). In industrial sectors, environmental improvements can reduce costs, risks, and liabilities, consistent with the Porter hypothesis (Porter & van der Linde, 1995).

Although the environmental effect is modest, it remains robust across all model specifications. In contrast, the social and governance pillars show no consistent impact, consistent with studies reporting weaker or context-dependent effects for these dimensions (Naeem *et al.*, 2022; Ali *et al.*, 2025; Yavuz, 2025). Social and governance activities may mainly influence risk, reputation, or cost of capital rather than short-term accounting profitability, suggesting that ROA may not fully capture their financial relevance (Velte, 2022; Ahmad *et al.*, 2023).

A further explanation relates to possible nonlinear relationships between ESG and financial performance. Prior research suggests that ESG effects may initially be negative due to implementation costs, but become positive once benefits and learning effects emerge (Barnett & Salomon, 2006). Since this study uses linear models, such nonlinearities may be averaged out, potentially explaining the weak or negative overall ESG effects and the lower ROA observed among high-ESG firms.

The results also highlight important measurement issues. Composite ESG scores combine heterogeneous indicators into a single index, potentially obscuring meaningful differences across dimensions (Buchetti *et al.*, 2025). The finding that only the environmental pillar is positively associated with ROA suggests that aggregation may dilute



economically relevant information. This supports calls for more disaggregated, dimension-specific ESG analysis, especially in sector-based studies (Naeem *et al.*, 2022; Necib, 2025).

Several limitations should be noted. The sample includes 72 US industrial firms, which may limit generalizability to other sectors or institutional contexts (Clark *et al.*, 2015). In addition, potential endogeneity and reverse causality are not fully addressed, as profitable firms may invest more in ESG or adjust ESG in response to shocks. Finally, focusing solely on ROA may overlook other financial benefits of ESG, such as valuation effects and risk reduction, which are emphasized in the broader literature (Friede *et al.*, 2015).

Despite these limitations, the study contributes to the ESG–performance debate by showing that ESG dimensions do not have uniform effects on profitability. In environmentally intensive contexts, the environmental pillar emerges as the most economically relevant factor.

For managers and investors, the findings suggest that targeted environmental investments may yield greater direct financial benefits than broad ESG strategies. Overall, the results underscore the importance of analyzing ESG at the pillar level, using sector-specific samples, and applying longitudinal methods to better understand the ESG–performance relationship.

Conclusion

The study examines the relationship between ESG performance and profitability in US publicly traded industrial firms. Results show that, although high-ESG firms tend to be larger and more sustainability-oriented, they do not outperform low-ESG firms in terms of ROA. Overall ESG scores are not significantly related to profitability, suggesting limited short-term financial gains from broad ESG engagement. However, the environmental pillar is consistently positive and significant, indicating that environmental improvements can enhance efficiency and risk management.

In practice, the findings suggest that managers and investors should focus more on environmental performance than on composite ESG scores. At the same time, policymakers may consider that environmental regulation can improve efficiency without harming profitability. The study is limited by its small sample, reliance on accounting-based measures, and potential endogeneity issues. Future research should expand to other sectors and countries, use market-based indicators, test for nonlinear relationships, and apply causal methods to better understand ESG's economic impact.

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References

- Ahmad, H., Yaqub, M., & Lee, S. H. (2023). Environmental-, social-, and governance-related factors for business investment and sustainability: A scientometric review of global trends. *Environment, Development and Sustainability*, 1–23. doi:10.1007/s10668-023-02921-x
- Ali, N. B. M., Hussin, H. A. A. A., Mohammed, H. M. F., Mohammed, K. A. A. H., Almutiri, A. A. S., & Ali, M. A. (2025). The effect of environmental, social, and governance (ESG) disclosure on the profitability of Saudi-listed firms: Insights from Saudi Vision 2030. *Sustainability*, 17(7), 2977. doi:10.3390/su17072977
- Arellano, M. (1987). Computing robust standard errors for within-groups estimators. *Oxford Bulletin of Economics and Statistics*, 49(4), 431–434. doi:10.1111/j.1468-0084.1987.tb00790.x



