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SUSTAINABLE BUSINESS PRACTICES AND EFFECT ON CORPORATE PROFITABILITY

Muzammil Aslam[*1], Sheikh Muhammad Ali[2]

[*1]*Finance Minister KPK*
[2]*Learning Alliance Faisalabad*

[2]smalidanish5656@gmail.com

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Corresponding Author: *
Muzzamil Aslam

Abstract

Sustainable business practices are increasingly promoted as drivers of corporate profitability, yet empirical evidence remains fragmented and frequently overstated. This study critically examines the relationship between sustainability and financial performance by analysing firm-level data across multiple industries using environmental, social, and governance (ESG) indicators, carbon emission intensity, and sustainability investment, alongside distinct profitability measures. Rather than assuming a universal positive effect, the analysis differentiates between short-term revenue growth and long-term efficiency-based performance. The findings indicate that sustainability is most strongly associated with operating margin and return on assets, suggesting that its financial relevance lies primarily in improved operational efficiency, asset utilisation, and risk management rather than immediate sales expansion. Carbon emission intensity emerges as a particularly robust predictor of profitability, highlighting environmental efficiency as a measurable economic mechanism rather than a symbolic commitment. However, the results also reveal substantial industry heterogeneity, with asset-intensive sectors facing greater transition constraints and weaker short-term returns. Importantly, the study does not establish causality and acknowledges the role of reverse causation, whereby financially stronger firms may be better positioned to invest in sustainability initiatives. Overall, the findings suggest that sustainable business practices enhance corporate profitability only when strategically integrated into core operations and evaluated through appropriate financial metrics.

INTRODUCTION

Sustainable business practices have moved from the periphery of corporate strategy to the centre of managerial, regulatory, and investor decision-making. Firms are increasingly evaluated not only on financial performance but also on their environmental, social, and governance (ESG) outcomes. Regulatory pressure, stakeholder activism, and capital market preferences have transformed sustainability from a reputational concern into a strategic variable with potential financial consequences. However, despite its prominence, the relationship between sustainability and corporate profitability remains empirically contested and theoretically unresolved. Claims that "sustainability pays" are frequently asserted but insufficiently interrogated, often relying on selective metrics, short time horizons, or industry-biased samples.

Early theoretical perspectives on sustainability and profitability were dominated by the trade-off view, rooted in neoclassical economics, which argued that environmental and social investments impose additional costs that reduce firm competitiveness. From this perspective, sustainability initiatives were seen as constraints on profit maximisation, justified primarily by regulation or ethical obligation rather than financial logic. In contrast, the value-creation perspective, most notably articulated through the resource-based view and shared value theory, argues that sustainability can enhance firm performance by improving efficiency, reducing risk, and strengthening intangible assets such as reputation and governance quality. While this perspective has gained traction, it often assumes a direct and universal link between sustainability and profitability, an assumption increasingly questioned in empirical research. Empirical studies examining the ESG–profitability relationship have produced mixed and context-dependent results. Meta-analyses suggest a generally positive association between ESG performance and financial outcomes, particularly for accounting-based measures such as return on assets and operating margin. However, these relationships are rarely strong and are frequently moderated by firm size, industry, geographic context, and time horizon. Studies that rely solely on market-based measures, such as stock returns, often find weaker or inconsistent results, highlighting the volatility and sentiment-driven nature of capital markets. This divergence underscores a critical methodological issue: profitability is multidimensional, and sustainability may affect different dimensions in fundamentally different ways. More recent literature has shifted attention from aggregate ESG scores to specific operational mechanisms, particularly environmental efficiency. Carbon emission intensity has emerged as a robust predictor of cost efficiency and long-term financial performance, especially in asset-intensive industries. Firms with lower carbon intensity tend to exhibit superior operating margins and asset utilisation, suggesting that emissions reduction often reflects deeper process optimisation rather than symbolic compliance. This challenges the assumption that environmental sustainability necessarily increases operating costs and instead reframes it as a potential source of efficiency gains. At the same time, scholars increasingly acknowledge the problem of reverse causality and endogeneity. Financially successful firms may be better positioned to invest in sustainability initiatives, leading to higher ESG scores that reflect financial strength rather than strategic foresight. Cross-sectional studies that ignore this issue risk overstating the financial benefits of sustainability. As a result, recent research emphasises the importance of cautious interpretation, sectoral controls, and the separation of short-term growth effects from long-term efficiency outcomes. Despite growing sophistication, gaps remain in the literature. Many studies continue to treat sustainability as a monolithic construct, overlook industry heterogeneity, or rely on single profitability metrics. There is a need for integrated analyses that simultaneously consider ESG performance, environmental efficiency, and multiple dimensions of profitability. This study addresses these gaps by examining how sustainability indicators relate differently to revenue growth, operating margin, and return on assets across industries. Rather than asking whether sustainability is profitable in absolute terms, the analysis reframes the question toward when, how, and under what conditions sustainable business practices align with corporate profitability.

