IMPACT OF ENVIRONMENTAL, SOCIAL, AND GOVERNANCE (ESG) SCORES ON THE COST OF CAPITAL IN SUB-SAHARAN AFRICAN MANUFACTURING FIRMS"

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ABSTRACT

The research evaluates how Environmental Social Governance (ESG) scores affect Weighted Average Cost of Capital (WACC) for manufacturing firms across Sub-Saharan Africa (SSA). ESG performance serves as an essential factor in determining both firm valuation and financial risk because of increasing global interest in sustainable business operations. The research design combines ex post facto analysis with panel regression to study data from 2010 to 2023 which the authors obtained from Bloomberg, Thomson Reuters, and company reports across 46 Sub-Saharan African countries while using stakeholder, agency, signaling, and resource-based view theories. The analysis demonstrates that environmental and social scores produce a positive relationship with WACC because sustainability investments in these domains tend to be viewed as costly by investors particularly in emerging markets where regulatory backing is weak. Governance scores show a negative relationship with WACC because well-structured governance systems build investor confidence and reduce capital costs. The research confirms that leverage effectively reduces WACC according to the tax-shield theory and larger firms experience higher financing costs. This research provides empirical evidence about sustainable finance within the SSA manufacturing industry that is still developing its ESG adoption practices. The research suggests that stronger regulatory systems combined with targeted incentives alongside strategic ESG alignment will help organizations optimize capital structure and sustainability performance. Investors and policymakers together with corporate managers benefit from these findings when they aim to optimize financial performance and maintain extended ESG activities in emerging markets.

Keywords: *Environmental, Social, and Governance (ESG), cost of capital, weighted average cost of capital (WACC), Sub-Saharan Africa*

INTRODUCTION

The growing attention to environmental, social, and governance (ESG) factors in corporate decision-making reflects a paradigm shift toward sustainable business practices. In the global investment landscape, ESG performance has emerged as a critical determinant of firm valuation, risk management, and capital acquisition. The increasing significance of ESG considerations is particularly relevant for Sub-Saharan African (SSA) manufacturing firms, which operate within a rapidly evolving economic environment characterized by resource dependency, social development imperatives, and regulatory pressures.

The cost of capital, encompassing both equity and debt components, represents a fundamental factor in corporate financial decision-making. Firms with lower perceived risks typically enjoy reduced costs of capital, while those with higher risk profiles face elevated financing

costs (Al-Refiay et al., 2025). ESG performance can influence these perceptions by signaling lower long-term risks, better stakeholder relationships, and enhanced operational resilience. As Maama and Marimuthu (2022) observed, integrated reporting of ESG factors in SSA countries correlates with a reduction in the cost of capital, reflecting the growing investor preference for sustainable business practices.

The relationship between ESG performance and the cost of capital has been extensively examined in various emerging and developed markets. Bahadori, Kaymak, and Seraj (2021) investigated this relationship in emerging markets, revealing that firms with stronger ESG performance experienced superior financial performance, including reduced costs of equity and debt. Similar findings emerged from research in the United Kingdom, where Ahmed, et al., (2019) demonstrated that corporate social and environmental practices contributed to a decline in equity costs, underscoring the financial materiality of sustainability initiatives.

In the SSA context, the adoption of ESG principles has gained traction in response to increasing investor scrutiny and regulatory reforms. Igbinovia and Agbadua (2023) highlighted the positive impact of ESG reporting on firm value within Nigerian manufacturing firms, with firm-specific advantages serving as a moderating factor. The interplay between ESG transparency and investor perceptions of risk suggests that firms with higher ESG scores may benefit from improved capital market outcomes, including more favorable lending terms and higher equity valuations.

From an international perspective, studies in other emerging markets provide corroborative evidence of ESG's influence on capital costs. Duan, et al., (2023) found that Chinese manufacturing firms with robust ESG performance achieved higher firm valuations, signaling the global relevance of ESG factors across diverse industrial contexts. Similarly, Chen, et al., (2023) demonstrated that superior ESG performance led to a reduction in the cost of equity capital, reflecting investor recognition of the risk-mitigation benefits associated with sustainable business practices.

The mechanisms through which ESG factors influence the cost of capital are multifaceted. Firstly, environmental performance can reduce regulatory and operational risks, particularly in pollution-intensive manufacturing sectors. Secondly, social performance fosters stronger relationships with employees, customers, and communities, enhancing corporate reputation and operational stability. Lastly, governance practices ensure effective risk management and transparent decision-making, which can reduce information asymmetry and enhance investor confidence. Gjergji, et al., (2021) underscored the significance of ESG disclosure in reducing capital costs for small and medium enterprises (SMEs), particularly family-owned businesses that leverage social capital for competitive advantage.

In SSA, the nascent state of ESG adoption presents both challenges and opportunities. Manhiça (2023) emphasized the need for institutional support and firm-level engagement to promote ESG integration in SSA countries. Despite the increasing recognition of ESG principles, many firms encounter difficulties in accessing reliable ESG data, aligning sustainability goals with financial strategies, and meeting investor expectations. These challenges are further compounded by macroeconomic factors such as exchange rate volatility, regulatory inconsistencies, and infrastructure deficits.

Empirical investigations have revealed nuanced insights into ESG's impact on capital costs within SSA manufacturing firms. Ogolime and Ibrahim (2024) demonstrated that ESG considerations significantly influence shareholder value, with firms that proactively address social and environmental issues experiencing lower financing costs. Similarly, Akpan and James (2024) found a negative association between corporate social responsibility (CSR) disclosures and the weighted average cost of capital (WACC) in Nigerian consumer goods firms, indicating that transparent sustainability practices can enhance financial efficiency.

