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Impact of ESG reporting on financial performance: Evidence from energy sector in India

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Abstract

This study aims to investigate the impact of Environmental, Social, and Governance (ESG) reporting on the financial performance of Indian energy firms. It seeks to address the existing research gap by examining how ESG disclosures influence key financial outcomes in one of the most ESG-sensitive industries. The analysis covers all energy sector companies listed on the BSE Sustainability Index, along with an equal number of energy sector firms from the BSE 500 Index, over the period 2015–2023. A quantitative explanatory approach is applied, employing panel data analysis to measure the effect of overall ESG scores, as well as individual ESG components Environmental (E), Social (S), and Governance (G) on financial performance indicators including Return on Assets (ROA), Return on Equity (ROE), and Earnings Per Share (EPS). Firm age, size, and leverage are incorporated as control variables. The results demonstrate that overall ESG performance has a significant and positive impact on financial indicators. Among the dimensions, Environmental and Governance factors show particularly strong positive associations with ROA and ROE, while the Social dimension, though weaker, also exhibits a positive relationship. The findings underline the strategic importance of ESG integration for firms in the energy sector, suggesting that enhanced ESG practices contribute to long-term financial sustainability.

Keywords: EPS, ESG Score, Panel data analysis, ROA, ROE.

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1. Introduction

The energy sector will play a significant role in shaping India's economic and developmental future. India, as the third-largest consumer of energy in the world, has been experiencing a sustained increase in electricity demand due to population growth, urbanization, and industrialization [1]. Capacity building and the mobilization of essential investments in renewable energy (RE) in the face of increasing energy demand, as a result of the current trending trade integration, are some of the challenges in fulfilling the promise of carbon neutrality by 2050. Furthermore, the European Union's CBAM, which will apply carbon pricing to exports starting in 2026, is also expected to affect exports from ASEAN, such as Vietnam, to this advanced economy block [2, 3]. In addition to solar, wind, hydro, and biomass, the rapid growth of this sector also includes a variety of traditional energy sources such as coal, oil, natural gas, etc [4]. The nation's GDP is largely dominated by energy, which also fuels transportation, agriculture, and other key sectors [5]. A stable and increasing supply of energy is essential for government programs such as the National Infrastructure Pipeline (NIP) and the Make in India program [6].

Access to energy also has a strong social dimension and greatly influences the quality of people's lives, especially in deprived and rural areas [7]. Vast numbers of homes have been touched by schemes like Saubhagya and Ujjwala Yojana, which have provided access to electricity, as well as smoke-free and safe cooking mediums. These, in turn, have had an impact on gender, education, and health [8]. Particularly, women and children have benefited from the increase in electrification, which has decreased energy poverty, increased access to digital technology, and reduced the time spent on collecting firewood [9].

The political loyalties in the energy sector are sensitive and strategic. Energy security and pricing issues usually overwhelm political discussions, and consequently, public opinion and election outcomes [10]. Electricity and cooking gas subsidies are employed as populist and socio-political tools by different political parties [11]. Furthermore, India has also demonstrated strong political will in its efforts to pursue clean energy, including participation in the international policy debate on climate and the use of initiatives such as the International Solar Alliance [12].

A healthy energy sector brings many benefits. Economic, industrial, and business activities, however, are facilitated and supported by a stable and low-cost supply of energy [13]. Investing in more renewable energy and less reliance on fossil fuels also contributes to environmental sustainability [14]. Energy security is enhanced by the emergence of distributed energy systems, smart grids, and storage batteries [15, 16].

But there are several problems the industry faces. Although the country has been working to diversify its energy sources, heavy dependence on coal has resulted in mounting CO2 emissions and air pollution in particular. Growth is constrained by structural issues, including high levels of transmission and distribution loss, fiscal challenges facing DISCOMs, red tape, and issues with land acquisition [17]. If the energy shortages were not enough, the large disparity in the level of access and quality of supply of services in urban and rural areas emphasizes the persistent energy inequalities.

In general, the Indian energy sector has achieved a lot in terms of energy access and renewable energy uptake, although there are still considerable barriers in the way, which require continuing policy reform, financial support, and technological advancement. These challenges will have to be met to achieve the goals of energy security, economic development, and environmental sustainability.

In light of the growing emphasis on sustainable development, the exploration of ESG reporting within the Indian energy sector becomes both timely and necessary. This sector is highly scrutinized due to its environmental footprint, social responsibilities, and regulatory demands, making ESG performance a decisive factor in shaping corporate reputation and investor confidence. Despite global evidence, research focusing on India's energy sector remains limited, creating a need to understand the nuanced relationship between ESG disclosures and financial outcomes in this context. This manuscript contributes by bridging that gap through a comprehensive analysis of energy firms listed on the BSE Sustainability Index and comparable firms from the BSE 500 Index over a nine-year period. By examining the effects of overall ESG scores and individual components on key financial indicators, this study provides empirical evidence that enhances academic discourse, informs policymakers, and offers actionable insights for industry practitioners aiming to integrate ESG strategies into financial decision-making and long-term sustainability planning.

2. Literature Review

The affiliation between ESG factors such as ESG score, E score, S score, and G score on financial performance is of utmost concern at a global level and also in emerging markets like India. To provide a backdrop for exploring this link from the perspective of the Indian energy industry, the paper reviews and synthesizes the theoretical arguments and experiential confirmation in the literature.