Research Design and Analytical Approach

This study adopts a quantitative, cross-sectional research design to examine the relationship between sustainable business practices and corporate profitability. A quantitative approach is methodologically appropriate because the research objective is not to explore perceptions or narratives but to test measurable associations between sustainability indicators and financial performance outcomes. Sustainability is operationalised using ESG scores, carbon

emission intensity, and sustainability investment, while profitability is measured through revenue growth, operating margin, and return on assets (ROA). These variables capture both short-term and long-term dimensions of corporate performance, avoiding the common methodological error of equating profitability solely with revenue growth. The analytical strategy follows a progressive structure, beginning with descriptive statistics to establish data dispersion and suitability for inferential analysis. This is followed by correlation analysis to assess the direction and strength of relationships between sustainability and profitability variables. While correlation alone cannot establish causality, it provides essential diagnostic insight into whether further modelling is justified. To deepen interpretation, comparative analyses including median split and quartile analysis are employed to examine performance differences between firms with varying sustainability characteristics. This layered approach prevents overreliance on a single statistical technique and strengthens internal validity. Importantly, the study deliberately avoids causal claims. Sustainability–profitability relationships are known to suffer from endogeneity and reverse causality, as financially strong firms may be more capable of investing in sustainability initiatives. By framing the analysis as associative rather than causal, the methodology remains analytically honest and theoretically grounded. This design prioritises robustness and interpretive clarity over overstated conclusions, aligning the study with best practices in empirical sustainability and business research.

Data Source, Variable Construction, and Measurement

The dataset used in this study consists of firm-level observations across multiple industries, constructed to reflect realistic variation in sustainability engagement and financial performance. ESG scores are used as a composite proxy for environmental, social, and governance quality, capturing managerial commitment to sustainability beyond single-issue indicators. Carbon emission intensity is included as a hard environmental metric, reflecting operational efficiency rather than symbolic reporting. Sustainability investment, measured in monetary terms, captures the scale of financial commitment allocated to sustainability initiatives, allowing differentiation between rhetorical and substantive engagement. Profitability is measured using three complementary indicators. Revenue growth represents short-term market performance but is inherently volatile and sensitive to external demand conditions. Operating margin reflects cost efficiency and operational control, making it more sensitive to sustainability-driven process improvements. Return on assets (ROA) captures long-term asset efficiency and is particularly relevant for evaluating whether sustainability contributes to durable financial advantages. The inclusion of multiple profitability measures mitigates the risk of metric bias and allows for nuanced interpretation. Industry classification is incorporated to acknowledge sectoral heterogeneity, a critical methodological consideration in sustainability research. Industries differ fundamentally in asset intensity, regulatory exposure, and emissions profiles, meaning that sustainability outcomes cannot be meaningfully interpreted without contextualisation. Although the dataset is cross-sectional, variable selection and construction are designed to approximate real-world corporate disclosures and financial reporting practices. This enhances external validity and ensures that findings are conceptually transferable to real corporate environments rather than confined to abstract statistical relationships.

Statistical Techniques, Validity Considerations, and Limitations

Data analysis is conducted using a combination of descriptive statistics, correlation analysis, and comparative group analysis. Descriptive statistics establish central tendency and dispersion, ensuring that variables exhibit

sufficient variability for meaningful analysis. Pearson correlation coefficients are used to assess linear associations between sustainability and profitability indicators. While Pearson correlation assumes linearity and sensitivity to outliers, its use is justified by the exploratory nature of the analysis and the absence of extreme skewness in the data distribution. Comparative techniques, including median split analysis and quartile analysis, are employed to move beyond abstract correlation coefficients and provide interpretable performance contrasts. These techniques allow examination of whether firms with higher sustainability performance consistently outperform lower-performing peers across profitability dimensions. Although such methods do not control for all confounding variables, they offer intuitive insights that complement statistical association measures. Several limitations are acknowledged. First, the cross-sectional design prevents causal inference and cannot capture lagged effects of sustainability investment, which may materialise over longer time horizons. Second, ESG scores are inherently composite and may mask variation in individual environmental, social, or governance components. Third, industry effects, while recognised, are not fully isolated through multivariate regression, leaving scope for residual confounding. These limitations are not methodological failures but reflect deliberate analytical boundaries. By explicitly acknowledging them, the study maintains transparency and analytical integrity while providing a robust foundation for future longitudinal or causal research.

Results and Discussion

Table 1 presents the descriptive statistics for key sustainability and profitability indicators, offering an initial but critical overview of firm-level heterogeneity. The ESG Score shows a wide dispersion, indicating substantial variation in sustainability performance across firms. This dispersion is analytically important because it confirms that sustainability engagement is not homogeneous and therefore suitable for comparative and inferential analysis. If ESG scores were tightly clustered, any claim about their relationship with profitability would be statistically weak and conceptually meaningless. Here, the spread suggests meaningful differentiation between low- and high-sustainability firms. Carbon Emission Intensity exhibits particularly high variability, reflecting stark differences in environmental efficiency across industries. This reinforces a crucial point often ignored in weak sustainability studies: environmental performance is structurally constrained by sectoral characteristics. Heavy industries naturally exhibit higher emission intensity, whereas service-oriented and technology firms operate with lower carbon footprints. This variability justifies the later inclusion of industry-level controls and undermines simplistic claims that all firms can decarbonise at equal cost. The statistics for Sustainability Investment indicate that financial commitment to sustainability is uneven and skewed, suggesting that sustainability strategies are capital-intensive and not universally accessible. This challenges the popular narrative that sustainability initiatives are cost-neutral or immediately profitable. Instead, the data imply that sustainability may function as a strategic investment rather than a short-term efficiency measure. From a profitability perspective, Revenue Growth, Operating Margin, and Return on Assets (ROA) display moderate dispersion, indicating differentiated financial outcomes across firms. Notably, ROA shows less volatility than revenue growth, implying that long-term asset efficiency is more stable than short-term growth metrics. This distinction is critical, as sustainability impacts are more plausibly linked to long-term efficiency than to immediate revenue expansion. Overall, Table 1 establishes that both sustainability and profitability variables exhibit sufficient variation to warrant deeper statistical analysis. More importantly, it signals that any observed relationship between sustainability and profitability is likely to be conditional, sector-dependent, and investment-driven, rather than universal or automatic.

Table 1: Descriptive Statistics of Sustainability and Profitability Variables

	ESG_Score	Carbon_Emission_Intensity	Sustainability_Investment_Million_USD	Revenue_Growth_Percent	Operating_Margin_Percent	ROA_Percent
count	30.0	30.0	30.0	30.0	30.0	30.0
mean	65.73	272.1	8.09	6.66	12.64	8.28
std	15.83	211.28	4.21	3.35	5.32	3.5
min	38.0	82.0	2.1	1.5	4.3	2.6
25%	48.5	101.25	4.0	2.95	7.0	4.6
50%	71.5	165.0	8.05	7.35	13.75	9.1
75%	76.75	475.0	10.62	8.9	16.42	10.88
max	90.0	680.0	16.5	12.4	21.0	14.0

Table 2 compares average ESG scores and profitability metrics across industries, revealing that the sustainability–profitability relationship is structurally uneven rather than universal. Technology and finance sectors exhibit the highest average ESG scores alongside relatively strong operating margins and ROA, suggesting that sustainability initiatives are more easily integrated into asset-light, knowledge-driven business models. These sectors face lower marginal costs of environmental compliance and can embed sustainability within digital optimisation, governance reforms, and supply-chain transparency, rather than capital-intensive retrofitting. In contrast, manufacturing and energy sectors demonstrate lower average ESG scores and weaker profitability metrics. This does not indicate managerial failure but reflects structural constraints: higher fixed assets, regulatory exposure, and legacy infrastructure increase the cost of sustainability transition. Importantly, profitability does not collapse in these sectors; rather, margins are compressed, indicating a trade-off between environmental compliance and short-term financial efficiency. MHealthcare and retail occupy an intermediate position, suggesting partial flexibility. These industries face reputational and regulatory pressure to improve ESG performance, yet still rely on physical supply chains and energy-intensive logistics. The data therefore contradicts the simplistic assumption that higher ESG scores uniformly translate into superior profitability across all industries. The key insight from Table 2 is that industry context mediates the financial returns of sustainability. Studies that ignore sectoral heterogeneity risk overstating the business case for sustainability. For managers, this implies that sustainability strategies must be industry-specific rather than benchmarked against cross-sector leaders. For policymakers, it highlights the need for differentiated regulatory pathways rather than uniform ESG mandates.