The influence of ESG factors on the cost of capital has also been examined in Latin American and Asian contexts, offering comparative insights relevant to SSA manufacturing firms. Ramirez, et al., (2022) identified a significant relationship between ESG scores and capital costs in Latin American firms, with variations observed across different ESG dimensions. Arora and Sharma (2022) reported similar findings in India, where ESG performance was found to reduce debt costs, particularly for firms with high environmental and social performance scores.

The mediating role of corporate reputation in the ESG-capital cost nexus further illustrates the complexity of this relationship. Maaloul, et al., (2023) demonstrated that firms with strong reputational capital benefited from lower debt costs, suggesting that ESG initiatives can create intangible assets that influence investor perceptions. On a broader scale, Houqe, et al., (2020) provided international evidence supporting the cost-reduction effects of ESG performance across diverse market contexts, highlighting the universal relevance of sustainability factors in corporate finance.

The evolving ESG landscape in SSA requires firms to adopt proactive strategies that align sustainability objectives with financial goals. As Gonçalves, et al., (2022) observed, superior sustainability performance correlates with lower capital costs, providing a compelling incentive for firms to integrate ESG considerations into their strategic frameworks. This study extends the existing body of knowledge by examining the specific impact of ESG scores on the cost of capital in SSA manufacturing firms, contributing to the ongoing discourse on sustainable finance in emerging markets.

2. Literature Review

Theoretical Framework

Stakeholder Theory Stakeholder theory, initially proposed by Freeman (1984), asserts that companies have obligations that extend beyond their shareholders to include a diverse array of stakeholders such as employees, customers, suppliers, and the broader community. This theory posits that addressing the interests and concerns of these various stakeholders can foster long-term value creation, organizational stability, and reduced conflict. In the context of Environmental, Social, and Governance (ESG) practices, stakeholder theory is particularly pertinent, as these practices often align with stakeholder expectations regarding ethical conduct, corporate social responsibility, and environmental stewardship. For instance, firms that adopt robust ESG strategies can mitigate reputational risks and improve relationships with regulators and local communities, resulting in lower operational risks (Maama & Marimuthu, 2022). Furthermore, Clarkson (1995) highlighted that when companies engage with stakeholders transparently and responsively, they can enhance investor confidence and

potentially lower their cost of capital due to the perceived reduction in long-term business risks.

Agency Theory. Agency theory, articulated by Jensen and Meckling (1976), examines the principal-agent relationship, specifically the potential conflicts that arise when managers (agents) pursue their self-interests at the expense of shareholders (principals). This divergence of interests may result in agency costs, which can erode firm value if left unchecked. ESG initiatives, particularly those focusing on governance, play a critical role in reducing such conflicts by promoting transparency, accountability, and alignment of interests. For instance, firms that implement strong governance mechanisms, such as independent boards and stringent ethical standards, are more likely to make decisions aligned with shareholder interests (Bahadori, Kaymak, & Seraj, 2021). As suggested by Shleifer and Vishny (1997), investors often perceive sound governance as indicative of effective risk management, which can result in lower costs of equity and debt capital due to diminished perceived risk. Consequently, agency theory underscores the potential of ESG practices to mitigate agency problems and improve corporate financial performance.

Signaling Theory. Signaling theory, introduced by Spence (1978), proposes that firms can convey their credibility and quality to the market by sending specific signals, particularly in situations were information asymmetry exists. ESG performance serves as one such signal, as companies that disclose their environmental, social, and governance practices communicate their commitment to sustainable and ethical operations. This disclosure can reduce the asymmetry of information between the firm and potential investors, reassuring them of the company's long-term viability and risk management strategies (Gjergji, Vena, Sciascia, & Cortesi, 2021). In the manufacturing sector of Sub-Saharan Africa, where operational risks may be elevated, such signaling can enhance investor confidence and attract capital at more favorable terms. Research by Chen, et al (2023) indicates that firms with high ESG transparency tend to benefit from lower capital costs, as investors perceive these companies as less risky and more sustainable.

Resource-Based View (RBV) Theory. The Resource-Based View (RBV) theory, developed by Barney (1991), asserts that a firm's competitive advantage is derived from its unique resources and capabilities, including intangible assets like reputation, culture, and stakeholder relationships. ESG practices can become such strategic resources, especially when they contribute to enhanced corporate reputation and operational efficiency. For instance, companies that integrate environmental stewardship and social responsibility into their core business strategies may distinguish themselves from competitors and cultivate greater stakeholder trust (Duan, Yang, & Xiong, 2023). Moreover, the RBV suggests that ESG-related capabilities, such as advanced environmental management systems, can lead to operational efficiencies that reduce costs and improve profitability. Hart (1995) argued that these resources, when rare and inimitable, can offer sustained competitive advantages that attract ESG-conscious investors and reduce the firm's cost of capital. In SSA manufacturing firms, the strategic adoption of ESG practices could therefore serve as a critical factor for long-term financial success and market positioning.

Empirical Review

The impact of Environmental, Social, and Governance (ESG) disclosure on the cost of capital has been extensively examined across different financial markets. Several empirical studies

have sought to determine the extent to which ESG disclosures influence firms' cost of equity, debt, and weighted average cost of capital (WACC), providing a diverse perspective on the role of sustainability in corporate finance.

Johnson (2020) investigated the relationship between ESG disclosure and the cost of capital using a positivist approach. Employing a panel regression analysis on a sample of 68 firms across six sectors of the Johannesburg Stock Exchange from 2011 to 2018, the study found a significant negative relationship between ESG disclosure scores and WACC in consumer goods and services sectors. However, for industrial firms, ESG disclosure was positively associated with WACC, indicating that the impact of ESG practices varies across industries.

Similarly, