



ESG ADOPTION AND CORPORATE FINANCIAL PERFORMANCE

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Abstract

A debate on the correlation between ESG adoption and financial performance of firms still exists in the frontier markets, as previous Pakistani studies have used correlational designs which do not allow for causal relationships. I filled this gap by testing, using a pre-post quasi-experimental design, the causal relationship between ESG and financial performance, whether firm size moderates this relationship, and whether the effect is sector specific. The sample comprises 20 companies listed on the PSX across seven sectors, providing a total of 120 firm year observations over three years pre and three years post ESG adoption, analyzed using firm fixed effects panel regression and complementary statistical tests. The results demonstrate that there is no statistically significant direct effect of ESG adoption on the variables ROA, ROE and PM and no significant moderating effect of firm size. On the sectoral level, there is a strong positive significance for Cement, and a strong negative significance for IT & Technology and Pharmaceuticals, a pattern that is surprising from a theoretical perspective. The results indicate that policymakers should justify ESG based guidelines on the grounds of stakeholder and environment instead of short-term financial gains and should not have a uniform policy for ESG regulation across different sectors.

Keywords: ESG Adoption, Corporate Financial Performance, Pre-Post Analysis, Firm Size Moderation, Pakistan Stock Exchange

1. Introduction

One of the foremost challenges in corporate finance is balancing environmental responsibility with financial performance. Environmental, Social and Governance (ESG) considerations have come to the fore of company, regulator and capital market strategies. The reasons behind this change go beyond climate change initiatives; it is also caused by increasing regulatory requirements like that of the UN 2030 Agenda for Sustainable Development and the Paris Agreement (2015), and changing investor priorities (Fu et al., 2023; Lee, 2020). The investment is unprecedented: \$55 trillion by 2035 to reach global climate targets (Azam et al., 2026), and a question arises as to whether it is good or bad for the financial performance of companies to adopt ESG.

Global studies largely conclude a positive relationship (Subagiya et al., 2026; Azam et al., 2026). Nazir et al. (2024) established a positive relationship between ESG and financial stability in commercial banks in Pakistan, and Chaudhary and Riaz (2025) showed that ESG composite scores had a positive influence on ROA, ROE and Tobin's Q in various sectors of the Pakistan Stock Exchange (PSX). The two studies, however, use correlational fixed effects models, and therefore the question remains whether the performance



increases are the result of the firms adopting ESG or simply of the fact that they were already more financially robust.

Pakistan is a climate vulnerable country and is at the nascent stage of developing a green banking regulatory framework through the State Bank of Pakistan. It has recently started introducing ESG disclosure requirements on the Pakistan Stock Exchange. In this changing regulatory environment, Indriyani et al. (2026) using bibliometric mapping of 2,952 publications confirm that Pakistan is one of the least represented countries in sustainable finance literature, highlighting the need for context specific empirical evidence.

To this end, the present study focuses on the financial performance of PSX listed companies before and after adopting ESG, employing a pre-post quasi-experimental design. This design differs from the previous correlational studies, which compared the performance of the firms' three years prior to ESG adoption with their three years after adoption, thus eliminating within firm change that was driven by factors other than the adoption of ESG. Firm size is the moderating variable tested and sectoral heterogeneity is explored in seven sectors namely: Oil & Gas, Fertilizers, Banking, Cement, Automobile, IT & Technology, and Pharmaceuticals.

1.1 Problem Identification

This study has three objectives: (i) to apply fixed-effects panel regression to test the direct effect of ESG adoption on ROA, ROE, and Profit Margin, providing causal pre-post evidence beyond prior correlational studies; (ii) to test whether firm size moderates the ESG-performance relationship; and (iii) to quantify sectoral differences in ESG's impact across seven PSX sectors.

The importance of this study lies in its use of a causal pre-post design to examine the impact of ESG on financial performance across seven sectors in Pakistan. By treating firm size as a moderator rather than a control variable, the study offers more credible evidence for the State Bank of Pakistan's Green Banking Guidelines, the PSX's ESG disclosure framework, and for managers deciding whether to invest in ESG.

2. Literature Review

This study's analysis of the relationship between ESG adoption and corporate financial performance is based on three complementary theoretical frameworks. Freeman (1984) proposed that firms who want to create long term value should pay attention to the interests of all of the stakeholders comprising their employees, customers, communities, regulators, and environment. The acceptance of ESG is not a cost, but an investment in establishing stakeholder legitimacy and regulatory goodwill (Nazir et al., 2024; Indriyani et al., 2026). Cho et al. (2023) reveal that high ESG Korean companies perform better on financial values, while Eccles et al. (2014) indicated that high sustainability companies attract long term investors and report better long-term financial performance. The signaling theory (Spence, 1973) provides an explanation of the way in which disclosure of ESG information sends credible signals to the capital markets. When a company issues its first sustainability report or ESG disclosure, it serves as an expensive but convincing message indicating that the company will no longer engage in short-term extraction but will attempt to create value in the long run. This signaling mechanism is directly supported by the study conducted by Albitar et al. (2020) using a UK sample, where they found a positive and significant relationship between ESG disclosure and firm performance before and after the first introduction of integrated reporting, and firm fixed effects models supported the existence of the relationship, not as a cross-sectional artifact. The Resource Based View (Barney, 1991) posits that companies have resources in the form of their ability to translate ESG promises into economic results, which is a resource that can differ among companies. Based on the RBV concept (Cohen & Levinthal, 1990), a firm's absorptive capacity is a key factor that determines its ability to convert ESG adoption into tangible performance improvements, and larger firms with higher financial slack, technical capabilities, and stakeholder networks are well positioned to leverage ESG adoption for tangible performance gains. The relationship between ESG performance and firm size is considered as a boundary condition of this study which has not been previously tested in Pakistan and is the main theoretical contribution of this study.