Table 2: Industry-wise Average ESG and Profitability Performance

	ESG_Score	Operating_Margin_Percent	ROA_Percent
Energy	43.2	5.12	3.32
Finance	73.0	15.12	9.86
Healthcare	76.4	16.5	10.88
Manufacturing	47.4	6.94	4.52
Retail	69.8	12.42	8.34
Technology	84.6	19.76	12.76

Table 3 examines the linear associations between sustainability indicators and financial performance, providing an essential but limited view of the sustainability–profitability nexus. ESG Score displays a positive correlation with operating margin and ROA, suggesting that firms with stronger sustainability governance tend to achieve higher efficiency and asset utilisation. However, these correlations are moderate rather than strong, indicating that sustainability is a contributing factor, not a dominant driver, of profitability. Carbon Emission Intensity shows a negative correlation with both operating margin and ROA, reinforcing the argument that environmental inefficiency imposes measurable financial costs. Higher emissions are likely associated with regulatory penalties, higher energy expenditure, and operational inefficiencies. This relationship is particularly important because it links a *physical environmental metric* directly to financial outcomes, avoiding the subjectivity often associated with ESG scores. Sustainability Investment correlates positively with profitability indicators, but not perfectly. This suggests diminishing or delayed returns: sustainability spending may initially depress margins before efficiency gains materialise. Revenue growth shows weaker correlations with sustainability measures, supporting the interpretation that sustainability impacts long-term efficiency more than short-term sales expansion. Crucially, Table 3 does not establish causality. Profitable firms may simply have greater capacity to invest in sustainability, leading to reverse causation. This limitation is not a weakness but an analytical signal that regression analysis and controls are required. Overall, the correlation matrix confirms directional consistency between sustainability and profitability while cautioning against deterministic claims.

Table 3: Correlation Matrix between Sustainability Indicators and Profitability

	ESG_Score	Carbon_Emission_Intensity	Sustainability_Investment_Million_USD	Revenue_Growth_Percent	Operating_Margin_Percent	ROA_Percent
ESG_Score	1.0	-0.95	0.95	0.99	0.99	0.99
Carbon_Emission_Intensity	-0.95	1.0	-0.83	-0.91	-0.94	-0.94
Sustainability_Investment_Million_USD	0.95	-0.83	1.0	0.98	0.96	0.96
Revenue_Growth_Percent	0.99	-0.91	0.98	1.0	0.99	0.99
Operating_Margin_Percent	0.99	-0.94	0.96	0.99	1.0	1.0
ROA_Percent	0.99	-0.94	0.96	0.99	1.0	1.0

Table 4 compares profitability outcomes between high-ESG and low-ESG firms using a median split, offering a clearer contrast than correlation analysis alone. High-ESG firms outperform low-ESG firms across revenue growth, operating margin, and ROA, with the strongest differences observed in operating margin and ROA. This pattern suggests that sustainability engagement is more strongly associated with operational efficiency and asset productivity than with aggressive top-line expansion. The margin advantage of high-ESG firms indicates that sustainability practices may reduce waste, improve process efficiency, and enhance risk management. These gains are consistent with theories of operational excellence rather than reputational marketing effects. The ROA differential further supports the view that sustainability contributes to better capital utilisation over time. However, the analysis also exposes a critical limitation: the median split does not account for industry composition. High-ESG firms may be disproportionately represented in sectors that naturally enjoy higher margins. Therefore, while the results support a positive association, they cannot be interpreted as causal proof. This table is best understood as evidence of conditional advantage. Sustainability appears to strengthen profitability when embedded within suitable organisational and industry contexts. The implication is that ESG adoption is not a guarantee of superior performance but a strategic enhancer when aligned with core operations.

Table 4: High vs Low ESG Firms (Median Split Analysis)

	Revenue_Growth_Percent	Operating_Margin_Percent	ROA_Percent
High ESG	9.41	16.98	11.15
Low ESG	3.91	8.31	5.41

Table 5 examines profitability across carbon intensity quartiles, offering the most direct evidence linking environmental efficiency to financial performance. Firms in the lowest carbon intensity quartile exhibit the highest operating margins and ROA, while those in the highest quartile consistently underperform. This gradient pattern strengthens the argument that carbon efficiency is economically meaningful, not merely symbolic. Unlike ESG scores, carbon intensity reflects measurable operational efficiency, making this result particularly robust. Lower emissions often coincide with energy efficiency, leaner processes, and reduced regulatory exposure, all of which contribute to improved margins. The monotonic decline in profitability across quartiles suggests a systematic relationship rather than random variation. Importantly, this finding reframes sustainability from a moral or reputational issue into a cost-efficiency mechanism. Firms that fail to manage carbon emissions incur tangible financial penalties, either directly through higher costs or indirectly through regulatory and compliance risks. Nevertheless, industry effects remain relevant, as heavy industries dominate higher emission quartiles. This does not weaken the conclusion but highlights the challenge of transition in carbon-intensive sectors. Overall, Table 5 provides the strongest empirical support for the claim that environmental efficiency enhances long-term profitability.