2.1. ESG and Financial Performance: Evidence from Global Markets

Many studies have indicated that financial performance goes hand in hand with ESG reporting. Analyzing more than 2,000 of such studies, Friede and other researchers [18] discovered that the overwhelming majority, approximately 90%, offered evidence that there was an optimistic relationship between companies' financial performance and ESG. It is established by many researchers that firms that adopt ESG policies usually enjoy an increasing brand value, decreased capital costs, and improved operational efficiency Fouda [19] and Wang et al. [20].

Pinto and Gaio [21] suggested that ESG policies clear information asymmetries and attract well-informed investors. Similarly, other researchers concluded that stronger ESG performance can significantly lower risk and increase firm value, especially in sectors like manufacturing and energy supply, which face a higher degree of exposure to environmental risk [22].

2.2. ESG in high-impact Sectors: Energy/Utilities

In high-impact sectors such as energy and utilities, ESG considerations are of critical importance because these industries have a significant environmental footprint, rely heavily on natural resources, and operate under strict regulatory frameworks [22, 23]. The environmental dimension is particularly crucial since emission-intensive operations directly contribute to climate-related challenges and influence how investors assess company value [24]. Firms that invest in cleaner technologies, improve energy efficiency, and successfully reduce emissions often experience stronger operational performance as well as improved financial outcomes [25]. The governance dimension also plays a vital role in these sectors, as transparent decision-making, effective board structures, and robust accountability mechanisms strengthen credibility and build investor trust [26].

Strong governance not only legitimizes environmental and social initiatives but also improves access to capital and supports long-term sustainability [27]. In addition, the social dimension is central to the success of firms in this industry because community engagement, employee welfare, and occupational safety determine both organizational reputation and the ability to maintain a license to operate in resource-sensitive environments. When considered together, the environmental, social, and governance factors directly shape the resilience, competitiveness, and financial viability of firms in the energy and utility sectors, making ESG integration a key driver of sustainable growth [28].

2.3. ESG Performance and Financial Indicators

In recent years, the association between corporate financial performance and environmental, social, and governance (ESG) practices has become one of the most widely debated and studied topics. Companies have been urged to incorporate sustainability practices into their operations by mounting pressure from stakeholders, including investors and regulators. This is especially true for sectors like utilities and energy that have a significant environmental impact. According to a wide range of research, companies that lead in ESG performance frequently outperform laggards in terms of traditional financial metrics like stock price growth, return on equity (ROE), return on assets (ROA), and earnings per share (EPS) [29, 30].

Businesses that incorporate sustainability into their operational and strategic frameworks experience improved employee engagement, waste reduction, and resource management [31]. For instance, companies that make investments in long-term employee satisfaction through fair labor practices, safe working conditions, and opportunities for career advancement typically see lower turnover rates [32]. Increased productivity and profitability are direct results of this stability, which raises ROE [33]. In energy-intensive industries, good environmental stewardship also lowers operational risks and promotes better use of financial and material resources, which results in higher returns on investment [34].

Transparent ESG disclosure tends to lower the perceived risk profile of businesses, according to a recurring theme in the literature [35]. Strong ESG practices are seen as more dependable by creditors and investors, which frequently makes it simpler to obtain lower-cost capital and debt financing. Conversely, businesses with poor governance and little sustainability reporting usually have higher debt ratios and higher borrowing costs [36]. This dynamic emphasizes that the quality and credibility of disclosures are just as crucial as the disclosures themselves. It is not merely the presence of sustainability reports but their depth, accuracy, and accountability that determine financial outcomes.

Although the process may be gradual, the evidence in India points to the long-term advantages of adopting ESG. Energy companies listed on the Bombay Stock Exchange, for example, have demonstrated that although the initial stages of implementing ESG practices can be costly, the long-term results frequently make the investment worthwhile [37, 38]. These advantages include increased resilience during uncertain times, reduced financial and reputational risks, and easier stakeholder engagement. Higher ROA, better stock market performance, and easier access to long-term funding have all been associated with improved ESG performance [39]. Transparent reporting increases the firm's competitive edge, fosters investor confidence, and attracts capital from investors who care about sustainability [40].

The energy sector is especially susceptible to risks such as policy changes, compliance requirements, and fluctuating resource costs due to its capital-intensive nature [41]. Businesses with structured ESG disclosures frequently have better profitability ratios and a greater ability to manage debt. Their proactive approach to risk management, compliance, and long-term planning is largely responsible for this. Findings are not totally consistent, though [36]. According to certain studies, social and governance aspects greatly improve financial performance, but environmental reporting by itself might not have the same positive financial effects. This implies that the substance and credibility of environmental disclosures are more important than their mere existence [42].

The regulatory framework in India has further shaped corporate ESG practices. The introduction of mandatory corporate responsibility reporting in 2012, followed by the Business Responsibility and Sustainability Reporting (BRSR) framework in 2021 by SEBI, has pushed firms towards structured and standardized disclosures [43]. Companies with higher ESG ratings have consistently been associated with stronger profitability, measured by indicators like ROA, as well as higher market valuations, often reflected in Tobin's Q. These regulatory measures have made ESG reporting not just a voluntary exercise but a compliance-driven requirement, leading to better transparency and accountability [44].

The South Asian energy sector, which includes companies in Bangladesh, Pakistan, and India, has demonstrated the value of ESG in reducing financial volatility at a regional level [45]. Long-term value creation and increased capital allocation efficiency have been associated with enhanced disclosure. This effect is especially noticeable in India, where ESG-related practices are given legitimacy by stricter corporate governance regulations. By lowering stock performance volatility and preserving comparatively steady returns, companies that consistently disclose sustainability have also demonstrated resilience during times of crisis, like the COVID-19 pandemic [46].

