The Impact of Corporate Sustainability on Financial Performance: Examining the Moderating Role of Capital Intensity

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Abstract:

This study investigates the relationship between corporate sustainability performance and firm financial performance while focusing on the moderating role of the capital intensity of firms. Using a comprehensive dataset of 1,807 U.S. firms from the Russell 3000 Index over the period 2012-2022, this research employs panel data methodologies, including fixed effects models and two-stage least squares (2SLS) analysis with instrumental variables, to address potential endogeneity concerns.

The findings of this study reveal a positive relationship between sustainability performance (as measured through ESG scores) and firm financial performance (as measured through ROA), supporting the "business case" for sustainability. Moreover, capital intensity is found to moderate the ESG-ROA relationship negatively. Importantly, these results are robust to multiple model specifications and estimation techniques, reinforcing the reliability of the findings.

Keywords: Corporate Sustainability, Financial Performance, ESG, Industry Competition, Capital Intensity, Employee Productivity

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1.0 Introduction

In an era marked by growing environmental concerns, social inequalities, and corporate governance scandals, the concept of corporate sustainability has understandably gained remarkable prominence. There has been a fundamental change in the social contract with businesses realizing that they can no longer solely pursue economic objectives, but also have to exhibit broader social and environmental accountability. This growing importance of corporate sustainability initiatives, often encapsulated under the umbrella term of Environmental, Social, and Governance (ESG) practices, is evident from anecdotal evidence. The global socially responsible investments have grown tremendously to reach the $35 trillion mark (Bloomberg L.P., 2021). The ESG-mandated assets are expected to account for 25% of all professional AUM globally by 2030 (Bloomberg L.P., 2024). Moreover, the spending on sustainability initiatives has also increased with Fortune 500 companies spending an estimated $20 billion annually (Thompson, 2020).

However, even as firms allocate significant resources towards sustainability initiatives and investments—a fundamental question persists: Does corporate sustainability truly enhance financial performance? This question lies at the heart of an ongoing theoretical and empirical debate. On one side, proponents argue that sustainability initiatives can lead to improved financial performance through various mechanisms such as enhanced reputation, increased operational efficiency, and better risk management (Porter and Kramer, 2006; Eccles, Ioannou and Serafeim, 2014). On the other hand, critics contend that such initiatives divert resources from core business activities and may not necessarily translate into financial benefits (Friedman, 1970; Barnea and Rubin, 2010). Despite a growing body of research examining the

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relationship between corporate sustainability and financial performance, the empirical evidence remains mixed and inconclusive (Gillan, Koch and Starks, 2021). A meta- analysis of over 2000 empirical studies found that while about 90% of studies find a nonnegative ESG–CFP (Corporate Financial Performance) relation, only 63% of studies report positive findings (Friede, Busch and Bassen, 2015). This lack of consensus suggests that the relationship may be more complex than initially thought, potentially influenced by various contextual factors and firm-specific characteristics (Vishwanathan et al., 2020).

Guided by these considerations, this paper sets out to achieve the objective of addressing the following research questions: What is the relationship between corporate sustainability performance (as measured by ESG scores) and firm financial performance (as measured by Return on Assets)? How does a factor like capital intensity moderate this relationship? To answer these questions, two hypotheses have been developed based on a comprehensive review of theoretical and empirical literature.

This article aims to contribute to the existing literature by addressing several research gaps. Despite extensive research, the relationship between corporate sustainability and firm performance remains ambiguous (Wang, Dou and Jia, 2016; Gillan, Koch and Starks, 2021) and suggests that the various empirical mechanisms through which CSR initiatives affect firm performance are yet to be fully uncovered (Vishwanathan et al., 2020). This lack of consensus, while not a gap per se, provides an opportunity for further research. The current inconsistent findings may have resulted from model misspecification and endogeneity issues (Lin, Yang and Liou, 2009; Malik, 2015). Many studies used simplified models that fail to account for the complex nature of CS and potential biases. Thus, there is a need for research addressing these concerns to provide more reliable estimates of CS impact on firm performance.

Moreover, a significant portion of existing research has focused on specific aspects of sustainability, such as social or environmental responsibility, rather than adopting a more comprehensive construct (Servaes and Tamayo, 2013; Malik, 2015). The governance dimension is often overlooked. The use of the broader ESG score is relatively less prevalent in the current literature. Thus, there is a rationale for exploring the CS-FP link using the holistic ESG metric as a construct for corporate sustainability. In addition, there have been explicit calls by authors to test mediating mechanisms and contextual factors while examining the CS-FP relationship (Surroca, Tribó and Waddock, 2010; Gillan, Koch and Starks, 2021). Capital intensity is one such factor whose moderating impact, if any, on the relationship between CSR and firm performance has received relatively limited attention. This also presents a potential research gap. Finally, the focus on a recent time period (2012- 2022) and the use of a comprehensive sample provide contemporary evidence in a rapidly evolving business landscape, where sustainability concerns have become increasingly prominent.

The remainder of this paper is structured such that Section 2 provides a comprehensive review of the literature and the formulation of the hypotheses. Section 3 details the methodology employed in this study. Section 4 presents and discusses the results of the empirical analyses. Finally, Section 5 discusses the implications of the findings for theory and practice. It also acknowledges the limitations of this study and suggests directions for future research.

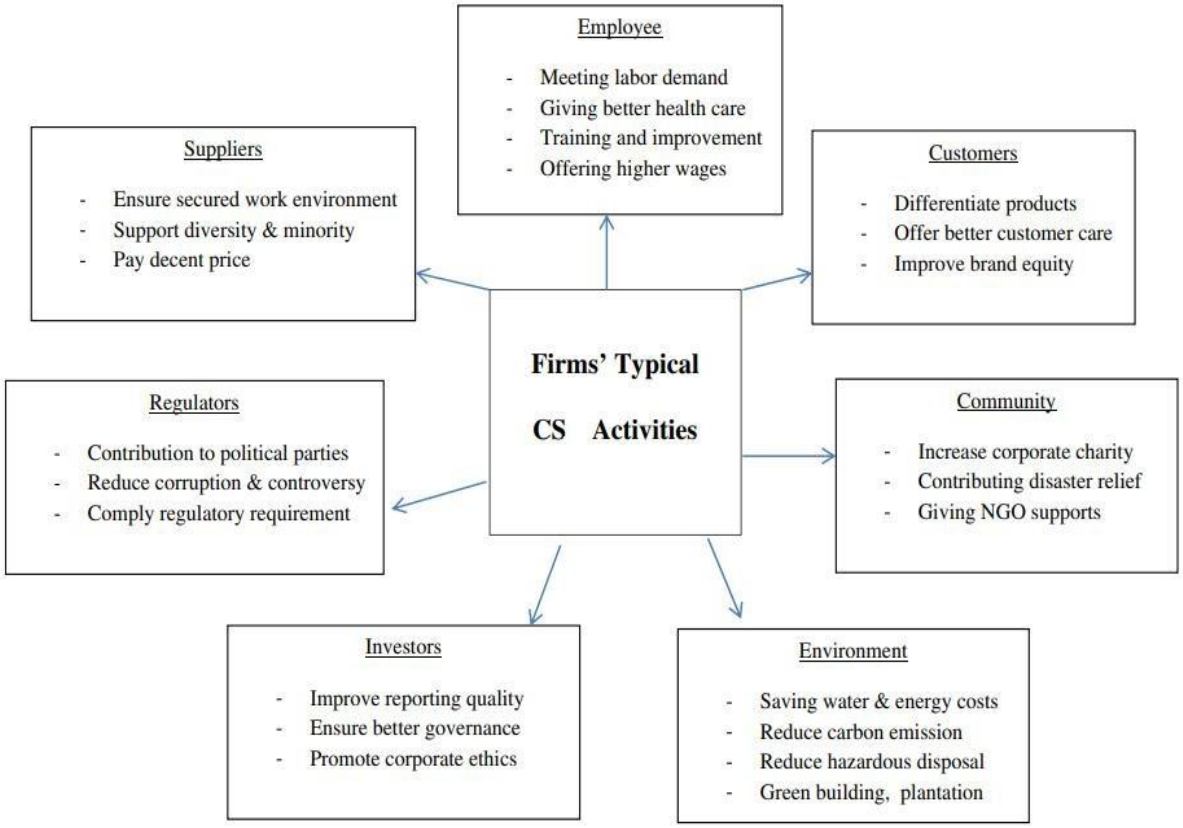
2.0Literature Review and Hypotheses Development

2.1 Corporate Sustainability and its interrelatedness with CSR and ESG

'Corporate Sustainability' or CS encompasses the broad set of corporate policies, actions, and efforts that firms undertake to voluntarily incorporate environmental and social issues in their business model, strategies, and organisational processes (Bansal, 2005; Eccles, Ioannou and Serafeim, 2014) to holistically cater to the current and future interests of all relevant stakeholders (Dyllick and Hockerts, 2002).