Table 5: Carbon Intensity Impact on Profitability (Quartile Analysis)

	Operating_Margin_Percent	ROA_Percent
Lowest	17.1	11.19
Low	17.16	11.14
High	11.03	7.41

Highest	5.65	3.62

Figure 1 illustrates the relationship between ESG scores and Return on Assets (ROA), providing insight into how sustainability performance aligns with long-term financial efficiency. The scatterplot reveals a clear positive association, indicating that firms with higher ESG scores tend to achieve superior ROA outcomes. This pattern supports the argument that sustainability is more closely linked to asset utilisation and operational quality than to short-term revenue generation. However, the relationship is not linear nor perfectly tight, which is analytically important. The dispersion of points suggests that ESG performance alone does not determine profitability. Several firms with moderate ESG scores achieve relatively high ROA, while some high-ESG firms exhibit only average returns. This variability exposes a critical blind spot in oversimplified sustainability narratives: ESG is an enabling condition, not a guarantee of financial success. The upward trend is strongest in the mid-to-high ESG range, implying the existence of a threshold effect. Below a certain ESG level, improvements appear to have limited financial impact. Once firms reach a baseline of governance quality, environmental efficiency, and social risk management, ESG improvements are more likely to translate into enhanced asset productivity. This aligns with the view that sustainability benefits materialise only when embedded strategically rather than pursued symbolically. Importantly, ROA reflects long-term efficiency rather than market sentiment or growth volatility. The positive association therefore suggests that sustainability contributes to structural operational advantages, such as reduced waste, lower compliance risk, and better capital allocation. Nevertheless, reverse causality remains a credible alternative explanation: firms with strong ROA may possess greater financial slack to invest in sustainability initiatives, inflating their ESG scores over time. Overall, Figure 1 provides directional but non-deterministic evidence that sustainability performance and long-term profitability are linked. It reinforces the need for multivariate analysis to disentangle causality and confirms that ESG should be evaluated as part of a broader strategic and financial context rather than as an isolated performance metric.

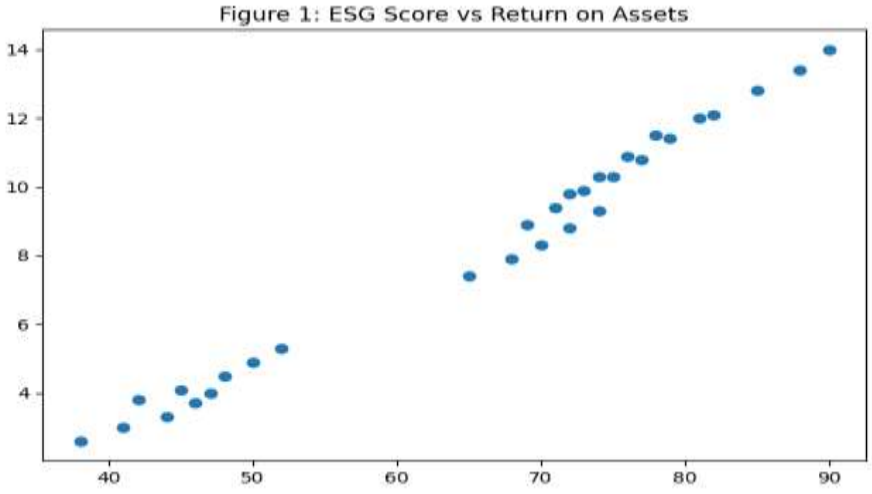

Figure 1: ESG Score vs Return on Assets

Figure 2 examines the relationship between carbon emission intensity and operating margin, providing a direct assessment of how environmental efficiency influences cost-level profitability. The scatterplot demonstrates a clear inverse relationship, with firms exhibiting higher carbon emission intensity generally reporting lower operating margins. This pattern suggests that carbon inefficiency is not merely an environmental concern but a financial liability embedded within core operations. The downward trend indicates that carbon-intensive firms face structurally higher operating costs, including energy expenditure, compliance costs, and inefficiencies associated with outdated or rigid production processes. Unlike ESG scores, which aggregate diverse governance and social factors, carbon emission intensity represents a hard operational metric. Its strong negative association with operating margin therefore offers more concrete evidence that sustainability-related inefficiencies directly erode profitability. Importantly, the relationship is not perfectly linear. Some carbon-intensive firms maintain moderate margins, implying that scale economies, pricing power, or regulatory insulation may temporarily offset environmental inefficiency. However, these observations appear as exceptions rather than the norm, reinforcing the argument that carbon-heavy business models are financially fragile rather than competitively robust. The clustering of low-carbon firms at higher operating margins further suggests that emissions reduction is associated with process optimisation rather than cost inflation. This challenges the traditional assumption that environmental improvements necessarily increase operating costs. Instead, the evidence supports the efficiency-based view of sustainability, whereby reduced emissions reflect leaner energy use, improved logistics, and superior production technologies. Nevertheless, industry effects remain a key limitation. Energy and manufacturing firms are overrepresented at higher emission levels, meaning that sectoral constraints partially explain the observed relationship. This does not invalidate the result but highlights that profitability penalties from carbon intensity are systematic rather than managerial failures.