2.1 ESG, Green Finance and Financial Performance

ESG adoption in Pakistan is taking place in the backdrop of the wider Asian region's trend of green finance, which involves using financial products and services, including green bonds, green credit and



sustainability linked loans, to channel financial resources towards climate friendly projects (Lee, 2020; Fu et al., 2023). Based on a difference-in-differences methodology applied to data at the firm year level of China's listed companies, Liu et al. (2026) conclude that green finance policy increases the ESG score of the companies, both through relaxing financing constraints and through an improvement in their profitability. Results from Azam et al. (2026) show that there is a positive correlation between green investment and ESG readiness in 57 economies, and an ROA increase of 0.8–1.2 percentage points for integration of ESG in Indonesian firms is similar in direction as tested in the current study, reported by Subagiya et al. (2026). The results of these studies demonstrate that the global ESG performance relationship observed in other studies is also consistent with this study, but this study measures the impact of the ESG adoption status itself, not of the intensity of green finance.

Another strand of research focuses on how ESG commitments can be translated into competitive advantage, which is achieved through ESG driven innovation, green patent development, clean technologies, and sustainability management systems (Ma & Zhuo, 2026; Wilson et al., 2026). Ma and Zhuo (2026) reveal that environmental regulation stringency affects green patent output of Chinese firms, and these impacts differ across firm size and financial market maturity level. A parallel study by Wilson et al. (2026) also reveals that UK companies with higher exposure to ESG financing generate more green patents and are more productive overall, particularly among larger companies that are more technologically advanced. The expectation of greater benefits from ESG adoption is supported in this literature by the assumption that absorptive capacity of the firm will be higher for larger firms, which forms the underpinning of this study's firm size moderation hypothesis (H2).

Firm level effects should be seen in this broader context, namely the macroeconomic and sustainability dimensions of green finance. Lee (2020) analyzes China's green finance development from a policy perspective and finds five characteristic trends: the transition from green bonds to sustainability bonds, the diversification of instruments, the transition from the business model to the corporate business model, rising demands for transparency and most importantly, the continued lack of an integrated green finance taxonomy. This taxonomic fragmentation is reported in most countries in China, in Europe and in developing countries, and directly accounts for the non-congruent results of studies of the same construct. In Pakistan, where the SBP taxonomy for green banking has been under development, it is currently more credible to measure the benefits for the firm from the annual reports, as adopted in this study, than to measure the benefits using a composite index based on standardized reporting.

Through the Method of Moments Quantile Regression (MMQR), Yu et al. (2026) explore the sustainability analysis of green finance for BRICS economies based on a balanced panel spanning 25 years and observe that green finance is consistently effective at all quantiles, with its impact growing in significance from -0.078 at the second quantile to -0.238 at the ninth quantile. The green finance-environmental sustainability relationship is moderated by green economic growth, and green finance drives green economic growth, which in turn strengthens the sustainability effect of green finance. This is a theoretical underpinning for the current study to focus on the moderating effect of firm size on the green finance-performance relationship: country level green economic capacity can amplify the impact of green finance; firm level resource capacity (size) can amplify the impact of green finance on performance.

Indriyani et al. (2026) found that, based on bibliometric analysis of 2952 works related to sustainable financial performance published between 1990 and 2024, the percentage of annual publications is 18.87%, and the publications published after 2015 have shifted emphasis from SFPs to ESG metrics, green bonds, climate risk, and sustainable investment as dominant research themes. This geographical concentration is especially significant as China, the US, and UK are responsible for most publications, with Pakistan only making a small contribution. The presence of "sustainable development," "sustainability," and "financial performance" as the top three most frequently used keywords implies that sustainable development and the three variables used in the present study are theoretically similar to the core issues of the field; the demand for context sensitive research in regions with low representation in the field justifies the present study's focus on Pakistan.



There is an extensive amount of research on how ESG performance correlates with corporate financial performance, and the findings are, in general, positive, although the results vary by industry and country. Albitar et al. (2020) provide some of the most comparable evidence to the present study, by comparing the relationship between ESG disclosure and firm performance within a period before and after integrated reporting came into effect in 2013 for the top 350 firms listed on the FTSE, and finds that, in both the pre and post integrated reporting periods, there was a positive and significant relationship, as measured by firm-fixed-effects models, between ESG disclosure events and measurable performance changes over time. Biju (2025), on the other hand, does not identify any significant causal relationship between ESG and firm performance in an emerging market panel, and finds results to be very sensitive to the nature of the performance metric (market based or accounting based). This difference in the emerging market findings highlights the importance of a pre-post design specific to Pakistan as the results from the other emerging markets did not necessarily extrapolate.