Figure-1

Typical Corporate Sustainability Actions of Firms, Source: Malik (2015)



The concept of corporate sustainability (CS) is intertwined with several other overlapping notions, such as corporate social responsibility (CSR) and corporate social performance, that are difficult to disentangle and often used interchangeably (van den Brink and van der Woerd, 2004; Waddock, 2004; Flammer, 2013). In fact, CS and CSR are often perceived as "two sides of the same coin" (Kanji and Agrawal, 2016). Despite the purported interchangeability, many researchers argue that a subtle distinction between CSR and CS exists (Steurer et al., 2005; Ebner, Rupert and Baumgartner, 2006) and that CSR can be visualised as a subset of CS. Corporate Social Responsibility (CSR) refers to the obligation of businesses to take into account social interest and value (Bowen, 1953) while formulating corporate policies and decisions (Carroll, 1999). In contrast, Corporate Sustainability is a broader concept that encompasses CSR (Lozano, 2008, 2015), with CSR representing the societal aspect of corporate sustainability (Ebner, Rupert and Baumgartner, 2006; Linnenluecke, Russell and Griffiths, 2009). Despite

these differences, the concept of CSR has been converging with the idea of CS over time (Montiel, 2008; Ashrafi et al., 2018).

Due to the overlapping nature of CS and CSR, and in the absence of a standardised method to measure corporate sustainability (Montiel and Delgado-Ceballos, 2013), researchers have extensively used "Environmental, Social, and Governance" (ESG) performance as a measure of corporate sustainability (Servaes and Tamayo, 2013; Lins, Servaes and Tamayo, 2017). ESG refers to integrating environmental, social, and governance priorities into business models (Gillan, Koch and Starks, 2021), to mitigate negative environmental impacts (Jiang, Chen and Chen, 2022), create societal value (Ferrell, Liang and Renneboog, 2016), and enhance transparency and accountability (Cheng, Ioannou and Serafeim, 2014). This study, moving forward, also uses the terms CS/CSR/ESG interchangeably.

2.2 Theoretical Background Underpinning Corporate Sustainability

The rationale for corporate sustainability, if any, has been a matter of extensive academic discourse (Ashrafi et al., 2018) with numerous theories and models exploring the issue (Kanji and Agrawal, 2016). These theories broadly propagate two opposing schools of thought.

The first strand of theories collectively argues against corporate sustainability and CSR through the "**shareholder primacy**" view. This view states that corporations should pursue the benefit of the shareholders and that managers, as agents, have a fiduciary duty towards the shareholders (Berle and Means, 1932). Friedman (1970) further affirmed this by introducing the "**shareholder perspective**", stating that businesses are economic entities whose sole social responsibility should be to increase the profits for the owners. This view posits that corporate spending for social causes represents an inefficient diversion of company resources that destroys firm value. Thus, the "shareholder primacy" argument states that the primary responsibility of a firm is to maximize its shareholders' wealth (Stout, 2002) and hence all corporate actions and decisions should prioritize the interest of shareholders (Sundaram and Inkpen, 2004) as they, being the residual claimants, have the greatest vested interest in the outcome of the corporation (Easterbrook and Fischel, 1991; Macey, 2014). Adopting the "shareholder primacy" philosophy enhances firm value as it facilitates entrepreneurial risk-taking (Sundaram and Inkpen, 2004) and ensures that the executives of the firm are not confused by multiple goals from differing stakeholders (Jensen, 2002). Moreover, a solitary corporate objective provides the management with clarity and promotes accountability within the firm.

Opposing the shareholder primacy view, a second stream of theories argues that firms have a responsibility not only to their shareholders but also to society and the environment. Dodd (1932), while refuting the shareholder primacy argument postulated by Berle and Means (1932), argued that *"public opinion, which ultimately makes law, has made and is today making substantial strides in the direction of a view of the business corporation as an economic institution which has a social service as well as a profit-making function…".* Perhaps the most prominent theory that advocates in favour of corporate sustainability is the **stakeholder perspective** (Freeman, 1984) which argues that firms should accommodate the interests of all relevant stakeholders while operating. Doing so will add value to the firm by facilitating business benefits (Bowen, 1953) such as enhancing the corporation's reputation and deepening customer loyalty (Freeman and McVea, 2001). CSR also facilitates competitive advantage as per the **resource-based view** (Barney, 1991) which suggests that sustainable actions improve a firm's

performance by giving rise to valuable, rare, and inimitable resources such as superior brand recognition, employee productivity, and innovation etc. (Branco and Rodrigues, 2006; Malik, 2015). Moreover, the disclosure and reporting of CSR activities caters to societal norms and expectations and thereby enhances the legitimacy (Deegan, 2002) and the long-run survivability of the business according to the **legitimacy theory** (Suchman, 1995). Finally, the **institutional theory** states that firms engage in socially and environmentally responsible actions due to institutional pressures arising from their environment (Campbell, 2007). These pressures can come from government regulations, industry norms, or other stakeholders. Firms that adeptly respond to these pressures may avoid reputational damage and legal sanctions, positively impacting performance.

In summary, the theoretical landscape surrounding the relationship between corporate sustainability and firm performance has evolved significantly over the years. While early theories were sceptical of CSR's benefits, subsequent theories have bolstered the business case for sustainability. This juxtaposition necessitates a thorough review of the relevant empirical literature.

2.3 Empirical Evidence on the Nexus Between Corporate Sustainability and Firm Performance

Many studies have documented a positive relationship between corporate sustainability and firm performance. The resource-based view (RBV) suggests that ESG activities allow firms to develop strategic resources that contribute to superior performance. Sustainable policies and practices build the reputation and legitimacy of firms (Eccles, Ioannou and Serafeim, 2014) and enhance customer trust and awareness (Servaes and Tamayo, 2013), resulting in improved firm performance.

Sustainable business practices also promote firm performance by fostering another key competency: the ability to differentiate from competitors and generate competitive advantage. Surroca, Tribó and Waddock (2010) conducted a panel study on 599 companies from 28 countries and found a positive relationship between CSR and firm performance. This relationship is moderated by intangible resources such as human capital, reputation, and innovation that allow the firms to differentiate themselves from their peers. ESG activities also facilitate product differentiation (Albuquerque, Koskinen and Zhang, 2018) by enabling

firms to position themselves as socially responsible (Di Giuli and Kostovetsky, 2014) and through practising “green innovation” (Zhou, Huang and Jiang, 2024). These enable firms to attract socially conscious customers (Fraj, Martínez and Matute, 2011; Flammer, 2015) who are often willing to pay premium prices for environmentally responsible products.

In addition, corporate sustainability engagement also appeals to other stakeholders like governments, resulting in greater access to government subsidies (Jiang, Chen and Chen, 2022). Moreover, the ability of ESG activities to curtail risk (Oikonomou, Brooks and Pavelin, 2012) and cost of capital (Chava, 2014; Ng and Rezaee, 2015) and to enhance access to finance (Cheng, Ioannou and Serafeim, 2014a) is well documented. Firms can access cheaper debt financing (Lian *et al.*, 2023) from creditors who perceive ‘green firms’ to be less risky (Palmieri *et al.*, 2024). The lower cost of capital translates to higher NPV projects and, hence, better firm performance. Several other studies have also affirmed this positive relationship between sustainable business practices and firm performance (Liang and Renneboog, 2017; Chen, Song

and Gao, 2023).

In contrast, there is also a growing body of literature that challenges the widely held belief that corporate sustainability engagement benefits firm performance. Di Giuli and Kostovetsky (2014) found no relationship between changes in a firm's ESG score and its revenue growth rate, and a negative relationship with changes in ROA. Similarly, Humphrey, Lee and Shen (2012) examined 256 companies in the UK between 2002-2010 and found no difference in the risk-adjusted stock returns of firms with high and low CSP ratings. Buchanan, Cao and Chen (2018) identified a negative relationship between firms' ESG rating and their firm value as measured through Tobin's Q. Duque-Grisales and Aguilera-Caracuel (2021) also observed a negative relationship between the ESG score(s) and the firm performance (ROA and Tobin's Q) of multinational companies. The authors claim that financial slack and international diversification mediate this negative relationship. They argue that international diversification leads to firms overspending on CSR activities, thereby damaging firm value.