Although evidence generally shows a positive link between ESG disclosures and financial performance in the Indian energy sector, research remains limited. Most studies either merge energy firms with broader industries or overlook the

separate influence of environmental, social, and governance dimensions, making it unclear which factors drive profitability and valuation the most. The relationship is shaped by regulatory frameworks, reporting quality, and specific ESG components. More focused, sector-level research is needed to clarify these dynamics and provide practical insights for investors, policymakers, and business leaders seeking to align sustainability goals with financial outcomes.

3. Research Aims and Methodology

The literature highlights several critical gaps concerning the effect of ESG reporting on the financial performance in the energy sector. Firstly, there is a noticeable scarcity of sector-specific analyses, as many studies aggregate data across various sectors, thus obscuring the unique dynamics of ESG performance among energy firms. Another issue is the weak causal analysis of the studies; since most do not use nuanced econometric techniques, such as panel-data analysis, fixed effects to account for causality, these studies all establish correlations rather than causality. In addition, the specific influences from Environmental, Social, and Governance on financial performance within an Indian energy industry context are not well established. The newly introduced BRSR framework by SEBI in 2022 has brought about remarkable changes in the norms of ESG disclosure; however, the same remains unexplored empirically regarding financial performance in the industry.

A very few study reflects

- the break-down of ESG performance into Environmental, Social, and Governance components,
- incorporation of firm specific controls variables like Firm Size, Firm Age, Leverage
- use of panel data regression models with control variables

3.1. Conceptual Framework & Research Hypotheses

In this analysis, the ESG score and its components, E, S, and G scores, are treated as independent variables, while financial performance metrics such as ROA, ROE, and EPS serve as dependent variables [47]. Additionally, control variables include firm size, firm age, and financial leverage [48].

Constructed on the appraisal of literature, it is assumed that there may be a positive or negative impact between independent variables (ESG score, E score, S score, G score) and control variables, i.e., size of the firm, age of the firm, and financial leverage, with the parameters of dependent variables such as ROA, ROE, and EPS [49].

The present study follows a quantitative, explanatory research design with panel data analysis to examine the cause-and-effect relationship between ESG reporting and the financial performance of Indian energy sector companies over multiple years.

3.2. Sample design & Data Collection

This study focuses on the Indian energy sector, a critical component of sustainable development due to its significant environmental and social impact. The sample includes all energy sector companies listed in the BSE Sustainability Index, along with an equal number of energy companies selected from the S&P BSE 500 Index, covering the period from 2015 to 2023. This time frame is chosen to capture post-Paris Agreement developments and evolving ESG disclosure practices in India. ESG scores and disclosures were derived from annual reports, Bloomberg, and other credible databases, while financial data was sourced from company reports, official websites, and stock exchange portals (NSE, BSE). To assess ESG performance, global reporting frameworks such as GRI and SASB are employed alongside India's BSRS guidelines. Content analysis is a widely accepted method for evaluating ESG disclosures in corporate reporting. It is used to ensure methodological robustness [50]. The study also references ESG data from major global providers like [51, 52]. A descriptive research design is adopted, and stratified sampling was applied to ensure balanced representation within the selected sector.

Table 1.
Sample Companies.

Companies taken from the BSE Sustainability indices		Companies taken from the S&P BSE 500 Index	
SL	**Name of Company**	**SL**	**Name of Company**
1.	Adani Power Ltd.	1.	CESC Limited
2.	NTPC Ltd.	2.	NHPC Ltd.
3.	Tata Power Co. Ltd.	3.	SJVN Ltd.
4.	Oil & Natural Gas Corp Ltd.	4.	NLC India Ltd
5.	Coal India Ltd.	5.	Torrent Power Ltd.
6.	Power Grid Corp of India Ltd.	6.	JSW Energy Ltd
7.	Bharat Petroleum Corp Ltd.	7.	Mangalore Refinery & Petrochemicals
8.	Indian Oil Corp Ltd.	8.	Oil India Ltd.
9.	Gail India Ltd.	9.	Indrappastha Gas Ltd.

Table 2.
Study Variables and Measurement.

Variable	Type	Explanation:
ESG SCORE	Independent	Composite ESG reporting score
E SCORE	Independent	Environmental component score
S SCORE	Independent	Social component score
G SCORE	Independent	Governance component score
ROA	Dependent	Return on Assets = Net Income / Total Assets, And then
Firm age	Control	Firm Age (years since incorporation)
Leverage	Control	Total Debt / Total Equity
EPS	Dependent	Earnings per share = Net Income / Total number of shares.
Firm size	Control	Size of the Firm (log of total assets or sales)
ROE	Dependent	ROE = Net Income / Shareholders' Equity

Tables 1 and 2 outline the study's sample and variables. Table 1 lists companies from the BSE Sustainability Indices and S&P BSE 500 Index, enabling comparison between firms with differing ESG focus. Table 2 details the study variables, with ESG score and its components (E, S, G) as independent variables; ROA, ROE, and EPS as dependent variables; and firm age, leverage, and size as control variables.

4. Data Analysis

The ESG score, along with its subcomponents E score, S score, and G score has been used as the set of independent variables, while financial performance indicators such as ROA, ROE, and EPS serve as the dependent variables. Firm size, firm age, and financial leverage are included as control variables. A panel regression model has been employed for the analysis [51-54].

4.1. Calculation of ESG Score

The ESG score of the selected firms throughout the selected period was extracted from the Bloomberg database. The ESG score was determined according to a binary index or an unweighted index of the disclosures or factors above. The unweighted index has the advantage that the components are equalized to a minimum and do not receive uneven treatment.