The closest study to the present work was done by Chaudhary and Riaz (2025) that investigates the impact of ESG composite scores on the ROA, ROE, and Tobin's Q for PSX sectors with the application of fixed effects panel regression model, and they obtained positive results in all three ratios. But the correlational design of their study doesn't prove that the performance improvements they see are due to the implementation of ESG, or that a firm would necessarily have a higher performance if it had been a smaller firm. Also, they examined only a composite score of ESG adoption and not the adoption event itself. Finally, their design does not account for the fact that firms may be more likely to adopt ESG if they are of higher financial standing. The present study overcomes these three limitations by adopting a pre-post design, a moderation test for the firm size, and an indicator of binary ESG adoption.

In the context of financial stability, Nazir et al. (2024) also found a positive relationship between ESG and financial stability in the Pakistani commercial banking sector, but their study was restricted to a single sector and was not designed causally. They have concluded that corporate governance contributes to competitive advantage, which aligns with the resource-based view on which this study's hypotheses are based.

The policy and institutional context in which firms operate are key determinants of the success of their ESG implementation in driving financial returns. The findings indicate that the effect of green finance policy is significantly higher in cities that are institutionally more developed as compared to the peripheral areas, highlighting the significance of the quality of financial infrastructure, which is relevant in Pakistan where financial activity is mainly concentrated in cities like Karachi and Lahore and not sufficient in the industrial periphery. The sustainability transition framework (Geels, 2002) represents a perspective on ESG adoption as a niche innovation that can spur systemic change towards sustainable economic models through conducive (dis) regulations. The firms under the study sample are in an early transition phase, where the ESG adopters are on the verge of implementing the ESG practices and may experience near term transition costs, but also benefit from first mover advantages in terms of access to capital and investor attention (Azam et al., 2026; Lee, 2020).

2.2 Firm Size as a Moderator

In this study, firm size is considered a moderate variable instead of control because of the convergent theory and empirical evidence that the ESG performance relationship varies with firm size. The theoretical foundation is the RBV's theory of absorptive capacity (Cohen & Levinthal, 1990): firms vary in the ability to identify, absorb and transform new resources and larger firms are generally more likely to have greater financial slack, technical expertise, and stakeholder networks that enable them to convert ESG commitments into financial performance.

Based on static and dynamic panel data of 351 FTSE 350 companies from 2002 to 2018, Ahmad et al. (2021) concluded that company size was a moderating factor, as larger companies achieved higher ESG performance impacts than smaller companies. Similarly, Abdi et al. (2022) discovered that company size moderated the relationship between sustainability disclosure and financial performance among global airlines; the connection was significantly different between full-service carriers and low-cost carriers. Recent research by Sun et al. (2025) revealed a positive moderating effect of firm size on the ability of Chinese listed



companies to leverage competitive market pressures for better ESG performance, as larger companies are more likely to benefit from scale and resources. Ma and Zhuo (2026) further stated that environmental regulation was more influential on green innovation in high-tech Chinese firms than in traditional industries, and Hidayat et al. (2026) concluded that larger Indonesian firms with high financial capacity had higher investment in sustainability, which is like the size related capacity effect.

The importance of the moderation analysis is that in Pakistan the companies listed on the Pakistan Stock Exchange (PSX) vary in size considerably ranging from big banking institutions to much smaller companies like automobile and IT. This variation helps to assess Hypothesis 2: The relationship between ESG adoption and financial performance is positively strengthened for larger PSX-listed firms.

2.3 Research Gap

The literature overall confirms that adoption of ESG can impact financial performance in several ways, but much of the existing literature is based on the adoption of composite ESG scores that may not be consistently available across the industry for Pakistani companies. The present study instead uses a binary ESG Status indicator based on the year of a firm's first sustainability report or ESG disclosure. A positive and significant coefficient would suggest that the process of ESG adoption (disclosure, board action, or just initial practices) is linked to performance improvement. This approach is especially well suited for the frontier markets like Pakistan where standardization of ESG reporting is still in its infancy (Azam et al., 2026; Indriyani et al., 2026).

Despite the growing literature on sustainable finance in Pakistan, it is still limited in terms of three aspects which are directly addressed by this study. While Nazir et al. (2024) have found evidence to make a link between ESG and financial stability in commercial banks, they are unable to comment on the variation of this relationship across sectors. Chaudhary and Riaz (2025) offer multi-specific evidence but are unable to prove causality; include the size of the firm as a control only; and use just one composite ESG score, which prevents an analysis of the adoption event itself.