Ultimately, the mixed empirical results discussed above confirm the inconclusive nature of the relationship between ESG and firm performance (Friede, Busch and Bassen, 2015; Gillan, Koch and Starks, 2021) and strengthen the call to examine relevant moderating variables. Despite the mixed empirical evidence, the majority portion of the meta-analyses have found a positive relation between CSR and financial performance (Friede, Busch and Bassen, 2015; Wang, Dou and Jia, 2016). Moreover, the above discussion supports the contention that the benefits of corporate sustainability outweigh the costs (Malik, 2015; Newman *et al.*, 2020). This paper also holds a similar view and hence proposes the following hypothesis:

Hypothesis 1: Corporate Sustainability Performance (as measured by ESG Score) is positively associated with firms' financial performance (as measured by ROA)

2.4 The Role of Capital Intensity as a Potential Moderating Variable

Capital intensity, representing a firm's investment in physical assets (Buchanan, Cao and Chen, 2018), may play a significant role in moderating the relationship between sustainability performance and firm performance. However, the nature of this moderation is subject to debate, with competing theoretical perspectives suggesting different potential outcomes.

Conceptually, firms with higher capital intensity are likely to be more productive, operationally efficient, and better utilize economies of scale, leading to better firm performance. However, the impact of capital intensity on firm performance can also be curvilinear as excessive capital intensity may also lead to reduced flexibility and higher fixed costs, potentially impacting profitability during economic downturns (Lee and Xiao, 2011). Capital intensity's relationship with sustainability is also multifaceted. On one hand, capital- intensive firms might be more receptive to social sustainability initiatives due to the pressure they face for their relatively larger carbon footprint (Moussa and Elmarzouky, 2023). On the other hand, the high costs associated with capital-intensive operations might also constrain a firm's ability to allocate resources to sustainability initiatives, particularly in the short term as per the slack hypothesis (Waddock and Graves, 1997).

The resource-based view (Barney, 1991) suggests that capital-intensive firms might be better positioned to better implement sustainability initiatives. These firms often possess superior technologies and processes that could enable more efficient integration of ESG practices bolstering financial performance. Moreover, stakeholder theory posits that capital-intensive

firms, due to their potentially larger environmental footprint, may face greater scrutiny from stakeholders. As such, these firms have more to gain from ESG initiatives in terms of improved stakeholder relationships and reputational gains (Jo and Harjoto, 2011).

Conversely, highly capital-intensive firms may also have fewer 'slack' resources remaining for ESG initiatives after investing in physical assets, thus representing a trade-off. This could lead to a negative moderation effect, as ESG investments might be seen as competing with necessary capital expenditures. Furthermore, capital-intensive industries often face significant pressure to demonstrate short-term financial performance due to high fixed costs, which might impose financial constraints and make it more difficult for these firms to realize the long-term benefits of ESG investments (Duque-Grisales and Aguilera-Caracuel, 2021). The institutional theory perspective adds another layer of complexity to this relationship. Capital- intensive firms usually pollute the environment more (Delmas and Blass, 2010), and hence are often subject to more stringent environmental regulations. This could either drive more comprehensive sustainability practices or impose additional costs that might negatively impact financial performance.

Based on the competing perspectives on the nature of the relationship and given that most of the mechanisms through which ESG initiatives promote financial performance are human- oriented (customer loyalty, employee morale and performance, stakeholder relations, etc.), it is expected that greater investment in physical assets might weaken the CS-CFP link. Thus, the following hypothesis is proposed:

Hypothesis 2: Capital Intensity negatively moderates the relationship between Corporate Sustainability performance (ESG Score) and firms' financial performance (ROA).

3.0 Methodology

3.1 Data and Sample Construction

This study is quantitative in nature and utilizes secondary data collected from the LSEG datastream database[2]. This comprehensive database provides Environmental, Social, and Governance (ESG) scores, which serve as a measure of corporate sustainability performance, as well as data on fundamental company metrics for the independent and control variables. This source is used for its reliability, comprehensive coverage, and extensive use in past related research (Dyck et al., 2019; Albuquerque et al., 2020; Chen, Song and Gao, 2023).

Constituents of the US equity market, specifically the Russell 3000 Index, are used to construct the sample for this study. The Russell 3000 Index is a capitalization-weighted index that represents approximately 98% of the investable U.S. equity market (FTSE Russell, 2023). The US market is chosen due to its size, influence, and availability of comprehensive and reliable ESG data (Dyck et al., 2019; Christensen, Hail and Leuz, 2021). The sample period spans a timeframe of 11 years from 2012 to 2022. This timeframe is carefully chosen to provide a relatively current perspective while avoiding potential distortions caused by the 2008 financial crisis (Marie Lauesen, 2013; Berkman, Li and Lu, 2021). The initial sample comprised 2,646 unique companies with 29,301 firm-year observations. Following standard practice, companies from the financial sector have been excluded due to their unique regulatory environment, capital structure, and accounting practices. Additionally, observations with missing data for key

[2] This was previously known as the Thompson Reuters Datastream.

variables have been dropped to ensure the completeness of the dataset (El Ghoul et al., 2011). After these adjustments, the final sample consists of 1,807 unique companies with 12,424 firm-year observations as shown in Table 1. The actual number of observations in the regression analysis might differ slightly due to listwise deletion in Stata.

Table-1

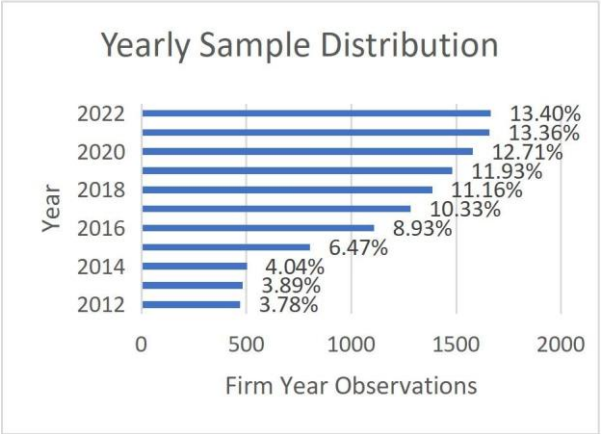
Sample Distribution

Panel A: Sample Construction

	No. of Unique Firms	No. of Firm Year Observations
Initial Sample Size	2646	29301
Dropped:		
Financial Sector Companies	632	6947
Missing ESG Score	59	8309
Missing Control Variables	148	1621
Final Sample Size	**1807**	**12424**

Panel B: Sample Distribution

Year	Firm Year Observations	Percentage
2012	470	3.78%
2013	483	3.89%
2014	502	4.04%
2015	804	6.47%
2016	1109	8.93%
2017	1284	10.33%
2018	1386	11.16%
2019	1482	11.93%
2020	1579	12.71%
2021	1660	13.36%
2022	1665	13.40%



Note: Table 1 provides insights on the study sample with Panel A outlining the sample size and Panel B reporting the annual sample distribution in tabular and graphical form.

Panel B of the above table shows a significant increase in data coverage over time, with the number of observations more than tripling from 470 in 2012 to 1665 in 2022. This growth pattern is consistent with the expanding availability of ESG data and increasing corporate sustainability reporting practices.

3.2 Econometric Modelling Techniques

3.2.1 Data Preprocessing and Preparation

Several steps have been taken to ensure the quality and reliability of the data before conducting the statistical analysis. First, the data have been thoroughly examined using box plots[3] and statistical tests to identify outliers that could unduly influence the results. Winsorization[4] at the

[3] See Appendix D for the boxplot graphs

[4] This involves replacing extreme values with less extreme values at the specified percentiles.

1st and 99th percentiles were done to mitigate the impact of extreme values without losing observations (Woolridge, 2010) to reduce the impact of data errors or exceptional events on statistical inferences (Adams et al., 2019). For data pertaining to R&D expenses, missing values have been replaced with zero as per the literature (Oikonomou, Brooks and Pavelin, 2012). It is assumed that a missing value indicates that the firm does not engage in that activity.

3.2.2 Statistical Techniques and Analysis

The dataset for this study comprises observations of multiple firms over several years. Hence, it is an unbalanced panel dataset and the panel data regression analysis has been selected as the appropriate econometric method. This approach is justified as it provides robust results due to increased sample variability, reduced collinearity among variables, greater efficiency, and more precise estimates (Baltagi and Song, 2006; Hsiao, 2007; Wooldridge, 2010). The use of panel data analysis is also well-established in the relevant empirical literature.