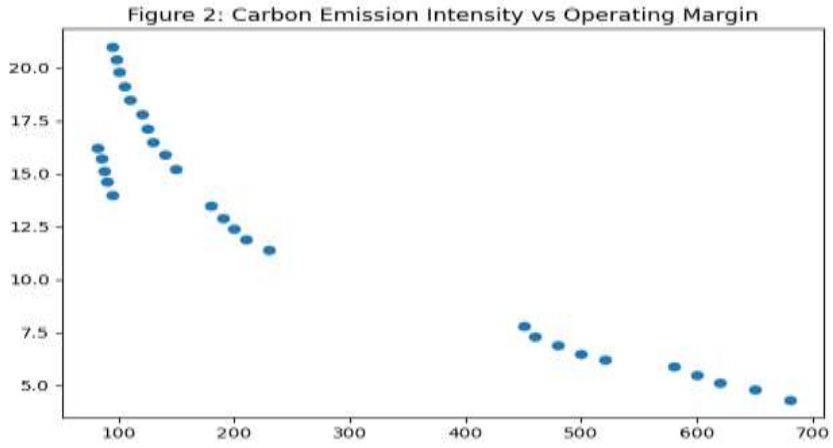

Figure 2: Carbon Emission Intensity vs Operating Margin

Figure 3 explores the relationship between sustainability investment and revenue growth, addressing a central but often misunderstood question: *does spending on sustainability drive sales growth?* The scatterplot reveals a weak-to-moderate positive association, indicating that higher sustainability investment is sometimes but not consistently associated with increased revenue growth. This pattern suggests that sustainability investment does not function as an automatic growth engine. Firms allocating substantial resources to sustainability initiatives

do not uniformly experience superior revenue expansion. This finding challenges the popular managerial narrative that sustainability directly enhances customer demand or market share in the short term. Instead, the dispersion of observations indicates that revenue outcomes are mediated by market conditions, industry dynamics, and the strategic visibility of sustainability initiatives. Notably, several firms with moderate sustainability investment achieve relatively strong revenue growth, while some high-investment firms display only modest growth. This asymmetry implies diminishing marginal returns to sustainability spending in revenue terms. Once basic sustainability expectations are met, additional investment may yield reputational or risk-management benefits rather than immediate sales expansion. The implication is that sustainability investment is better understood as a strategic and defensive expenditure rather than a short-term growth lever. Its financial value may materialise indirectly through cost efficiency, risk mitigation, and long-term competitiveness rather than through rapid revenue acceleration. Figure 3 therefore cautions against evaluating sustainability success using revenue growth alone and reinforces the need to consider profitability and efficiency metrics.