The present study extended the above literature in three ways. First, it used a quasi-experimental pre-post design, which mitigated the self-selection bias present in cross-sectional ESG studies (Wilson et al., 2026; Liu et al., 2026). Second, it explored firm size as a theoretically grounded moderator rather than a control, as in Chaudhary and Riaz (2025). Third, it added Profit Margin to the dependent variable battery, which reflects the revenue side efficiency gains, which are more relevant in the capital light sectors covered in the study, like IT & Technology, and Pharmaceuticals. This study fills a gap that is not the lack of ESG related evidence in Pakistan, but the lack of causal, multi sector, pre-post evidence to test firm size as a moderator. Indriyani et al. (2026) also find that Pakistan is among the least covered frontier markets in the sustainable finance literature and Azam et al. (2026) find that the institutional ESG readiness of Pakistan is among the lowest in the countries studied. This renders the contribution of the present study both geographically and empirically unique, compared with previous studies.

3. Methodology

This study was a quantitative explanatory research study with pre-post quasi-experimental design with operating year of the individual firm as the year of treatment. In addition to comparing within firms, the authors could make causal inferences beyond what can be achieved from the correlational fixed effects approach used by Chaudhary and Riaz (2025) and Nazir et al. (2024).

The panel consisted of 20 PSX listed companies from seven different sectors, and each company contributed six years of observations (three years prior and three years since the introduction of ESG). The dependent variables were Return on Asset (ROA), Return on Equity (ROE) and Profit Margin measured on a yearly basis and based on the audited financial statements. The independent variable was the ESG adoption status (0 = pre-ESG and 1 = post-ESG). The analysis was conducted based on fixed effects panel regression with moderation analysis based on Baltagi (2021).

Population: All PSX listed companies with identifiable ESG adoption dates and sufficient data availability across the observation period. The population was selected as the firms listed on PSX because



PSX is the main capital market in Pakistan where the requirements of ESG disclosure and State Bank of Pakistan's Green Banking Guidelines are being implemented.

Sampling: Purposive nonprobability sampling. Instead of random sampling, purposive sampling was used, as the study required firms with a specific ESG adoption date and at least three years of complete financial data before and after the adoption date.

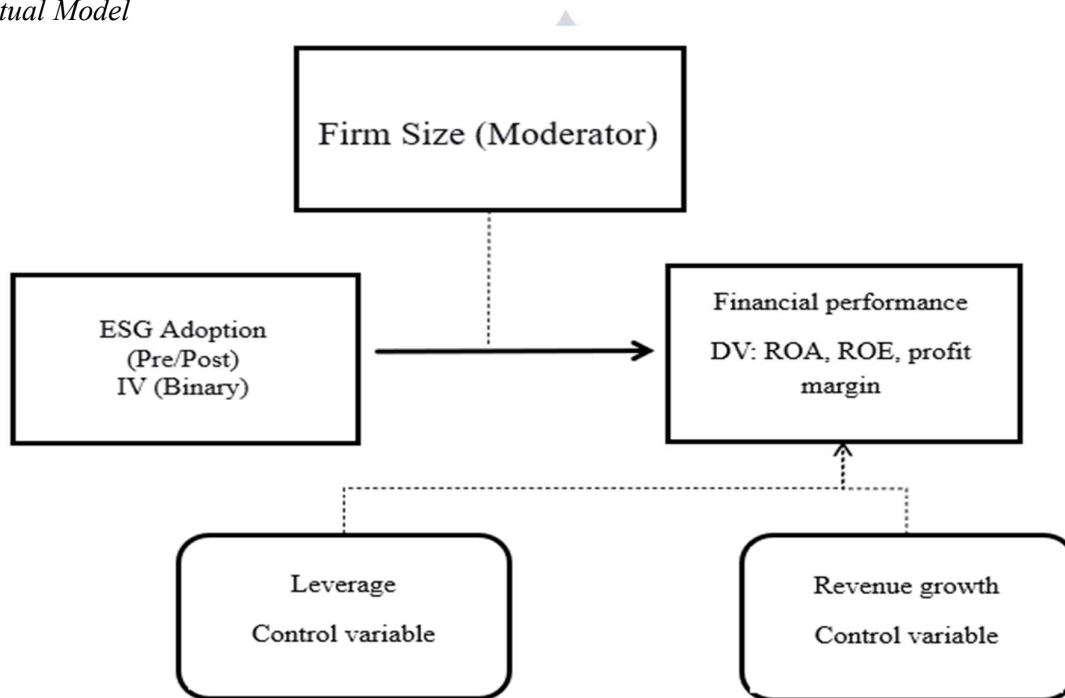
Sample: 20 Companies across 7 Sectors; Oil & Gas (4), Banking (4), Fertilizers (3), Automobile (3), Cement (2), IT & Technology (2) and Pharmaceuticals (2). These sectors were chosen to provide a meaningful blend of capital intensity, regulatory exposure and ESG maturity, from heavily regulated, capital-intensive sectors (Oil & Gas, Cement) to asset light, governance sensitive sectors (IT & Technology, Pharmaceuticals). This enabled the study to investigate whether the financial implications of ESG are sector specific as indicated by Hypothesis 3.