The Hausman test has been conducted to determine the most appropriate panel data estimation method (Long *et al.*, 2020). Based on the results, the fixed effects model has been employed in this study. The fixed effects model is particularly suitable for this analysis as it accounts for unobserved heterogeneity by controlling for time-invariant unobserved characteristics of firms (Clark and Linzer, 2015) that may influence both their sustainability performance and financial outcomes. This also reduces the risk of omitted variable bias, a common concern in sustainability-financial performance studies (Lin, Yang and Liou, 2009; Malik, 2015). The basic model is represented by the equation:

$$y_{it} = X_{it}\beta + \alpha_i + u_{it}$$

Where y_{it} is the dependent variable for individual i at time t, X_{it} represents a $1 \times k$ vector of observable time-variant independent variables, β is a vector of coefficients, α_i is the time-invariant unobserved individual effect (fixed effect), and u_{it} is the error term.

The Breusch-Pagan test has been conducted to check for heteroskedasticity in the models and the clustered-robust standard errors were calculated to provide consistent standard errors even in the presence of heteroskedasticity (White, 1980). Endogeneity is a potential concern in this study, as it is in much of the research on CSR and firm performance (McWilliams and Siegel, 2000; Lin, Yang and Liou, 2009). Endogeneity can arise due to reverse causality and omitted variable bias. To address potential endogeneity issues, a two-stage least squares (2SLS) approach has also been conducted using an instrumental variable to isolate the causal effect of ESG performance on firm performance (Long *et al.*, 2020).

Various instrumental variables have been used in existing literature such as firm age (Jo and Harjoto, 2011; Akben-Selcuk, 2019), CSR report dummy variable (Wang *et al.*, 2020), and lagged ESG score (Chen, Song and Gao, 2023). In this study, the yearly average industry ESG score calculated based on the peers of a firm has been used as the instrumental variable (Cheng, Ioannou and Serafeim, 2014b; El Ghoul, Guedhami and Kim, 2015). This IV is appropriate as it is correlated with a firm's ESG score (relevance condition) as industry-wide sustainability initiatives taken by peers pressurize a firm to enhance its adoption of ESG activities (Ioannou and Serafeim, 2012). Moreover, this IV is also unlikely to directly affect the firm's financial performance except through its influence on the firm's own ESG practices (exclusion restriction).

In addition to the main panel data analysis and the 2SLS approach, several preliminary tests and analyses are also conducted. A thorough descriptive analysis of the variables and Pearson's

correlation analysis is conducted to examine the bivariate relationships between the variables and identify potential multicollinearity issues (Wooldridge, 2010). The Variance Inflation Factor (VIF) test is employed to further assess multicollinearity (O'Brien, 2007).

3.3 Model Variables and Specification

The model variables used in this study are described below with the summary presented in Table A in Appendix A.

3.3.1 Independent Variable

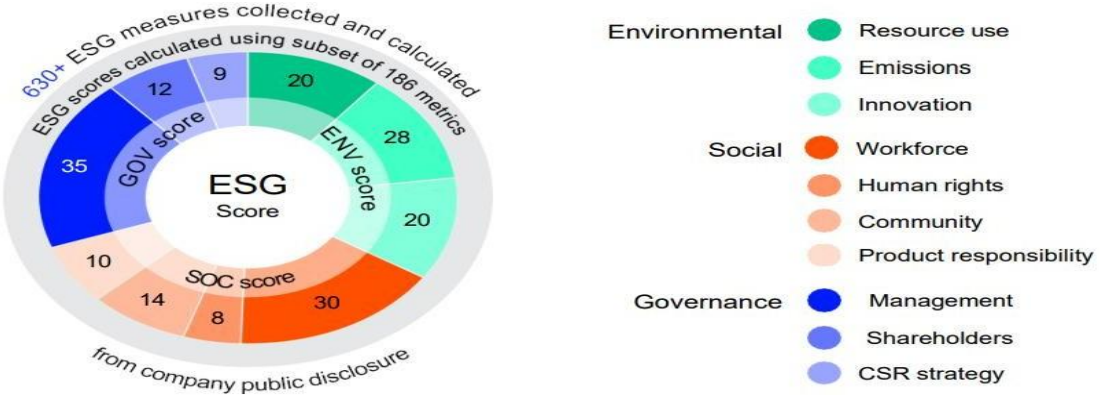
Several variables have been used in empirical literature to measure corporate financial performance including Return on Asset (Long *et al.*, 2020; Chen, Song and Gao, 2023), Tobin's Q (Servaes and Tamayo, 2013; Chang and Lee, 2022), and Earnings Per Share (Akben-Selcuk, 2019). In this study, **Return on Assets (ROA)** has been used as the independent variable and proxy for firm financial performance. It is calculated as net income after tax divided by total assets (Duque-Grisales and Aguilera-Caracuel, 2021). ROA indicates how profitable a firm is and how efficient management is at using its assets to generate earnings.

3.3.2 Dependent Variable

The dependent variable examined in this study is the sustainability performance of corporates and this is measured through the **composite ESG scores** of firms obtained from the Refinitiv LSEG database. The use of ESG scores as a measure of corporate sustainability performance is well-established in the literature (Lins et al., 2017; Duque-Grisales and Aguilera-Caracuel, 2021; Chen, Song and Gao, 2023). Refinitiv's ESG scores are a robust proxy for corporate sustainability performance as they offer a comprehensive and objective view of sustainability performance through the use of publicly available data, minimizing bias from self-reported information (Buchanan, Cao and Chen, 2018).

Figure-3

Components of ESG Score, Source: Refinitiv



The composite ESG score is a weighted aggregation of the scores of three pillars (Environment, Social, and Governance) calculated based on 186 ESG company-level datapoints[5].

The **Environmental Pillar** assesses how responsible a firm is towards the environment and the

[5] The full calculation methodology of the ESG score can be accessed at https://www.lseg.com/content/dam/data- analytics/en_us/documents/methodology/lseg-esg-scores-methodology.pdf

ecosystems by analyzing 68 factors such as carbon emissions, energy efficiency, waste management, water usage, and biodiversity impact. The **Social Pillar** evaluates the extent to which a firm takes into consideration the interests of its wider stakeholders and society to generate trust and goodwill. Finally, the **Governance Pillar** analyzes how capable a company's systems and processes are in ensuring that its board members and executives act in the best interests of its long-term shareholders.

3.3.3 Moderating Variables

Capital intensity has been used as a moderating variable in this study. Capital Intensity refers to the extent to which a firm relies on fixed or real capital in its production process as opposed to labour. There are different measures of capital intensity including total assets by total revenue (Saeed, Alnori and Yaqoob, 2023) and total assets by total employees (Servaes and Tamayo, 2013). However, in this study, capital intensity is measured as the ratio of capital expenditures (CAPEX) to the book value of assets (Buchanan, Cao and Chen, 2018). This measure reflects the level of investment in fixed assets relative to total assets.

3.3.4 Control Variables

It is imperative to control for the non-focal variables in the regression model to mitigate omitted variable bias and spurious relationships (Spector and Brannick, 2011; Carlson and Wu, 2012), enhance the precision of the estimates, and strengthen the overall explanatory power of the model (Atinc, Simmering and Kroll, 2012; Bernerth and Aguinis, 2016). Thus, several control variables have been embedded in the model specifications to account for firm-specific factors that may influence the relationship between ESG performance and financial performance. These include:

(a) Firm Size: The size of a firm is an important determinant of both its financial and sustainability performance (Ramzan, Amin and Abbas, 2020; Wang *et al.*, 2020) as it influences a firm's ability to spend on investment opportunities (Servaes and Tamayo, 2013) and on sustainability initiatives (Chang and Lee, 2022). The most widely used proxy for firm size, and the measure that has been used in this study, is the natural logarithm of total assets (Chijoke-Mgbame *et al.*, 2020; Gupta and Krishnamurti, 2021).

(b) Leverage: Leverage refers to the amount of debt a firm has in its capital structure (Graham and Harvey, 2001; Fama and French, 2002). Leverage directly affects a firm's risk profile (Inoue and Lee, 2011), cost of capital (Bertomeu, Beyer and Dye, 2011), and hence the financial performance (Margaritis and Psillaki, 2010; Ibhagui and Olokoyo, 2018). The degree of leverage also affects the ESG activities of a firm by influencing a firm's stakeholder relationships and risk perceptions (Jo and Harjoto, 2011). In this study, leverage has been calculated as the ratio of total debt to total assets following past empirical studies (Gupta and Krishnamurti, 2021; Chen, Song and Gao, 2023).

(c) Liquidity: Liquidity refers to the ability of firms to meet their short-term obligations with ease. Optimal liquidity influences corporate financial performance by facilitating operational flexibility, allowing firms to capitalize on sudden investment opportunities, and providing a buffer against sudden financial distress (Lazaridis and Tryfonidis, 2006; Dhole, Mishra and Pal, 2019). Similarly, liquidity impacts corporate sustainability performance as well. Firms with higher liquidity may have more financial flexibility to invest in ESG projects, potentially leading to improved ESG performance (Uyar, Abdelqader and Kuzey, 2022). In this study, liquidity has

been proxied by the ratio of current assets to current liabilities following Akben- Selcuk (2019).