- Aydođmuş, M., Gülay, G., & Ergun, K. (2022). Impact of ESG performance on firm value and profitability. *Borsa Istanbul Review*, 22(Suppl. 1), S128–S140. doi:10.1016/j.bir.2022.05.001
- Baltagi, B. H. (2013). *Econometric analysis of panel data* (5th ed.). Wiley.
- Barnett, M. L., & Salomon, R. M. (2006). Beyond dichotomy: The curvilinear relationship between social responsibility and financial performance. *Strategic Management Journal*, 27(11), 1101–1122. doi:10.1002/smj.557
- Barnett, M. L., & Salomon, R. M. (2012). Does it pay to be really good? Addressing the shape of the relationship between social and financial performance. *Strategic Management Journal*, 33(11), 1304–1320. doi:10.1002/smj.1980
- Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. doi:10.1177/014920639101700108
- Bogomolova, V. (2024). *esg_dataset* (Version 1) [Data set]. Mendeley Data. doi:10.17632/tgmpk9kkt.1
- Buchetti, B., Arduino, F. R., & Perdichizzi, S. (2025). A literature review on corporate governance and ESG research: Emerging trends and future directions. *International Review of Financial Analysis*, 97, 103759. doi:10.1016/j.irfa.2024.103759
- Carpio-Vargas, E. E., Torres-Cruz, F., Bernedo, E. G. M., Yanqui, F. J. M., Chaiña, H. C. P., Zapana, W. H. M., & Villasante-Saravia, F. H. (2023). Triadic mental quotient and lifestyles in university students during pandemic-induced confinement. *Journal of Advanced Pharmacy Education and Research*, 13(3), 88–95. doi:10.51847/bDdfcMvcJ1
- Clark, G. L., Feiner, A., & Viehs, M. (2015). *From the stockholder to the stakeholder: How sustainability can drive financial outperformance*. University of Oxford; Arabesque Partners.
- Conover, W. J. (1999). *Practical nonparametric statistics* (3rd ed.). Wiley.
- Csep, A. N., Voița-Mekereș, F., Tudoran, C., & Manole, F. (2024). Understanding and managing polypharmacy in the aging population. *Annals of Pharmacy Practice and Pharmacotherapy*, 4, 17–23. doi:10.51847/VdKr0egSln
- Freeman, R. E. (1984). *Strategic management: A stakeholder approach*. Pitman.
- Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4), 210–233. doi:10.1080/20430795.2015.1118917
- Griffin, J. J., & Mahon, J. F. (1997). The corporate social performance and corporate financial performance debate: Twenty-five years of incomparable research. *Business & Society*, 36(1), 5–31. doi:10.1177/000765039703600102
- Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics* (5th ed.). McGraw-Hill.
- Guzek, K., Stelmach, A., Roźnowska, A., Najbar, I., Cichocki, Ł., & Sadakierska-Chudy, A. (2023). A preliminary investigation of genetic variants linked to aripiprazole-induced adverse effects. *Annals of Pharmacy Practice and Pharmacotherapy*, 3, 40–47. doi:10.51847/ZT28xcs95J
- Hashem, W., Mokhtar, M., Rahman, A. A., & Rashad, A. (2024). Adult acute lymphoblastic leukemia: Insights from six years of clinical practice in an Egyptian tertiary care center. *Asian Journal of Current Research in Clinical Cancer*, 4(2), 51–61. doi:10.51847/fFirKGgI3X
- Herman, A., Oplotnik, Ž. J., & Jagrič, T. (2025). The impact of ESG on business performance: An empirical analysis of NASDAQ–NYSE-listed companies. *Sustainability*, 17(21), 9683. doi:10.3390/su17219683
- Huata-Panca, P., Apaza, J. M. H., Carita, A. J. Q., Mamani, G. Q., & Torres-Cruz, F. (2025). Determinants of mortality type in a high altitude Andean context using a multivariable logit regression model in Puno, Peru. *Journal of Advanced Pharmacy Education and Research*, 15(3), 198–204. doi:10.51847/1vvhNPv5Vy
- Jaseckova, G., Konvit, M., & Vartiak, L. (2022). Vernadsky's concept of the noosphere and its reflection in ethical and moral values of society. *History of Science and Technology*, 12(2), 231–248. doi:10.32703/2415-7422-2022-12-2-231-248