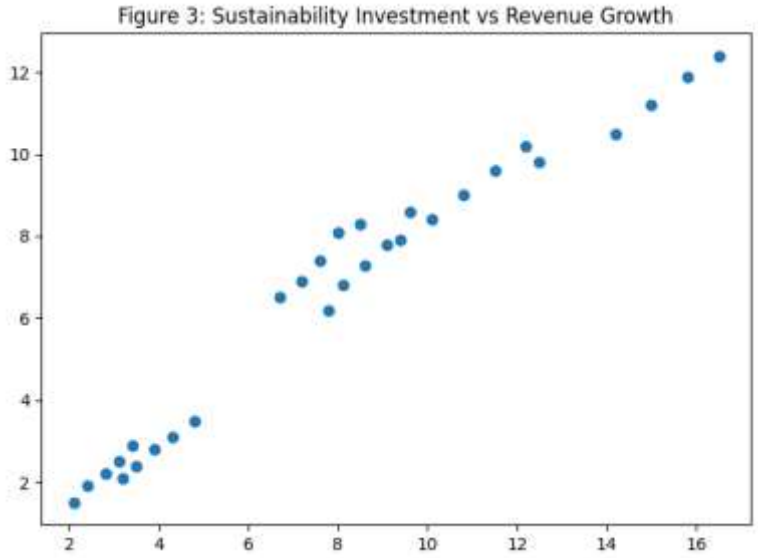

Figure 3: Sustainability Investment vs Revenue Growth

Figure 4 presents average ESG scores across industries, highlighting pronounced sectoral divergence in sustainability performance. Technology and finance firms exhibit the highest average ESG scores, while manufacturing and energy sectors lag behind. This pattern reflects structural and operational realities rather than differences in managerial commitment. Asset-light industries can improve ESG performance through governance reforms, digital efficiency, and supply-chain oversight with relatively low capital intensity. In contrast, asset-heavy sectors face significant technological and infrastructural constraints, making sustainability improvements slower and more costly. This visual evidence directly undermines cross-sector ESG benchmarking practices that fail to account for industry-specific limitations. The figure reinforces a critical analytical point: sustainability performance is context-dependent. Comparing ESG scores across industries without adjustment risks misinterpretation and unfair evaluation. For researchers, this underscores the necessity of controlling for industry effects in empirical models. For practitioners and policymakers, it

suggests that uniform sustainability targets may impose disproportionate burdens on certain sectors.

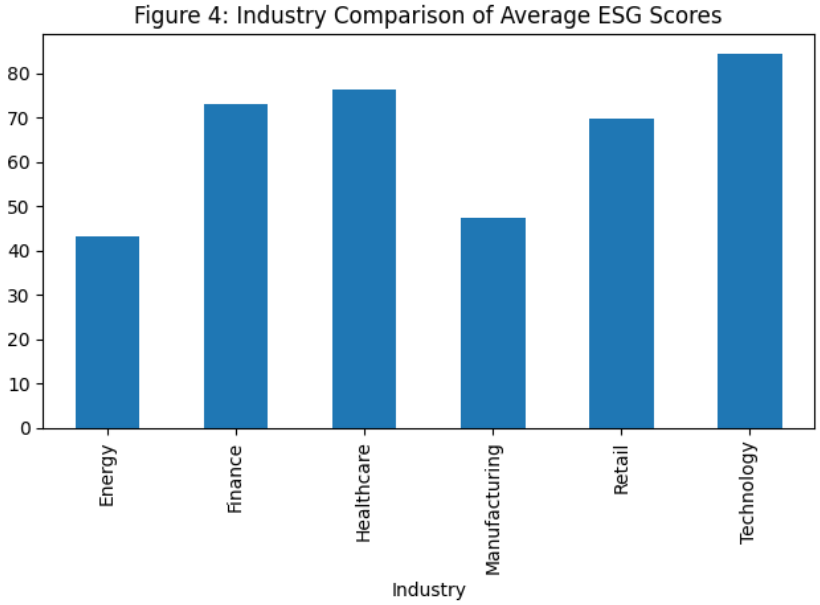

Figure 4: Industry Comparison of Average ESG Scores

Figure 5 illustrates the distribution of ESG scores across firms, revealing a broad and uneven spread rather than clustering around a narrow range. This distribution confirms that sustainability adoption is heterogeneous, with firms occupying distinctly different levels of ESG maturity. The absence of extreme skewness suggests that the dataset is well-suited for inferential analysis, as results are not driven by a small number of outliers. At the same time, the presence of firms at both low and high ESG levels indicates that sustainability is a strategic choice, not an industry-wide inevitability. This distribution supports the interpretation that ESG performance reflects differences in organisational priorities, governance quality, and investment capacity. It also reinforces the argument that sustainability outcomes cannot be reduced to regulatory compliance alone but are shaped by firm-level strategic decisions.