(d) Sales Growth: Sales growth is calculated as the year-over-year percentage change in total revenue (Long *et al.*, 2020) and represents the growth potential of firms (Jia, 2020). The higher the growth potential of firms, the more resources it is likely to have at their disposal to invest in business opportunities and ESG initiatives (Chen, Song and Gao, 2023). Consequently, growth can influence both the sustainability and financial performance of firms (Buchanan, Cao and Chen, 2018; Akben-Selcuk, 2019).

(e) Firm Age: Firm age is measured as the difference between the year of incorporation and the last year (2022) of this study's sample period (Jia, 2020). Older firms are more likely to be in the mature stage of their lifecycle and hence often have more established processes, more stable cash flows, and stronger reputations, which can influence both their ESG initiatives and financial performance (Hasan and Habib, 2017). However, an argument can also be made that younger firms might be more flexible and innovative in their approach to sustainability.

(f) Research and Development Intensity: R&D intensity, measured as the ratio of R&D expenditures to total sales, is a crucial control variable in ESG-financial performance studies (Servaes and Tamayo, 2013; Buchanan, Cao and Chen, 2018). R&D intensity captures a firm's commitment to innovation, which can significantly impact both ESG practices and financial performance (Padgett and Galan, 2010; Surroca, Tribó and Waddock, 2010).

3.3.5 Regression Model Specification

Multiple model specifications have been developed and utilized to rigorously test the two hypotheses postulated in this study.

Model 1:

$$ROA_{it}=\beta_0+\beta_1 ESG_{it}+\beta_2 Size_{it}+\beta_3 Lev_{it}+\beta_4 Liq_{it}+\beta_5 Growth_{it}+\beta_6 Age_{it}+\beta_7 R\&DInt_{it}+\alpha_i+\lambda_t+\epsilon_{it} \quad (1)$$

Model 1 is used to investigate the impact of corporate sustainability performance on the financial performance of firms (Hypothesis 1). ROA_{it} is the proxy for financial performance, and ESG_{it} is the proxy for sustainability performance for firm *i* in year *t.* The coefficient β_1 represents the impact of a one-unit change in ESG score on ROA, holding all other variables and fixed effects constant. The coefficients β_2 to β_7 measure the effects of control variables on ROA, ceteris paribus. α_i and λ_t represent the time-invariant year and industry-fixed effects, respectively. They have been included to control for time-invariant factors that might affect the relationship (Duque-Grisales and Aguilera-Caracuel 2021). Finally, the error term ϵ_{it} accounts for unobserved factors that may affect ROA for firm *i* at time *t*.

Model 2:

$$ROA_{it}=\beta_0+\beta_1 ESG_{it}+\beta_2 CI_{it}+\beta_3 ESG_{it}\times CI_{it}+\beta_4 Size_{it}+\beta_5 Lev_{it}+\beta_6 Liq_{it}+\beta_7 Growth_{it}+\beta_8 Age_i+\beta_9 R\&DInt_{it}+\alpha_i+\lambda_t+\epsilon_{it} \quad (2)$$

Model 2 is used to examine the impact of corporate sustainability performance on financial performance, considering the moderating effect of capital intensity (Hypothesis 2). ROA_{it} represents financial performance, and ESG_{it} denotes sustainability performance for firm *i* in year *t*. The coefficient β_1 indicates the effect of a one-unit change in ESG score on ROA when capital intensity is zero, ceteris paribus. β_2 represents the direct effect of capital intensity (CI_{it}) on ROA, while β_3 captures the interaction effect between ESG and capital intensity. Coefficients β_4 through β_9 measure the effects of control variables on ROA. α_i, λ_t, and ϵ_{it} represent the fixed

effects and error term, respectively.

4.0 Results and Analyses

4.1 Descriptive Statistics

The descriptive statistics of the variables examined in this study are reported in Table 2 below.

Table-2

Descriptive Statistics

	Count	Mean	St. Dev	Min	p25	Median	p75	Max
ROA	12424	.0177	.1488	-.6932	-.0009	.0431	.0863	.3057
ESG	12424	43.67	19.77	1.196	27.78	41.28	59.03	93.90
Capital Intensity	12424	.1053	.2139	.00058	.0211	.0394	.0864	1.573
Size	12424	21.90	1.628	18.40	20.76	21.81	22.98	25.92
Liquidity	12424	2.56	2.435	.3954	1.220	1.807	2.865	15.33
Leverage	12424	.5781	.2551	.0831	.4120	.5740	.7202	1.47
Growth	12307	.1426	.4199	-.6363	-.0090	.0703	.1846	2.96
Age	12424	28.18	25.10	1	11	21	34.5	112
R&D Intensity	12362	.3322	1.722	0	0	0	.0791	14.94

Note: Table 2 presents the descriptive statistics of all the variables incorporated in the model specifications of this study. The statistics have been calculated using the winsorized values to mitigate the impact of outliers.

Return on Assets (ROA), the primary dependent variable, has a mean of 0.0177 with a standard deviation of 0.1488. This suggests that, on average, firms in the sample generate a positive ROA, albeit with significant variation. The wide range (-0.6932 to 0.3057) further substantiates the dispersion in the financial performance of the sample constituents, indicating the presence of both highly profitable firms and those experiencing significant losses. The Environmental, Social, and Governance (ESG) score, serving as the independent variable, has a mean of 43.67 with a standard deviation of 19.77. The mean score falls in the second quartile of Refinitiv's score description and represents a satisfactory ESG performance and moderately transparent ESG disclosure[6]. There is substantial variation (ranging from 1.196 to 93.90) in the ESG performance also.

Capital Intensity has a modest mean of 0.1053 with a standard deviation of 0.2139. However, a conclusive remark cannot be made due to the absence of any established benchmark to compare with. Among the control variables, firm size (in natural logarithm) demonstrates a mean of 21.90 with a standard deviation of 1.628, indicating a diverse range of firm sizes in the sample. Liquidity has a mean of 2.56 which is significantly above the thumb-rule benchmark of 2, suggesting that most firms in the sample have sufficient liquidity. This could potentially have contributed to the low mean ROA as there exists a trade-off between liquidity and profitability. Leverage with a mean of 0.5781 indicates that most firms use a considerable amount of debt in their capital structure probably to exploit the tax benefit associated with debt. Both Liquidity and Leverage exhibit considerable variation (St. Dev- 2.44 and 0.26, respectively) suggesting diverse working capital policies and financial structures across the sampled firms. Sales Growth exhibits a positive mean of 0.1426 with a high standard deviation of 0.4199. Firm Age ranges widely from 1 to 112 years, with a mean of 28.18 years and a standard deviation of 25.10,

[6] See table B in Appendix B for full interpretation.

indicating a mix of both young and mature firms in the sample. R&D Intensity displays a notable right-skew, with a mean of 0.3322 and a high standard deviation of 1.722, suggesting that while some firms invest heavily in R&D, many others (as indicated by the median of 0) do not report R&D expenditures.

4.2 Correlation Analysis

4.2.1 Pearson's Correlation Analysis

Pearson's correlation coefficient analysis has been conducted to assess the strength and direction of the bivariate linear relationships between the variables (Woolridge, 2010) and to preliminarily identify potential multicollinearity issues. The results of the analysis are reported in Table 3 below and reveal a statistically significant correlation between almost all pairs of variables except the pairs- Size and Capital Intensity, and Age and Employee productivity. The dependent variable- ROA, exhibits a positive correlation with the independent variable, ESG score ($r = 0.209$) at the 1% significance level. This suggests that firms with higher sustainability performance tend to have better financial performance, providing preliminary support for hypothesis one of this study. Capital intensity is negatively correlated with ROA ($r = -0.053, -0.278$) and this correlation is significant at the 1% level. The negative correlation implies that capital-intensive firms tend to have slightly lower financial performance.

Regarding the control variables, size exhibits the strongest significantly positive correlation with both ROA and ESG scores, indicating that larger firms have better sustainability and financial performance. This relationship may be due to greater resources available for ESG initiatives or increased scrutiny faced by larger firms. Leverage shows a positive correlation with ESG score ($r = 0.201$, $p < 0.01$), while Liquidity is negatively correlated ($r = -0.265$, $p < 0.01$). Firm Age is positively correlated with both ROA ($r = 0.183$, $p < 0.01$) and ESG score ($r = 0.266$, $p < 0.01$), suggesting that more established firms tend to have better financial and ESG performance. This is expected and supports the findings from existing literature. Notably, R&D Intensity shows a strong negative correlation with ROA ($r = -0.511$, $p < 0.01$), which may indicate that firms investing heavily in R&D experience short-term pressure on their financial performance.