If the evidence of one indicator was revealed by the company in annual report, one score was given, and for not disclosed, a zero point was given.

E score of company 'X':

$$\text{E score}_{(x)} = \sum_{i=0}^{N1} I_{(E)(x)}$$

S score of company 'X':

$$\text{S score}_{(x)} = \sum_{i=0}^{N2} I_{(S)(x)}$$

G score of company 'X':

$$\text{G score}_{(x)} = \sum_{i=0}^{N3} I_{(G)(x)}$$

The ESG score of company 'X' as follows:

$$\text{ESG score}_{(x)} = \text{E score}_{(x)} + \text{S score}_{(x)} + \text{G score}_{(x)}$$

N1 = the highest number of environmental items/parameters likely to be disclosed by a company.
N2 = maximum no of social items/parameters to be disclosed by a company
N3 = maximum no of governance items/parameters that would be disclosed by a company.
N = the maximum no. of items (E, S & G) expected to be disclosed by a company, where $N \leq 117$.

ROA, ROE, EPS, Firm Size, Firm Age, and Financial Leverage were calculated by using the following formulas:

Return on Assets (ROA) = Value of ROA can be found by dividing Net Income by Total Assets

Net income was determined using the corporate income statement. Total assets were taken from the business's financial statement.

Return on Equity (ROE) = Value of ROE can be found by dividing Net Income by Shareholders' Equity

Net income was computed from the company's income statement. This equity owned by shareholders was taken from the company's balance sheet.

$$\text{Earnings Per Share (EPS)} = \frac{\text{(Net Income - Preferred Dividends)}}{\text{Average Outstanding Shares}}$$

Net income based on the company's income statement. Preferred dividends mean dividends to the preferred stockholders. Average Outstanding Shares are typically calculated as (Beginning Outstanding Shares + Ending Outstanding

Shares) / 2.
Firm Size: Firm size is the total assets of the company. It is calculated by the Log of total Assets
Firm Age: Company's age since its establishment (in years).
Financial Leverage: Debt to Equity ratio. Financial Leverage = Total debts /Total equity.

5. Results and Regression Model

To ensure accurate estimations, data series must be stationary at the same level [55]. Accordingly, the stationarity of all selected variable data series was tested using the unit root test in EViews 12. At a 5% significance level, all original data series for the chosen variables were found to be stationary [56].

Model -1: $ROA_{it} = \alpha_0 + \alpha_1 ESG_{it} + \alpha_2 E_{it} + \alpha_3 S_{it} + \alpha_4 G_{it} + \alpha_5 LEV_{it+} \alpha_6 FS_{it} + \alpha_7 FA_{it} + \mu_{it}$

5.1. Chow Test / RFET

H0: Pooled Ordinary Least Squares is the best model.
Ha: Fixed Effect Model is the best model.

Table 3.
Chow Test / RFET.

Effects Test	Statistic	d. f.	Prob.
Cross-section F	9.424303	(17,137)	0.0000
Cross-section Chi-square	125.463916	17	0.0000

According to the Chow test results given in Table 3, the FEM was chosen as the best model for these data, and H0 (POLS) was rejected at a 5% significance level.

5.2. Hausman Test (HT)

H0: REM is the best model.
Ha: Fixed Effect Model is the best model.

Table 4.
HT.

Test Summary	Statistic	d. f.	Probability
Cross-section random	35.390939	7	0.0000

Source: Authors' analysis through EViews.

Consequently, panel data regression in this research would use FEM [57] as per the results shown in Table 4. The usual test assumptions need to be fulfilled before assessing the final model.

Here,
Fixed Effect Model =FEM, Pooled Ordinary Least Squares=POLS, Chow Test = CT, Randon Effect Model=REM, Hausman Test =HT, Redundant Fixed Effects Test =RFET

5.3. Classic Test Assumptions (Jarque Bera test results)

Running a panel data regression model requires first performing a number of traditional assumption checks. Heteroscedasticity, autocorrelation, multicollinearity, and normality tests are among them [55, 57].
A normality test was performed using Jarque-Bera to assess the distribution of data as depicted in Figure 1.
H0: The data are normally distributed.
Ha: The data are not normally distributed.

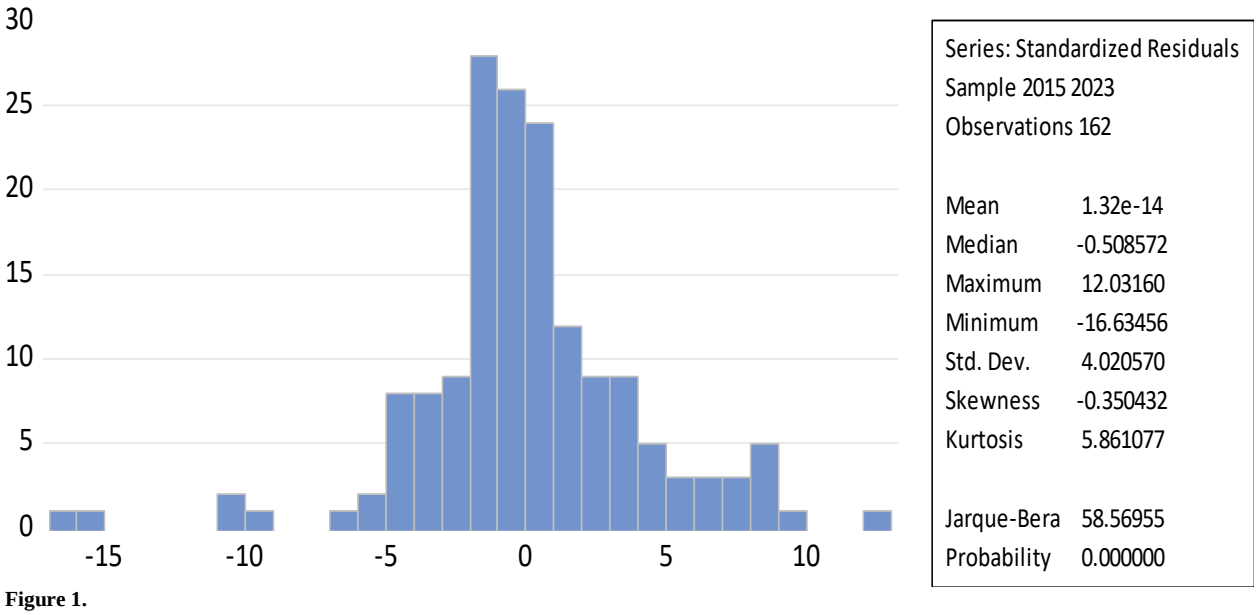

Figure 1.
Jarque-Bera test results.

Figure 1 presents the results of the normality test using the Jarque-Bera statistic applied to the standardized residuals. The test yields a value of 58.57 with a p-value of 0.0000, leading to the rejection of the null hypothesis of normal distribution. Although this suggests that the residuals are not normally distributed, it does not invalidate the regression results. According to econometric theory, particularly in large samples, the Central Limit Theorem (CLT) ensures that the estimators remain consistent and asymptotically normal, even when the residuals deviate from normality. Therefore, normality is not a strict requirement for unbiased and consistent parameter estimation in panel data regression [58]. Hence, the non-normality indicated in Figure 1 does not compromise the reliability of the model's inferences.

5.4. Multicollinearity Test Through VIF

Table 5.
Multicollinearity test through VIF.

Variable	VIF	1/VIF
ESG	35.17	0.028429
E score	9.98	0.100203
S score	6.91	0.144734
G score	6.44	0.155377
FA	1.14	0.873491
LEV	1.02	0.983121
FS	1.01	0.99
Mean VIF	8.81	

As shown in Table 5, the Variance Inflation Factor (VIF) values for most variables are below the critical threshold of 10, indicating no significant multicollinearity issues, except for the composite ESG score, which has a VIF of 35.17. This suggests that multicollinearity may be present when including the overall ESG score alongside its components (E, S, and G), consistent with the observation [56].
The multicollinearity test results are applicable to all models.

5.5. Panel Regression Model Results

Table 6.
Panel Regression Model Analysis.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.095983	0.127779	0.751162	0.4538
ESG Rating	-0.04667	0.050787	-0.91898	0.3597
E Rating	-0.07184	0.056535	-1.27065	0.206
S Rating	-0.09599	0.068813	-1.39489	0.1653
G Rating	0.00463	0.014956	0.309595	0.7573
LEV	0.36505	0.139316	2.620306	0.0098
FS	-0.00013	9.18E-05	-1.42978	0.1551
Effects Specification				
Cross-section fixed (dummy variables)				
R^2	0.628947	MDV	5.415185	
ARS	0.563945	SDDV	4.481215	
SER	2.959147	AIC	5.148706	
SSR	1199.648	SC	5.625187	
LL	-392.045	HQC	5.342164	
FS	9.675801	DWS	1.552366	
P(F-S)	0			

Here;

R2 = R-squared, ARS = Adjusted R-squared, SER = Standard Error of Regression, SSR = Sum of Squared Residuals, LL = Log-Likelihood, FS = F-Statistic, P(F-S) = Probability of F-Statistic, MDV = Mean Dependent Variable, SDDV = Standard Deviation of Dependent Variable, AIC = Akaike Information Criterion, SC = Schwarz Criterion, HQC = Hannan-Quinn Criterion, DWS = Durbin-Watson Statistic.

In this model, given in Table 6, the only independent variable that demonstrates a statistically significant connection with ROA is Firm Age (p = 0.0098). These results reveal that there is no significant association between ROA and the ESG variables (ESG, E, S, G), leverage, and firm size (FS). Unobserved firm-specific effects have been controlled, as defined by the fixed effects. The Durbin-Watson statistic suggests potential positive autocorrelation, warranting further investigation.

The model is a good overall fit (R2 = 0.629), and the predictors explain about 62.89% of the variability in profitability. This model is validated by the very significant F value (p < 0.00).

Model -2: $ROEit = \alpha0 + \alpha1ESGit + \alpha2Eit + \alpha3Sit + \alpha4Git + \alpha5LEVit + \alpha6FSit + \alpha7FAit + \mu it$

Chow Test

H0: POLS is the best model.

Ha: FEM is the best model.

Table 7.
Chow Test.

Effects Test	Statistic	d. f.	Probability
Cross-section F	2.915316	(17,137)	0.0003
Cross-section Chi-square	50.021383	17	0.0000

The null hypothesis (POLS) is rejected by the results given in Table 7 at the 5% level, resulting in the FEM being the preferred model for this data set.

5.6. Hausman Test (HT)

H0: REM is the best model.

Ha: FEM is the best model.

Table 8.
HT results.

Test Summary	Statistic	d. f.	Probability
Cross-section random	46.812028	7	0.0000

5.7. Classic Test Assumptions (Jarque Bera Test Results)

A normality test was performed using by Jarque-Bera test to assess the distribution of data as depicted in Figure 2.

H0: The data are normally distributed

Ha: The data are not normally distributed.