Firms were included only if formal ESG adoption was revealed in annual reports and complete financial data was available for a minimum of 3 years before and after ESG integration and were excluded for incomplete or inconsistent financial information or for conflicts involving greenwashing or breaches of rules.

3.1 Conceptual Model

Figure 1

Conceptual Model



3.2 Hypotheses

H1: There is a positive correlation for the adoption of ESG (post-integration period) and ROA, ROE and Profit Margin compared with the pre-integration period.

H2: The relationship between the ESG adoption and corporate financial performance is positive and is strengthened with the increase in firm size; especially for PSX listed firms.

H3: The impact of ESG on the financial performance varies across industries, larger impact in IT & Technology, Pharmaceuticals and Banking than in Cement and Automobile.

3.3 Variable Definitions and Measurement

ESG Status was operationalized as a binary indicator, not a continuous composite score, due to the inconsistent availability of standardized third party ESG ratings for PSX listed firms. The variable was coded



1 for the years after a firm's first sustainability report or explicit ESG disclosure in its annual report and 0 for the years before.

Firm size was measured by the natural logarithm of total assets (Baltagi, 2021) and was included as a moderating variable to test Hypothesis 2 because larger firms are expected to have more absorptive capacity, financial slack, and stakeholder networks to convert ESG adoption into measurable financial outcomes (Cohen & Levinthal, 1990; Wilson et al., 2026).

Leverage and Revenue Growth were included as control variables as established firm-level determinants of financial performance, independent of ESG adoption.

3.4 Data Collection

All data were secondary, derived from:

- PSX Annual Report: Net Income, Total Assets, Equity, Debt, Revenue.
- Company Annual Reports: Year of ESG adoption (first sustainability report/ESG disclosure).
- World Bank / SBP: Macro-economic controls (where necessary).

Standardization: All amounts in PKR. US dollar amounts converted using annual average exchange rates of SBP.

ESG Integration Year: The year in which a company issued its first sustainability report or included an explicit ESG section in its annual report.

3.5 Software and Tools

The analysis was performed using Stata 11. The baseline, moderation and sector-wise models were estimated with fixed effects panel regression with standard errors clustered at the firm level. The Hausman test was used to select between fixed and random effects, and diagnostic tests for heteroskedasticity, multicollinearity and autocorrelation were conducted as per standard procedures in panel data (Baltagi, 2021). One way ANOVA with Bonferroni post hoc tests was used to test sector heterogeneity, whereas the binomial sign test was used for proportions of pre-post improvement. Data was first cleaned in Microsoft Excel before being imported into Stata.

3.6 Robustness Checks

Placebo Test: ESG adoption years were randomly reassigned for each firm, and the main models were re-estimated (1,000 repetitions).

Sub-sample Analysis: One sector was left out at a time, and the model was re-estimated; coefficients remained stable across exclusions.

3.7 Diagnostic Testing

Table 1

Diagnostic Tests

Test	Purpose	Criterion	Source
Shapiro-Wilk	Test of normality for residuals	*p* > .05 indicates normality	Shapiro & Wilk (1965)
Breusch-Pagan	Test for homoskedasticity	*p* > .05 homoskedasticity	Breusch & Pagan (1979)
Durbin-Watson	Test for serial autocorrelation	Value $\approx$ 2 indicates no autocorrelation	Durbin & Watson (1951)
Hausman	Test for model specification (FE vs. RE)	*p* < .05 indicates FE was preferred	Hausman (1978)
Variance Inflation Factor (VIF)	Test for multicollinearity	VIF < 5 indicates acceptable levels	Following Baltagi (2021)

A series of tests were performed to check the validity of the panel regression model. Table 1 shows the results and decision criteria.



4. Results and Discussion

4.1 Descriptive Statistics Results

Table 2

Descriptive Statistics for Full Sample (N = 120)

Variable	Mean	SD	Min	Max
ROA	0.0813	0.0711	-0.0575	0.3020
ROE	0.2048	0.1519	-0.1883	0.6704
Profit Margin	0.2199	0.2414	-0.1108	1.0000
Firm Size	18.7231	1.5617	15.6730	22.4342
Leverage	0.1248	0.1721	0.0000	0.6658
Revenue Growth	0.4491	2.8001	-0.4546	30.6597

Note. N = 120 firm year observations across 20 PSX-listed firms.

The average profitability of the firms in the sample was moderate (ROA is 8.1%, ROE is 20.5%) and there was a great dispersion of profitability values among firms and sectors, which included a few loss-making observations.

Table 3

Descriptive Statistics by ESG Status

Variable	Pre-ESG Mean (SD)	Post-ESG Mean (SD)
ROA	0.0847 (0.0723)	0.0779 (0.0703)
ROE	0.2065 (0.1474)	0.2032 (0.1574)
Profit Margin	0.2198 (0.2335)	0.2200 (0.2510)

Note. Pre-ESG: ESG Status = 0; Post-ESG: ESG Status = 1.

The overall mean performance was essentially the same before and after ESG adoption for all three measures, suggesting that the association might be weaker than postulated.

4.2 Correlation Analysis

Table 4

Pearson Correlation Matrix

Variable	ROA	ROE	Profit Margin	ESG Status	Firm Size	Leverage
ROA	1.000					
ROE	0.773***	1.000				
Profit Margin	0.200*	0.475***	1.000			
ESG Status	-0.048	-0.011	-0.034	1.000		
Firm Size	-0.456***	-0.059	-0.012	0.041	1.000	
Leverage	-0.277**	-0.281**	-0.347***	0.125	-0.132	1.000

Note. *p* < .05. **p < .01. ***p < .001.

Leverage was negatively correlated with all three performance measures, and there was no significant correlation between ESG Status and any performance measure.

4.3 Baseline Fixed Effects Panel Regression

To test the direct effect of ESG adoption on financial performance, following the firm-fixed-effects panel approach of Albitar et al. (2020) and Baltagi (2021):

$$Y_{it} = \alpha_i + \beta_1 \text{ESG}_{it} + \beta_2 \text{FirmSize}_{it} + \beta_3 \text{Leverage}_{it} + \beta_4 \text{RevenueGrowth}_{it} + \epsilon_{it}$$

(where Y_{it} = ROA, ROE, or Profit Margin, estimated separately for each)

Where: In the following models, the subscript i denotes the individual firm ($i = 1, 20$) and the subscript t denotes the year of observation ($t = 1, 6$ for each firm). The term α_i is firm fixed effects, which capture firm specific time invariant characteristics which may bias the estimated effect of ESG adoption, such as management quality or industry positioning. ESG is the binary indicator for treatment (0 = years before, 1 = years after) a firm implemented its ESG policy. The time varying control variables are as follows: FirmSize, Leverage and RevenueGrowth. The β coefficients are the estimated effect of the independent variables on the



dependent variable and ϵ_{it} is the error term which is clustered at the firm level to reflect serial correlation within firms over time.

Table 5

Fixed Effects Regression Results

Variable	ROA	ROE	Profit Margin
ESG Status	-0.0055 (0.0165)	-0.0131 (0.0397)	0.0060 (0.0215)
Firm Size	0.0084 (0.0197)	0.0423 (0.0481)	-0.0027 (0.0261)
Leverage	-0.1036 (0.0719)	-0.2213 (0.1541)	-0.0799 (0.0957)
Revenue Growth	0.0030*** (0.0008)	0.0057** (0.0019)	0.0021* (0.0009)
R^2 (within)	0.0822	0.0718	0.0240
N	120	120	120

Note. Standard errors are clustered (firm-level) in parentheses. * $p < .05$. ** $p < .01$. *** $p < .001$. The analysis of ESG Status reveals that across all three models it is statistically insignificant and H1 is not supported.

4.4 Moderation Analysis (Firm Size)

To investigate the moderating effect of firm size on the ESG performance relationship, the moderating effect approach taken by Ahmad et al. (2021) and Sun et al. (2025) was followed:

$$Y_{it} = \alpha_i + \beta_1 \text{ESG}_{it} + \beta_2 \text{FirmSize}_{it} + \beta_3 (\text{ESG}_{it} \times \text{FirmSize}_{it}) + \beta_4 \text{Leverage}_{it} + \beta_5 \text{RevenueGrowth}_{it} + \epsilon_{it}$$

(where Y_{it} = ROA, ROE, or Profit Margin, estimated separately for each)

The interaction term $\text{ESG}_{it} \times \text{FirmSize}_{it}$ was included to test whether the impact of ESG adoption on financial performance varied by firm size, with its main effects mean-centered to aid interpretation. A positive and statistically significant coefficient of β_3 for the interaction term is the important parameter to consider, as it would support Hypothesis 2 demonstrating that there is a positive financial benefit for firms to adopt ESG as they get larger. The meaning of all other terms is the same as in the baseline model.

Table 6

Moderation Regression Results

Variable	ROA	ROE	Profit Margin
ESG Status	-0.0074 (0.0173)	-0.0165 (0.0421)	0.0038 (0.0220)
Firm Size (centered)	0.0075 (0.0179)	0.0407 (0.0451)	-0.0038 (0.0246)
ESG $\times$ Firm Size	0.0071 (0.0065)	0.0118 (0.0127)	0.0078 (0.0096)
Leverage	-0.0898 (0.0680)	-0.1984 (0.1473)	-0.0648 (0.0950)
Revenue Growth	0.0028*** (0.0008)	0.0054** (0.0020)	0.0019* (0.0009)
R^2 (within)	0.0987	0.0816	0.0343
N	120	120	120

Note. Clusters (firm-level) SEs are in parentheses. * $p < .05$. ** $p < .01$. *** $p < .001$. In none of the models, the interaction between ESG and Firm Size was positive but not significant.

4.5 Sector Heterogeneity Analysis

Sector-wise ROA:

$$\text{ROA}_{it} = \alpha_i + \beta_1 \text{ESG}_{it} + \beta_2 \text{FirmSize}_{it} + \beta_3 \text{Leverage}_{it} + \epsilon_{it}$$

This model was estimated separately in the seven sectors following the Liu et al. (2026) sector disaggregated approach that can be used to detect heterogeneous treatment effects. The symbols carry the same meaning as in the baseline model, but each estimation was limited to firms in a single sector.

Table 7

Sector Wise Regression Results (ROA)

Sector	*n* Firms	ESG Status β	*p*-value
Oil & Gas	4	0.0667	.228
Fertilizers	3	0.0075	.178
Banking	4	0.0004	.825



Cement	2	0.0507	.005**
Automobile	3	-0.0622	.039*
IT & Technology	2	-0.0861	< .001***
Pharmaceuticals	2	-0.0875	< .001***

Note. *p < .05. **p < .01. ***p < .001. Interpretation: Sector size effects are different in size and direction; sectors with 2–3 firms should be interpreted firm by firm or not as sector representative.

Table 8

One Way ANOVA: ESG Impact Across Sectors

Source	F	*p*-value
Between Sectors	2.6674	.019*

Note. *p < .05.

The ANOVA test supported H3 in the sense that there is an overall statistically significant difference between the impact of the ESG in each sector.

Table 9

Bonferroni Post-Hoc Comparison (Significant Pair)

Sector Pair	Mean Difference	Adjusted *p*
Banking – Oil & Gas	0.0559	.038*

Note. *p < .05. All other 20 pairwise comparisons were non-significant.

There was a statistically significant difference in ESG impact only between Banking and Oil & Gas; all other sector pairs were statistically indistinguishable.

4.6 Pre-Post Change Analysis

For each firm i , the pre-post change in performance was calculated as:

$$\Delta Y_i = (\text{Mean } Y_{\text{post}}) - (\text{Mean } Y_{\text{pre}})$$

(where Y = ROA, ROE, or Profit Margin, calculated separately for each)

The change in performance of firm i was defined as the difference between the average performance of firm i during the post-ESG-adoption period and the average performance of the firm i during the pre-ESG adoption period. Then, the non-parametric approach described in Baltagi (2021) was applied to test whether the proportion of firms that experienced a positive change (ΔROA_i , ΔROE_i , or ΔPM_i) was statistically different from 0.5, the proportion that would be expected by chance alone.

Table 10

Binomial Sign Test: Pre-Post Performance Change

Measure	Firms Improved	Total	Proportion	*p*-value
ROA	8	20	40.0%	.503
ROE	9	20	45.0%	.824

Note. Page 17 of the supplied file contains corrupted OCR numerals that cannot be reproduced without reconstruction.

4.7 Robustness Check

Table 12

Robustness Check (ROA Model)

Variable	Mean Coefficient	Placebo SD	Min	Max	Original Coefficient
Placebo Model ESG (ROA)	-0.0078	0.0085	-0.0373	0.0261	-0.0055
Placebo Model ESG (ROE)	-0.0210	0.0186	-0.0821	0.0473	-0.0131
Placebo Model ESG (Profit Margin)	-0.0044	0.0131	-0.0469	0.0470	0.0060

Note. The analysis was based on 1,000 repetitions in which the adoption years of the firms were randomly reassigned.

**Table 13***Robustness Check (ROA Model)*

Sector Excluded	ESG Status β	*p*-value	N
Fertilizers	-0.0068	.734	102
Oil & Gas	-0.0177	.262	96
Banking	-0.0063	.771	96
Automobile	0.0110	.513	102
Cement	-0.0143	.373	108
IT & Technology	-0.0064	.716	108
Pharmaceuticals	0.0067	.662	108

Note. Full-sample ESG Status coefficient (Table 5) = -0.0055, *p* = .741.

The coefficient ESG Status was small and statistically insignificant when excluding any single sector, which means that there is no single sector driving or masking the null H1 result.

4.8 Discussion

4.8.1 H1: ESG Adoption Significantly Improves Financial Performance (ROA, ROE, Profit Margin). Not supported. The fixed effects regression results (Table 5) indicate that the pre-post changes in financial performance that were observed were not related to the ESG Status coefficient, as both are not statistically significant for ROA, ROE or Profit Margin (e.g. the full sample ROA coefficient is -0.0055, *p* = .741). The null result is further supported by the binomial sign test, which found that the proportion of firms whose performance improved after adopting the ESG index in all three measures; ROA, ROE, and Profit Margin, was at or below chance level (Table 10), and by the placebo test, in which the original ESG coefficients fell within the range of 1,000 random placebo reassignments, implying that they are statistically indistinguishable from noise (Table 12). The results are similar to Rahman et al. (2023), Shobhwani and Lodha (2023) and Biju (2025), who also did not find any significant relationship between ESG adoption and financial performance in their studies, while Chaudhary and Riaz (2025) and Nazir et al. (2024) found positive relationship between ESG and financial performance in their correlational studies in Pakistan.