Table-3

Pearson's Correlation Table

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) ROA	1.000								
(2) ESG	0.209***	1.000							
(3) Capital Intensity	-0.278***	-0.100***	1.000						
(4) Size	0.303***	0.617***	-0.009	1.000					
(5) Liquidity	-0.236***	-0.265***	0.132***	-0.418***	1.000				
(6) Leverage	-0.024***	0.201***	-0.053***	0.299***	-0.507***	1.000			
(7) Growth	-0.092***	-0.138***	0.071***	-0.140***	0.178***	-0.091***	1.000		
(8) Age	0.183***	0.266***	-0.079***	0.206***	-0.136***	0.028***	-0.122***	1.000	
(9) R&D Intensity	-0.511***	-0.128***	0.467***	-0.236***	0.404***	-0.130***	0.101***	-0.115***	1.000

Note: Table 3 presents the pair-wise bivariate correlation coefficients. The results mostly align with prior expectations and do not contain any extreme values indicative of multicollinearity. ***,**,* represent statistical significance at the 1%, 5%, and 10% level.

4.2.2 Multicollinearity Analysis

Multicollinearity occurs when independent variables in a regression model are highly correlated with each other (Dormann *et al.*, 2013). This can inflate standard errors, reduce the statistical significance of independent variables, and make it difficult to distinguish the individual effects of collinear variables on the dependent variable (Vatcheva *et al.*, 2016).

To assess the multicollinearity, insights from Pearson's Correlation test and the Variance Inflation Factor (VIF) test have been used. According to Pearson's analysis, the correlation coefficient of most pairs is very modest (maximum 0.617) suggesting a low threat of multicollinearity. The VIF test substantiates this by measuring how much the variance of an estimated regression coefficient is increased due to collinearity (O'Brien, 2007). The results of the VIF test conducted on the comprehensive model (incorporating all variables in one model) are shown in Table 4.

Table-4

VIF Test

Variable	VIF	1/VIF
ESG	1.70	0.589
Capital Intensity	1.30	0.768
Size	2.01	0.498
Liquidity	1.71	0.583
Leverage	1.41	0.708
Growth	1.06	0.943
Age	1.08	0.925
R&D Intensity	1.62	0.617
Mean VIF	**1.43**	

Note: Table 4 presents the variance inflation factors of the model variables. The results indicate the absence of any multicollinearity.

The VIF for all the variables ranges between 1.03 to 2.01, with a mean of 1.43. These are considerably less than the widely accepted benchmark of 10 and the conservative benchmark of 5. Moreover, the tolerance values (1/VIF) exceed the commonly used threshold of 0.1. Thus, multicollinearity is not a significant concern for this study.

4.3 Heteroskedasticity Test

A key prerequisite of the OLS regression is the assumption of homoskedasticity- the condition that the variation of the residual term is constant at all levels of the independent variable. A violation of this condition is termed heteroskedasticity and causes biased standard errors (White, 1980). Hence, the Breusch-Pagan/Cook-Weisberg test is conducted to check for heteroskedasticity.

Table-5

Breusch-Pagan/Cook-Weisberg test

	Model 1	Model 2
Chi^2 Test Value	4123.62	4378.52
P-Value	0.0000	0.0000
Null Hypothesis	Rejected	Rejected

Note: Table 5 shows the results of the Breusch-Pagan/Cook-Weisberg test and indicates the presence of heteroskedasticity.

The null hypothesis of this test is that there is homoskedasticity. All the P-values are 0.0000 resulting in a rejection of the null hypothesis at all significance levels. Thus, there is evidence of heteroskedasticity in each of the models. Consequently, the clustered-robust standard errors have been calculated in this study to facilitate valid statistical inference.

4.4 Hausman Test

This test analyses whether the individual-specific effects are uncorrelated with the other regressors in the model to ascertain whether a random or fixed effect model is appropriate in a given context (Hausman, 1978). This is important as incorrect methods can lead to biased estimates and loss of efficiency. The null hypothesis of the Hausman test is that the random effect model is more appropriate whereas the alternative hypothesis advocates for the fixed effect model (Woolridge, 2010).

Table-6

Hausman Test

	Model 1	Model 2
Chi^2 Test Value	64.10	312.29
P-Value	0.0000	0.0000
Null Hypothesis	Rejected	Rejected
Model	Fixed Effect	Fixed Effect

Note: Table 6 reports the results of the Hausman test and indicates that the fixed effect estimation method is appropriate for each of the model specifications developed in this study.

Across both models, the test yields significant Chi-square values (ranging from 64.10 to 312.29) with p-values of 0.0000, leading to a rejection of the null hypothesis at all significance levels. Thus, the fixed effects model is appropriate for all the specifications.

4.5 Regression Analysis

The overarching objective of this paper is to explore whether a relationship exists between sustainability performance and the financial performance of corporate entities. To examine this relationship as well as the moderating effects of capital intensity, a fixed-effect panel regression analysis has been conducted. The results of the regression analysis are presented below in Table 7.

Table-7

Regression Results using Fixed Effect Model

Dependent Variable	**Model 1** ROA	**Model 2** ROA
ESG	0.00034*** (0.0001)	0.00041*** (0.0001)
CI		-0.01411 (0.0232)
ESG × CI		-0.00143*** (0.0006)
Size	0.01671*** (0.0021)	0.01750*** (0.0021)
Liq	0.00270* (0.0014)	0.00277** (0.0014)
Lev	-0.10636*** (0.0146)	-0.10803*** (0.0146)
Growth	0.00118 (0.0051)	0.00157 (0.0050)
R&Dint	-0.03320*** (0.0018)	-0.02976*** (0.0020)
Age	0.00028*** (0.0001)	0.00027*** (0.0001)
Constant	-0.30338*** (0.0427)	-0.31633*** (0.0426)
Observations	12,283	12,283
Number of Firms	1794	1794
Year Fixed Effect	Yes	Yes
Industry Fixed Effect	Yes	Yes
R-Squared	0.3881	0.3935
Adj. R-Squared	0.3844	0.3898
Prob > F	0.0000	0.0000

Note: Table 7 reports the results of the fixed effect regression analysis of the two models developed for the two hypotheses. ROA is the dependent variable and ESG score is the independent variable. Year and Industry -fixed effects have been incorporated in both models. Cluster-robust standard errors are shown in parentheses with clustering done at the firm level. The statistical significance is denoted through asterisks. ***, **, and * represent 1%, 5%, and 10% significance level respectively. The full definition of the variables is mentioned in Appendix A.

4.5.1 Model 1 - The relationship between sustainability performance and firms' financial performance

The results from Model 1 (Table 7, Column 1) provide strong evidence of a positive relationship between corporate sustainability performance (ESG score) and firms' financial performance (ROA). The coefficient for ESG ($\beta_1 = 0.00034$) is positive and statistically significant at the 1% level. This suggests that, on average, a one-unit increase in a firm's ESG score is associated with a 0.034 percentage point increase in ROA, ceteris paribus. While the magnitude of this effect may initially seem small, it is economically meaningful given the scale of operations for large corporations. For instance, considering the mean total asset of
$13.2 billion for Russell 3000 companies in this sample, an increase in ROA of 0.034% translates to an impressive $4.49 million in additional net profits. The R-squared and adjusted R-squared indicate that approximately 38% of the variation in ROA is explained by the model variables. The F-statistic ($p < 0.0001$) confirms the overall significance and fit of the model.

The positive relationship between ESG score and ROA implied through the regression results corroborates prior empirical evidence (Flammer, 2015; Lins, Servaes, and Tamayo, 2017; Chen, Song and Gao, 2023), and aligns with multiple theoretical perspectives. It supports the stakeholder theory that argues that considering the interests of various stakeholders through CSR activities can lead to improved financial performance (Freeman et al., 2010; Chernev and Blair, 2015; Breuer *et al.*, 2018) by enhancing customer loyalty, improving community relations, and lowering costs. Moreover, the results also substantiate the resource-based view (Barney, 1991) positing that CSR initiatives can create unique, valuable resources such as reputational capital and stakeholder relationships, leading to competitive advantages. This enhanced reputation leads to increased sales, better access to finance, and higher profitability (Green and Peloza, 2011; Galbreath and Shum, 2012).

The insights from model 1 also support the 'doing well by doing good' perspective that sustainability initiatives boost financial performance. For managers, this finding suggests that investing in ESG initiatives can yield financial benefits. However, the small magnitude of the effect implies that ESG should be viewed as part of a holistic business strategy rather than a standalone solution for financial performance improvement. Managers should consider integrating ESG initiatives into their core business operations to maximize both financial and social returns.