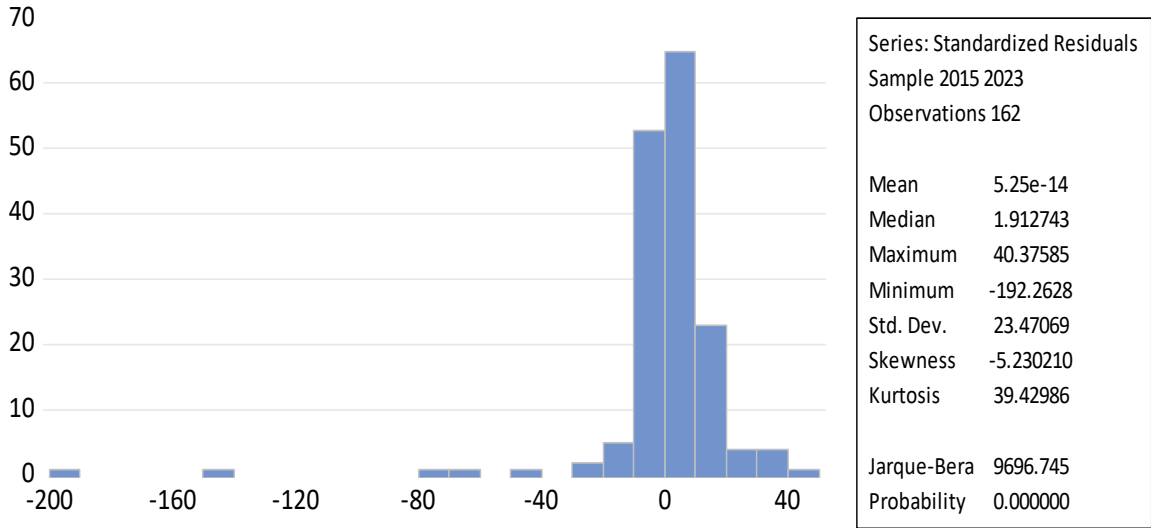

Figure 2.
Jarque-Bera test results.

Figure 2 displays a Jarque-Bera test statistic of 9696.745 with a p-value of 0.0000, confirming that the residuals are not normally distributed. The sharp skewness (–5.23) and high kurtosis (39.42) further support this. Despite this, non-normality does not affect the validity of panel regression results, as consistent and unbiased estimates are still achievable in large samples due to the Central Limit Theorem [59].

5.8. Panel Regression Model Results

Table 9.
Panel Regression Model Results.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-52.8999	43.56953	-1.21415	0.2268
ESG Rating	-0.35082	0.941504	-0.37262	0.71
E Rating	0.022073	0.374213	0.058985	0.953
S Rating	-0.20598	0.416563	-0.49447	0.6218
G Rating	-0.00558	0.507027	-0.011	0.9912
LEV	1.20527	0.110197	10.93745	0
FA	2.448588	1.026509	2.385355	0.0184
FS	-0.00093	0.000676	-1.36763	0.1737
Effects Specification				
Cross-section fixed (dummy variables)				
R^2	0.630407	MDV	11.40691	
ARS	0.56566	SDDV	33.08372	
SER	21.80364	AIC	9.143058	
SSR	65129.64	SC	9.619539	
LL	-715.588	HQC	9.336516	
FS	9.736571	DWS	1.181177	
P(F-S)	0			

The results given in Table 9 indicate that firms that succeed in servicing debt obligations tend to have higher stock returns, possibly due to the benefits of financial leverage. LEV has a very strong, optimistic, and highly significant relationship with ROE ($p < 0.00$).

This study shows that firm age also strongly impacts a company's ROE, while ESG factors seem to have no significant effects according to this particular investigation.

64.04% of the discrepancy in profitability can be predicted by the variables incorporated in the model, which showed an excellent overall fit ($R^2 = 0.630407$). The statistical significance of the model is confirmed by the highly significant F-statistic, $p < 0.001$.

Model -3: $EPS_{it} = \alpha_0 + \alpha_1 ESG_{it} + \alpha_2 Eit + \alpha_3 S_{it} + \alpha_4 G_{it} + \alpha_5 LEV_{it+} \alpha_6 FS_{it} + \alpha_7 FA_{it} + \mu_{it.}$

Chow Test:

H0: POLS is the best model.

Ha: FEM is the best model.

Table 10.
Chow Test.

Effects Test	Statistic	d. f.	Probability
Cross-section F	9.518875	(17,137)	0.0000
Cross-section Chi-square	126.337869	17	0.0000

According to Table 10 results, the Null hypothesis is rejected (which assumes a POLS model) at 5% significance level. Therefore, it is concluded that FEM is an adequate choice for this dataset.

5.9. Hausman Test
H0: REM is the best model.
Ha: FEM is the best model.

Table 11.
Hausman Test.

Test Summary	Statistic	d. f.	Probability
Cross-section random	38.037567	7	0.0000

5.10. Classic Test Assumptions (Jarque Bera test results)
A normality test was performed using Jarque-Bera to assess the distribution of data as depicted in Figure 3.

H0: The data are normally distributed.
Ha: The data are not normally distributed.