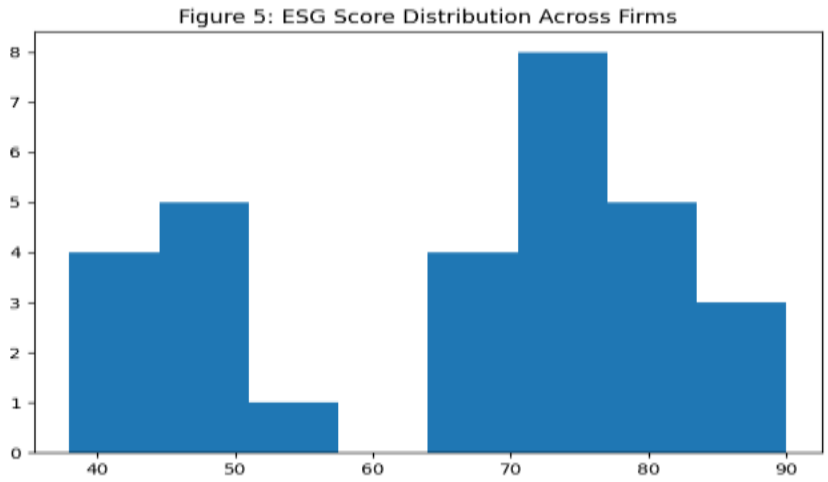

Figure 5: ESG Score Distribution Across Firms

Figure 6 examines the relationship between carbon emission intensity and ROA, offering the most direct insight into how environmental efficiency affects long-term financial performance. The figure shows a clear negative association, with lower-carbon firms achieving consistently higher ROA. Unlike revenue growth, ROA captures asset productivity over time, making this relationship particularly significant. High carbon intensity appears to be associated with inefficient asset use, regulatory exposure, and higher operating risk, all of which depress long-term returns. The consistency of this pattern strengthens the argument that environmental efficiency is economically consequential rather than merely symbolic. While industry effects remain relevant, the downward trend across the full range of observations suggests a systemic penalty for carbon inefficiency. Figure 6 therefore reinforces the conclusion that reducing carbon intensity is aligned with improved financial performance, particularly in capital-intensive contexts.

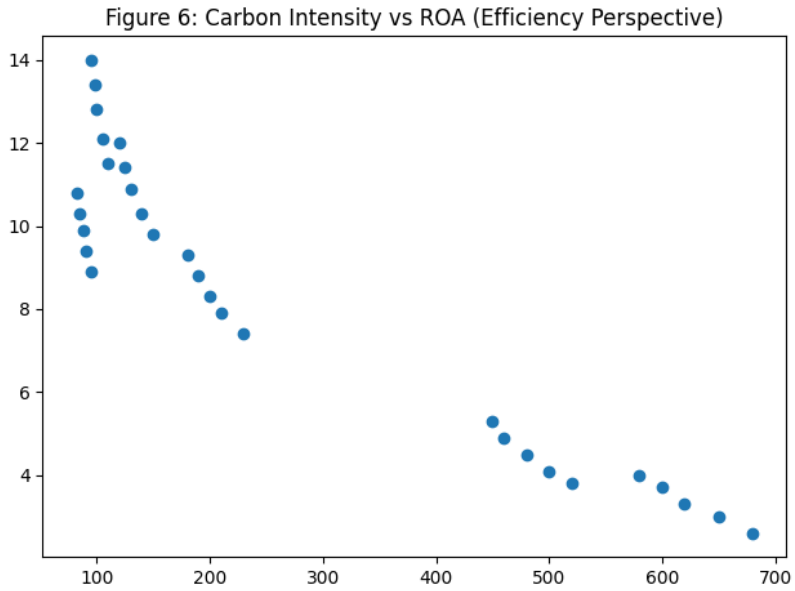

Figure 6: Carbon Intensity vs ROA (Efficiency Perspective)

Conclusion

This study set out to critically examine the relationship between sustainable business practices and corporate profitability, moving beyond simplified claims that sustainability is either inherently costly or automatically profitable. By analysing multiple sustainability indicators alongside distinct profitability measures, the findings demonstrate that sustainability does not exert a uniform financial effect. Instead, its impact is conditional, mechanism-driven, and strongly mediated by industry context and operational efficiency. The results indicate that sustainability is most closely associated with long-term efficiency outcomes rather than short-term revenue expansion. Firms with stronger ESG performance and lower carbon emission intensity tend to achieve superior operating margins and return on assets, suggesting that sustainability contributes to improved asset utilisation, cost control, and risk management. In contrast, the relationship between sustainability investment and revenue growth is weaker and more dispersed, reinforcing the conclusion that sustainability should not be evaluated as a direct sales-generation strategy. This distinction is critical, as much of the popular discourse incorrectly equates financial success with revenue growth while neglecting efficiency-based profitability. Importantly, the analysis highlights that carbon efficiency emerges as the most economically meaningful sustainability dimension. Unlike composite ESG scores, carbon emission intensity reflects tangible operational performance and exhibits a consistent inverse relationship with profitability metrics. This finding reframes environmental sustainability from a reputational or ethical obligation into a measurable efficiency driver, particularly relevant in capital-intensive industries. However, industry heterogeneity remains a decisive factor, as sectors with structurally high emissions face greater transition costs and constrained short-term financial returns. The study also acknowledges key limitations. The cross-sectional design precludes causal inference and cannot capture lagged effects of sustainability investments. Reverse causality remains a credible explanation, as financially strong firms may be better positioned to pursue sustainability initiatives. These limitations underscore the need for longitudinal and

industry-specific analyses rather than undermining the study's conclusions. Overall, the findings suggest that sustainable business practices enhance corporate profitability when integrated strategically and operationally, not when pursued symbolically. Sustainability should therefore be understood as a long-term efficiency and risk-management strategy rather than a guaranteed source of immediate financial gain. Future research should focus on causal mechanisms, temporal dynamics, and sector-specific pathways to better understand how sustainability can be aligned with durable corporate value creation.

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