Overall, hypothesis 1 is supported on the basis of the regression results underscoring a strong economic rationale for engaging in sustainability initiatives.

4.5.2 Model 2 - The moderating role of capital intensity on the relationship between sustainability performance and firms' financial performance

As observed from Table 7 (column 2), the coefficient for ESG ($\beta_1 = 0.00041$, $p < 0.01$) remains positive and significant, supporting the general premise that higher sustainability performance improves financial performance. CI or capital intensity ($\beta_2 = 0.01411$) has a negative, albeit statistically insignificant, relationship with ROA. This substantiates the negative correlation observed through Pearson's analysis and suggests that higher capital intensity might pose challenges to financial performance, possibly due to increased fixed costs and reduced flexibility. The model explains approximately 39% of the variation in ROA (R-Square = 0.3935) and has an overall good fit (Prob>F = 0.0000).

The interaction term ESG × CI ($\beta_3 = -0.00143$) is negative and statistically significant at a 1% level, indicating that capital intensity negatively moderates the relationship between ESG and ROA. Thus, hypothesis 2 is supported by model 2's results. In economic terms, this interaction coefficient suggests that for every one-unit increase in capital intensity, the effect of a one-unit increase in ESG score on ROA decreases by 0.00143.

This negative moderation effect can be explained through several theoretical and empirical lenses. Highly capital-intensive firms may face a trade-off between investing in physical assets and allocating resources to ESG initiatives. This could lead to ESG investments competing with necessary capital expenditures, potentially explaining the observed negative moderation. This provides support to the RBV view (Barney, 1991). Duque-Grisales and Aguilera-Caracuel (2021) demonstrated that financial slack positively moderates the ESG- performance relationship. This implies that capital-intensive firms, often characterized by higher fixed costs and lower financial slack, may struggle to allocate resources effectively towards ESG activities, thereby experiencing a negative moderation effect on their financial performance. Thus, the negative moderation observed also contributes to the slack hypothesis theory.

The findings of model 2 suggest that the nature of a firm's assets plays a crucial role in determining the financial impact of ESG efforts. It aligns with the contingency theory perspective (Donaldson, 2001), which posits that the effectiveness of organizational practices depends on the specific context of the firm. This has important implications for managers of capital-intensive firms. They should be cautious when implementing ESG initiatives and may need to develop tailored strategies that align with their asset structure. This might involve focusing on ESG activities that directly enhance operational efficiency or reduce costs related to their physical assets. For instance, energy-efficient technologies can simultaneously address sustainability goals and improve operational efficiency.

Overall, model 2 challenges the notion that sustainability initiatives uniformly benefit all types of firms. The negative moderating effect observed suggests that highly capital-intensive firms may face unique challenges in translating sustainability efforts into financial benefits.

4.6 Robustness Analysis

4.6.1 Robustness Test using two-stage least squares regression

A two-stage least squares (2SLS) regression analysis has been performed in this study to address potential endogeneity concerns. The average yearly industry ESG score calculated based on the peers of a firm has been used as the instrumental variable based on empirical literature (Cheng, Ioannou and Serafeim, 2014; El Ghoul, Guedhami and Kim, 2015) as it fulfils the relevance,

strength, and exogeneity conditions. An instrumental variable analysis[7] was conducted and it showed strong evidence for the validity of the instrument. The first-stage F-statistic of 1988.64 far exceeds the threshold of 10, indicating a strong instrument. The underidentification test (Anderson LM statistic: 1714.48, $p<0.0001$) confirms the model is identified, and the Cragg-Donald F-statistic (1988.636) surpasses all Stock-Yogo critical values, ruling out weak identification concerns. The results of the 2SLS regression are shown in Table 8.

Table-8

Regression results of the two-stage least squares method

Dependent Variable	**Model 1** ROA	**Model 2** ROA
ESG (IV)	0.0024***	0.0038***
	(0.0005)	(0.0009)
CI		0.5385
		(0.3273)
ESG × CI		-0.0188*
		(0.0109)
Size	0.0008	0.0040
	(0.0043)	(0.0054)
Liq	0.0033**	0.0027
	(0.0015)	(0.0017)
Lev	-0.1098***	-0.1199***
	(0.0146)	(0.0165)
Growth	0.0066	0.0010
	(0.0053)	(0.0075)
R&Dint	-0.0337***	-0.0335***
	(0.0019)	(0.0028)
Age	0.0001	0.0001
	(0.0001)	(0.0001)
Constant	-0.0722	-0.1887
	(0.0781)	(0.1216)
Observations	12,283	12,283
Number of Firms	1794	1794
Year Fixed Effect	Yes	Yes
Industry Fixed Effect	Yes	Yes
R-Squared	0.3502	0.2040
Prob > chi2	0.0000	0.0000

Note: Table 8 reports the second-stage results of the 2SLS regression. The instrumental variable used is the annual industry average ESG score. Clustered standard errors (at the firm level) are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. The first-stage F-statistic is 1988.64, indicating a strong instrument.

The results of the 2SLS regression analysis largely corroborate the findings from the fixed effects models. Model 1 re-confirms the positive relationship between ESG scores and ROA ($\beta_1 = 0.0024$, $p < 0.01$), supporting Hypothesis 1. This effect remains significant even after

[7] See Table C in Appendix C.

controlling for potential endogeneity, suggesting that the positive impact of sustainability performance on financial performance is not caused by reverse causality or omitted variable bias.

Model 2 continues to support Hypothesis 2, with the interaction term ESG × CI (β_3 = -0.0188, p < 0.1) remaining negative and marginally significant at the 10% level. This reinforces the finding that capital intensity negatively moderates the ESG-ROA relationship, albeit with slightly reduced statistical significance.

Overall, the 2SLS results reinforce the robustness of the findings from the fixed effects models, providing stronger evidence for the causal relationship between ESG performance and financial performance, as well as the moderating effects of capital intensity.

4.6.2 Robustness Test using yearly industry-adjusted ROA as the dependent variable

The second robustness test is reported in Table 9. The proxy for the dependent variable has been changed from the firm-specific ROA to the industry-adjusted annual ROA. Such use of industry-adjusted performance measures facilitates control for industry-specific factors that might affect firm performance. Industry-adjusted ROA has been calculated by subtracting the industry median ROA from each firm's ROA for each year. The results in Table 9 are largely consistent with the main findings observed through all the models for our primary fixed-effect analysis.

Table-9

Fixed Effect Regression using Industry-Adjusted ROA

Dependent Variable	**Model 1** ROA_Adj	**Model 2** ROA_Adj
ESG	0.00033***	0.00041***
	(0.0001)	(0.0001)
CI		-0.00076
		(0.0221)
ESG × CI		-0.00148***
		(0.0005)
Size	0.01505***	0.01570***
	(0.0021)	(0.0021)
Liq	0.00407***	0.00412***
	(0.0014)	(0.0014)
Lev	-0.09240***	-0.09391***
	(0.0148)	(0.0148)
Growth	-0.00639	-0.00619
	(0.0047)	(0.0047)
R&Dint	-0.03200***	-0.02930***
	(0.0019)	(0.0021)
Age	0.00026***	0.00026***
	(0.0001)	(0.0001)
Constant	-0.29518***	-0.30693***
	(0.0419)	(0.0420)
Observations	12,283	12,283
Number of Firms	1794	1794
Year Fixed Effect	Yes	Yes
Industry Fixed Effect	Yes	Yes
R-Squared	0.2003	0.2056
Adj. R-Squared	0.1955	0.2007
Prob > F	0.0000	0.0000

Notes: This table reports the results of a fixed effects regression using industry-adjusted ROA as the dependent variable. Clustered standard errors (at the firm level) are reported in parentheses.

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

4.6.3 Robustness Test using one-year lagged ESG score as the independent variable

Table-10

Fixed Effect Regression using lagged ESG Score

Dependent Variable	**Model 1** ROA	**Model 2** ROA
ESG_Lag	0.00030**	0.00037***
	(0.0001)	(0.0001)
CI		-0.02146
		(0.0265)
ESG_Lag × CI		-0.00155**
		(0.0006)
Size	0.01630***	0.01721***
	(0.0022)	(0.0022)
Liq	0.00284*	0.00285*
	(0.0015)	(0.0015)
Lev	-0.10890***	-0.11045***
	(0.0151)	(0.0150)
Growth	0.00643	0.00621
	(0.0056)	(0.0056)
R&Dint	-0.03451***	-0.03064***
	(0.0021)	(0.0022)
Age	0.00023***	0.00023***
	(0.0001)	(0.0001)
Constant	-0.28815***	-0.30272***
	(0.0446)	(0.0447)
Observations	12,283	12,283
Number of Firms	1794	1794
Year Fixed Effect	Yes	Yes
Industry Fixed Effect	Yes	Yes
R-Squared	0.3908	0.3979
Adj. R-Squared	0.3865	0.3935
Prob > F	0.0000	0.0000

Note: Table 10 presents the results of a fixed effects regression using a lagged ESG score as the independent variable. Clustered standard errors (at the firm level) are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

The one-year lagged ESG score has been used as the independent variable instead of the contemporaneous ESG score in this robustness test reported in Table 10. This approach is often used to address potential reverse causality concerns and to account for the possibility that the effects of ESG initiatives may take time to materialize (Waddock and Graves, 1997). The results

remain consistent with our main findings, with lagged ESG scores showing a positive and significant relationship with ROA across both models. A notable change is in Model 1, where the coefficient for lagged ESG ($\beta = 0.00030$, $p < 0.05$) is slightly smaller and less significant compared to the contemporaneous ESG score in our main analysis, though it suggests a potentially diminished effect over time.

Overall, the results of the fixed effect regression models (Table 7) collectively provide evidence for a positive relationship between corporate sustainability performance and financial performance, thus confirming hypothesis 1. Moreover, the analysis identifies that capital intensity negatively moderates this relationship, confirming hypothesis 2. The robustness tests (Table 8-10) prove the consistency of these results across various model specifications, including those addressing potential endogeneity concerns, reinforcing the reliability of the findings.

5.0 Conclusion

With the increasing global emphasis on sustainable business practices in the backdrop, this study set out to investigate the complex relationship between corporate sustainability performance and financial performance, and the moderating the role of capital intensity.

The findings of this study contribute significantly to the debate surrounding the sustainability-performance nexus. First and foremost, the study provides robust evidence supporting a positive relationship between Environmental, Social, and Governance (ESG) performance and Return on Assets (ROA), substantiating the "business case" for sustainability (Epstein and Roy, 2003). This finding aligns with stakeholder theory (Freeman,1984) and the resource-based view (Barney, 1991) of the firm, suggesting that investments in sustainability can create value through improved stakeholder relationships and the development of unique organizational resources.

However, the study's most significant contribution lies in its examination of the moderating factors that influence this relationship. The analysis revealed that the ESG-financial performance link is not uniform across all firms. Capital intensity was found to negatively moderate the ESG-ROA relationship, suggesting that highly capital-intensive firms do not financially benefit from sustainability engagements. This finding aligns with resource allocation perspectives and underscores the potential trade-offs that capital-intensive firms must navigate when investing in ESG initiatives.

The findings of this study have significant implications for theory, practice, and policy. From a theoretical perspective, this study contributes to the ongoing academic discourse on the financial implications of corporate sustainability by providing a more nuanced understanding of the ESG-performance relationship. It supports the second strand of theories (stakeholder supremacy) discussed in the literature review of this paper and weakens the first strand of theories centered on the ‘shareholder primacy’ view. It extends existing theories by demonstrating how firm-specific factors can moderate this relationship and advances theoretical understanding of the conditions under which sustainability efforts are most likely to yield financial benefits.

For practitioners, these findings offer valuable insights for strategy formulation. The overall positive relationship between ESG and financial performance provides a strong rationale for investing in sustainability initiatives. However, the moderating effects uncovered in this study suggest that a one-size-fits-all approach to sustainability is unlikely to be effective. Managers should carefully consider their firm's capital intensity when designing and implementing ESG

strategies. For instance, Capital-intensive firms may need to be particularly selective in their ESG investments, prioritizing initiatives that directly enhance operational efficiency or reduce costs related to their physical assets.

From a policy perspective, the findings of this study highlight the need for more tailored approaches to promoting corporate sustainability. Policymakers should recognize that the challenges and opportunities associated with sustainability initiatives can vary significantly across firm types. For instance, policies aimed at promoting sustainability in capital-intensive industries need to be carefully designed to avoid unintended negative impacts on financial performance. More broadly, these findings suggest that policy interventions should aim to create an environment that enables firms to pursue sustainability in ways that align with their specific characteristics and competitive contexts.

Despite its contributions, this study has several limitations that should be acknowledged. Firstly, while the sample is comprehensive for U.S. firms, it may not capture global variations in the ESG-financial performance relationship. Using panel data featuring firm-year observations across multiple countries could potentially improve this study. Secondly, the study relies on ESG scores as a proxy for sustainability performance. While these scores are widely used and accepted, they may not capture all aspects of a firm's sustainability efforts. Particularly, those that are less easily quantified or reported. Finally, this study focuses on the operating performance using ROA as the primary measure of financial performance. However, ROA can be subject to earnings management. Thus, this study could have incorporated market-based measures such as Tobin's Q or stock returns to offer additional perspectives on the CSR-firm performance nexus.

These limitations, along with the findings of this study, point to several promising avenues for future research. First, more granular analyses of specific ESG components (environmental, social, and governance separately) could reveal whether certain aspects of sustainability are more influential in driving financial performance under different conditions. Second, qualitative studies exploring how firms navigate the challenges identified in this research, particularly in highly capital-intensive contexts, could provide valuable insights for both theory and practice. Third, research into potential non-linear relationships between ESG performance and financial outcomes could further enhance our understanding of this complex relationship.

In conclusion, this study contributes to the understanding of the complex relationship between corporate sustainability and financial performance by highlighting the critical roles of capital intensity. The findings support the notion that sustainability can indeed pay off financially, but they also underscore the importance of considering firm-specific factors in the pursuit of sustainable business practices. As businesses continue to grapple with increasing pressure to be more accountable in today’s dynamic world, understanding these subtleties is crucial for effectively balancing social responsibility with financial performance.

Appendices

Appendix A: Definition of Variables

Table-A
Definition of Variables

Variable	Label	Definition	Reference
Dependent Variable			
Return on Asset	ROA	Net Income After Tax is divided by Total Assets.	Long et al., 2020;
Independent Variable			
ESG Score	ESG	Composite ESG Score from LSEG Refinitiv Database.	Duque-Grisales and Aguilera-Caracuel, 2021;
Moderating Variable			
Capital Intensity	CI	Capital Expenditure is divided by Total Assets.	Buchanan, Cao and Chen, 2018
Control Variables			
Firm Size	Size	Natural logarithm of Total Assets.	Servaes and Tamayo, 2013;
Leverage	Lev	Total Debt is divided by Total Assets.	Buchanan, Cao and Chen, 2018
Liquidity	Liq	Current Assets is divided by Current Liabilities.	Akben-Selcuk, 2019
Sales Growth	Growth	The difference between current years sales revenue and last years sales revenue is divided by last years revenue.	Long et al., 2020; Jia, 2020
Firm Age	Age	The year of incorporation is subtracted from the ending year of the sample period (2022) in this study.	Withisuphakorn and Jiraporn, 2016; Jia, 2020
Research and Development Intensity	R&DInt	Research and Development Expense is divided by sales revenue. Missing R&D expense values are replaced with zero.	Servaes and Tamayo, 2013; Buchanan, Cao and Chen, 2018

Note: Table A shows the definition and label of the variables used in the model specifications of this study.

Appendix B: Refinitiv's ESG score interpretation

Table-B

Refinitiv's ESG score interpretation

Score range	Description	
0 to 25	First Quartile	Scores within this range indicates poor relative ESG performance and insufficient degree of transparency in reporting material ESG data publicly
25 to 50	Second Quartile	Scores within this range indicates satisfactory relative ESG performance and moderate degree of transparency in reporting material ESG data publicly.
50 to 75	Third Quartile	Scores within this range indicates good relative ESG performance and above average degree of transparency in reporting material ESG data publicly.
75 to 100	Fourth Quartile	Score within this range indicates excellent relative ESG performance and high degree of transparency in reporting material ESG data publicly.

Note: Table B shows the interpretations of the ESG score produced by the Refinitiv Database.

Appendix C: Instrumental Variable Analysis

Table-C

Instrumental Variable Analysis

First Stage Regression		
	F Statistics	**P-Value**
	1988.64	0.0000
Underidentification Test		
	Anderson canonical correlation LM statistic	**P-Value**
	1714.48	0.0000
Weak Identification Test		
	Cragg-Donald Wald F statistic	**Stock-Yogo critical values**
	1988.64	10% maximal IV size – 16.38 15% maximal IV size – 8.96 20% maximal IV size – 6.66 25% maximal IV size – 5.53

Note: Table C reports the results of the first-stage regression, underidentification test, and weak identification test performed as a part of the instrumental variable analysis. The results reveal the chosen instrumental variable (annual industry ESG score) to be of good quality that fulfils all the criteria of an appropriate IV.

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