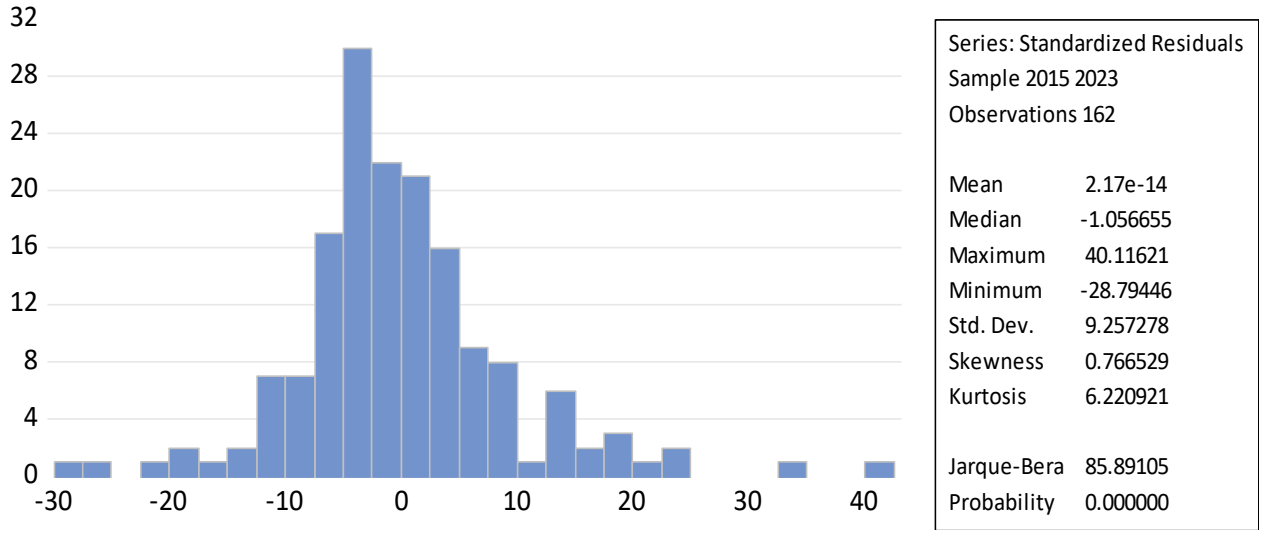

Figure 3.
Jarque-Bera test results.

Figure 3 shows the standardized residuals with a Jarque-Bera statistic of 85.89 and a p-value of 0.0000, indicating non-normality. The residuals are slightly right-skewed (0.77) and leptokurtic (6.22). However, as per [59], in panel data, non-normality does not affect estimator validity due to the Central Limit Theorem in large samples.

5.11. Panel Regression Model Results

Table 12.
Panel Regression Model Results.

Variable	Coefficient	Std. Error	t-Statistic	Probability
C	-27.0177	13.57828	-1.98978	0.0486
ESG Rating	0.013911	0.293416	0.047412	0.9623
E Rating	-0.04322	0.116622	-0.3706	0.7115
S Rating	-0.18189	0.12982	-1.40107	0.1635
G Rating	-0.32804	0.158013	-2.076	0.0398
LEV	0.014734	0.034342	0.429019	0.6686
FA	1.941103	0.319907	6.067703	0
FS	-0.00035	0.000211	-1.67868	0.0955
Effects Specification				
Cross-section fixed (dummy variables)				
R^2		0.639654	MDV	11.02753
ARS		0.576528	SDDV	10.44187
SER		6.795021	AIC	6.811284
SSR		6325.606	SC	7.287765
LL		-526.714	HQC	7.004742
FS		10.13292	DWS	1.811466
P(F-S)		0		

As shown in Table 12, among the independent variables, Firm Age (FA) has a positive and statistically significant relationship with EPS ($p < 0.00$). The overall model demonstrates a good fit, with an R-squared value of 0.639654, indicating that approximately 64% of the variation in EPS is explained by the model. The F-statistic is also significant ($p < 0.00$), confirming the model's overall reliability. In summary, only firm age shows a significant contribution to EPS growth, while ESG, firm size, and leverage do not exhibit any statistically significant effects.

6. Overall Findings and Implications

The regression models demonstrate high accuracy levels, with R^2 values ranging between 63% and 64%, indicating that the selected variables explain a substantial portion of the variation in firm profitability among energy sector companies. The F-statistics are statistically significant at $p = 0.0000$ across all three models, confirming the reliability of the estimations.

In Model 1, which analyzes Return on Assets (ROA), only Firm Age (FA) exhibits statistical significance, with a p-value of 0.0098. The analysis shows that energy companies with more years under their belt demonstrate enhanced asset performance because they have established operational efficiency and market credibility along with developed infrastructure. The analysis reveals no significant relationship between ESG scores and Return on Assets (ROA), along with leverage and firm size, because the capital-intensive and regulation-driven energy sector likely disconnects short-term ESG practices from asset performance.

Model 2 demonstrates a robust and statistically significant direct correlation between leverage and Return on Equity (ROE) ($p = 0.0000$). Energy companies that utilize higher leverage appear to have greater potential for increasing shareholder returns, which probably stems from their ability to use debt funding for large energy projects. The lack of significant ESG effects indicates that traditional financial structures continue to play a dominant role in determining equity returns within the energy sector.

Model 3 presents Earnings Per Share (EPS) as its focus and shows Firm Age (FA) as its only significant predictor ($p = 0.0000$) to demonstrate that older firms generate higher earnings per share because of their stability, established customer base, and improved risk management. The lack of significant impact from ESG variables, together with firm size and leverage, indicates that energy companies' ESG adoption remains in its early stages before it can affect earnings performance through policy alignment or additional time.

In summary, across all models, firm age consistently influences financial performance, while ESG scores currently show limited direct impact on profitability indicators in the Indian energy sector. This may highlight the need for deeper ESG integration, stronger policy enforcement, or longer-term measurement horizons to capture their financial benefits.