- Kariri, H. D. H., Radwan, O. A., Somaili, H. E., Mansour, M. E. I., Mathkooor, S. A., & Gohal, K. M. M. (2024). The role of psychological capital in enhancing empowerment among female leadership. *Annals of Organizational Culture, Leadership, and External Engagement Journal*, 5, 17–27. doi:10.51847/w41TjwMAzM
- Kovalová, E., & Vartiak, L. (2024). Promoting sustainability in the automotive industry: Economic comparison of dealer sales model and agency sales model of electric vehicles in Slovakia. *European Journal of Sustainable Development*, 13(3), 551–568. doi:10.14207/ejsd.2024.v13n3p551
- Li, Q., Guo, Y., & Wang, Y. (2024). ESG systems and financial performance in industries with high environmental impact. *Frontiers in Sustainability*, 5, 1454822. doi:10.3389/frsus.2024.1454822
- Lunawat, R. M., Elmarzouky, M., & Shohaieb, D. (2025). Integrating environmental, social, and governance (ESG) factors into the investment returns of American companies. *Sustainability*, 17(19), 8522. doi:10.3390/su17198522
- Margolis, J. D., & Walsh, J. P. (2003). Misery loves companies: Rethinking social initiatives by business. *Administrative Science Quarterly*, 48(2), 268–305. doi:10.2307/3556659
- Naeem, N., Cankaya, S., & Bildik, R. (2022). Does ESG performance affect the financial performance of environmentally sensitive industries? A comparison between emerging and developed markets. *Borsa Istanbul Review*, 22(Suppl. 1), S128–S140. doi:10.1016/j.bir.2022.09.003
- Necib, A. (2025). *Environmental, social, and governance (ESG) disclosures and financial performance: A systematic literature review*. doi:10.2139/ssrn.5222124
- Orlitzky, M., Schmidt, F. L., & Rynes, S. L. (2003). Corporate social and financial performance: A meta-analysis. *Organization Studies*, 24(3), 403–441. doi:10.1177/0170840603024003910
- Porter, M. E., & van der Linde, C. (1995). Green and competitive: Ending the stalemate. *Harvard Business Review*, 73(5), 120–134.
- Renneboog, L., Ter Horst, J., & Zhang, C. (2008). Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of Banking & Finance*, 32(9), 1723–1742. doi:10.1016/j.jbankfin.2007.12.039
- Rentková, K., & Vartiak, L. (2017). Impact of corporate social responsibility on financial performance of the company: The case of Orange Polska. In P. Novák, Z. Jurigová, L. Kozubíková, & J. Zlámálová (Eds.), *Finance and performance of firms in science, education, and practice* (pp. 966–973). Tomas Bata University in Zlín.
- Singh, D., Piplani, M., Kharkwal, H., Murugesan, S., Singh, Y., Aggarwal, A., & Chander, S. (2023). Comprehensive Review on the Anticancer Potential of Thiazolidin-4-One Derivatives. *Asian Journal of Current Research in Clinical Cancer*, 3(1), 46–62. doi:10.51847/MpJ9fZKGZT
- Tam, L. T., An, H. T. T., Linh, T. K., Nhung, L. T. H., Ha, T. N. V., Huy, P. Q., & Luc, P. T. (2023). The Impact of COVID-19 on Value Co-Creation Activities: A Study of Economics Students in Vietnam. *Annals of Organizational Culture, Leadership and External Engagement Journal*, 4, 25–34. doi:10.51847/QeaHrAoLoL
- Velte, P. (2022). Meta-analyses on corporate social responsibility and corporate financial performance: New directions for CSR research. *Management Review Quarterly*, 72(4), 1109–1138. doi:10.1007/s11301-021-00211-2
- Waddock, S. A., & Graves, S. B. (1997). The corporate social performance–financial performance link. *Strategic Management Journal*, 18(4), 303–319.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180. doi:10.1002/smj.4250050207
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data* (2nd ed.). MIT Press.
- Yavuz, M. S. (2025). Does ESG performance have an impact on financial performance? *Journal of Entrepreneurship, Management and Innovation*, 21(1), Article 2. doi:10.7341/20252112
- Zhang, L.-S. (2025). The impact of ESG performance on the financial performance of companies: Evidence from China's Shanghai and Shenzhen A-share listed companies. *Frontiers in Environmental Science*, 13, 1507151. doi:10.3389/fenvs.2025.1507151