4.8.2 H2: The ESG Performance Relationship Is Moderated by Firm Size. Not supported. The interaction term ESG $\times$ Firm Size was positive in all three models (Table 6) but not statistically significant in all three models for ROA, ROE and Profit Margin. The size of the firm was therefore not a moderator in this sample for the ESG performance link. This finding contradicts the absorptive capacity argument in line with the RBV, which is also not consistent with previous moderation evidence of Ahmad et al. (2021), Abdi et al. (2022), and Sun et al. (2025) as they found that absorptive capacity is a significant strengthener in the link between ESG and firm performance.

4.8.3 H3: ESG's Effect on Financial Performance Differs Significantly Across Sectors. Partially supported. The overall difference of ESG's effect on ROA among the sectors is statistically significant as per the one-way ANOVA (Table 8) with $F = 2.6674$ and *p* = .019. At the sector level, Cement was significant and positive ($\beta = 0.0507$, *p* = .005), whereas Automobile ($\beta = -0.0622$, *p* = .039), IT & Technology ($\beta = -0.0861$, *p* < .001) and Pharmaceuticals ($\beta = -0.0875$, *p* < .001) were significant and negative, while Oil & Gas was not significant. But only one of 21 possible pairwise comparisons between the sectors is significant (Table 9), namely, Banking versus Oil & Gas (mean difference = 0.0559, *p* = .038), and all others were not significantly different. Since some sectors contain only 2–3 firms, these sector-level estimates should be viewed critically, but not as complete sector-representative. The findings of partial support align with the research results of Liu et al. (2026) and Ma and Zhuo (2026), who also reported that the effects of ESG are heterogenous and inconsistent across sectors rather than consistent.

5. Conclusion

This study used a pre-post quasi-experimental design to evaluate the effect of ESG adoption on the financial performance of 20 PSX-listed companies across seven sectors (120 firm year observations, three years pre and three years post adoption). The results found no significant direct effect of ESG adoption on financial performance, no moderating effect of firm size, and a significant but reversed pattern of sectoral



heterogeneity: Cement showed a positive effect while IT & Technology and Pharmaceuticals showed negative effects, contrary to the hypothesized direction.

These findings offer limited support for stakeholder theory, signaling theory and the resource-based view (RBV) in explaining the ESG performance relationship in Pakistan's frontier market. The absence of a direct ESG effect is inconsistent with the stakeholder value mechanism (Freeman, 1984) and the signaling argument (Spence, 1973; Albitar et al., 2020). The non-significant ESG $\times$ Firm Size interaction also contradicts the absorptive capacity view (Cohen & Levinthal, 1990; Barney, 1991), which predicted that larger firms would convert ESG adoption into financial gains more effectively. The sectoral results present a further puzzle: sustainability transition theory (Geels, 2002) predicts stronger gains in asset light sectors (IT & Technology, Pharmaceuticals) than in capital intensive ones (Cement, Automobile), yet the opposite pattern was observed. This suggests the sectoral difference is driven by idiosyncratic firms or sector level characteristics rather than capital intensity or transition cost, particularly since several sectors contain only two to three firms.

6. Recommendations

I. For managers: ESG adoption is not necessarily an automatic and uniform source of short to medium term financial gain. Adoption of ESG should be viewed primarily to achieve stakeholder legitimacy and compliance with regulators, not to a guaranteed return on assets, return on equity, or profit margin.

II. For policymakers (SBP, PSX): It is recommended that the rationale for introducing policy support for ESG be based on stakeholder, environmental, and long-term systemic considerations rather than on the expectation of significant near-term firm level financial performance gains. Sectoral regulators should not adopt a "one size fits all" attitude for ESG policy.

III. For investors: Investors should not assume that there will be a financial advantage to a PSX-listed firm adopting ESG in the short and medium term. Any sector specific ESG investment approach should be regarded as tentative and not as a sound foundation for returning expectations.

7. Future Recommendations

i. Future research should build on the findings of this study by using longitudinal data to observe the null and partial effect over a period of five to ten years, to see if they either end up being null, strengthened, or reversed over a longer time frame, and should construct continuous measures of ESG intensity instead of a binary measure of ESG adoption (as this construct cannot differentiate between firms that have meaningfully different depths of ESG integration, and both are classified as "post-ESG" firms).

ii. A purposive sample of 20 firms was adequate for the pre-post fixed-effects design but was not a random sample and would therefore limit generalizability to the broader population of PSX listed companies, and to smaller firms and excluded sectors (such as Textile, Power Generation); the findings from the Automobile, IT & Technology and Pharmaceuticals sectors were also thin (2–3) and should be interpreted with some caution. The results may also be applicable only to the context of Pakistan's regulatory and market setting and the binary ESG indicator does not reflect the depth or strength of ESG practices. The time varying confounding was reduced by the pre/post design, though it was not completely ruled out, and the 3 years of post-adoption may not reflect longer term outcomes.

Author's Contributions

All authors participated in ideation, development, and writing the manuscript. All authors read and approved the final manuscript.

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Informed Consent

Informed consent was obtained from all participants prior to data collection. Participants were informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw



at any time without any consequences. The confidentiality and anonymity of respondents were guaranteed throughout the research process.

Data Availability

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request. The authors are committed to transparency and will provide detailed methodological information and analysis protocols upon request.

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