6.1. Managerial Implications

Business managers from energy companies and other large capital-intensive industries can derive multiple important findings from this study. The research demonstrates that Firm Age (FA) maintains a statistically significant relationship with all three profitability indicators: ROA, ROE, and EPS, indicating that organizational maturity substantially affects financial performance. Energy companies demonstrate that accumulated operational expertise, regulatory familiarity, strong supplier and stakeholder networks, and long investment cycle management capabilities lead to these financial results. The finding indicates that younger firm managers should allocate resources to develop long-term capabilities, including brand

building, operational efficiency, stakeholder trust, and technological advancement, which are typically observed in mature firms.

The research indicates managers should not reduce their ESG efforts because the study fails to demonstrate statistically significant short-term profitability effects from E, S, and G scores. The energy sector faces rising sustainability concerns and regulatory changes, which make ESG adoption valuable for achieving indirect long-term benefits, including improved risk management, enhanced investor appeal, a stronger reputation, and alignment with global energy transition goals. Managers should view ESG as a strategic investment in the firm's long-term resilience and stakeholder alignment, even if immediate financial gains are not observable.

Model 2 demonstrates that companies in the energy industries can improve shareholder value through proper debt financing application, which results in positive leverage effects on ROE. Nevertheless, this must be approached with caution. Before managers can determine their firm's debt capacity, they need to assess cash flow stability and risk appetite to prevent financial distress through excessive leverage. Strategic alignment between capital structure decisions, long-term growth plans, operational realities, and market conditions must be established by firms.

The research reveals that traditional financial and operational bases, including firm age and capital structure, remain important for profitability, but ESG practices maintain strategic value in sectors where environmental and social elements are quickly becoming essential for market success and organizational acceptance.

6.2. Policy Implications

Policymakers from India and similar economies need these study results to develop effective strategies for corporate sustainability and profitability enhancement. A continual positive relationship between firm age and financial performance shows that policy initiatives must support the development of young enterprises into stable, mature companies. The governmental organizations, including MSME Ministries, together with NITI Aayog and Startup India, should launch structured programs to provide business incubation alongside capacity building and subsidized credit and mentorship support for new firms facing initial operational challenges. Tax incentives that increase with time for firms that survive and scale can motivate businesses to adopt long-term strategies.

The lack of correlation between ESG indicators and short-term profitability makes it difficult for governments to promote CSR and sustainable business practices. The Ministry of Corporate Affairs and SEBI should implement mandatory ESG disclosure standards and support sector-specific ESG guidelines while integrating ESG compliance into their governance audit processes. The implementation of regulatory measures will integrate ESG practices into corporate operations, thus generating long-term value even when immediate short-term profitability benefits remain unseen.

The strong leverage effect on ROE highlights the need for financial environments that provide proper regulation alongside facilitation. The financial environment needs to provide businesses in the energy, manufacturing, and infrastructure sectors with easy access to debt capital while protecting against excessive leverage risks. The regulatory bodies of RBI, SEBI, together with financial sector regulators, should find an equilibrium between lending opportunities and risk control through proper leverage regulations and clear capital structure information disclosure requirements.

The establishment of universal ESG reporting standards that match GRI or ISSB frameworks, along with universal accessibility and comparison, will motivate both investors and civil society groups to participate meaningfully. Firms will integrate ESG into their sustainable business operations when they recognize its non-financial advantages, which include enhanced risk governance, strengthened brand reputation, and increased investor appeal. Enterprise maturity needs to become the main focus of policy development through institutional support initiatives that integrate ESG within regulatory structures and provide responsible finance access through capital market stability. The measures developed for Indian economic conditions apply to other emerging markets that seek to harmonize profit-making with sustainability and governance standards.

7. Conclusion

The study examines how ESG performance and governance impact financial performance indicators ROA, ROE, and EPS in India's energy sector while considering firm age, size, and financial leverage. The research sample included companies from the BSE Sustainability Index, together with comparable firms from the S&P BSE 500 Index. Research indicates that firm age produces steady positive effects on all three performance indicators because of experience combined with established systems and market credibility. The positive correlation between leverage and ROE shows that debt management strategies can boost shareholder earnings. The models demonstrated that neither ESG scores nor firm size produced any meaningful impact on profitability metrics.

The results indicate that managers need to understand ESG as a fundamental component of their long-term strategy, which builds corporate resilience and strengthens investor trust and market reputation. Management should prioritize capital structure development together with sustainable growth approaches, which base their strategies on company maturity. Policy implementation requires enhanced assistance programs for new businesses, together with regulatory ESG integration and stable capital markets that promote ethical financial practices. The study contributes to the literature by offering sector-specific insights from an emerging economy, emphasizing the nuanced role of ESG and firm fundamentals in financial performance. It underscores that, while ESG may not always correlate directly with short-term profitability, its indirect value cannot be overlooked, especially in sustainability-driven sectors like energy.

8. Limitations and Future Research Scope

The research provides essential findings regarding ESG score correlations with financial results in India's energy industry, but allows space for new research. The study limits itself to particular Indian energy companies listed on defined

indices, which restricts its ability to understand the entire sector. Research should increase its sample size by studying firms from various developing and developed markets to achieve wider applicability and cross-market insights. Researchers should investigate multiple industry sectors beyond energy to determine if ESG performance relationships differ between different business types. The examination of ESG effects would benefit from longer time periods of data collection. Future research should enhance the model through detailed ESG dimensions analysis while adding firm-specific control variables and examining the regulatory environment or corporate governance practices as moderating factors for better cross-country application.

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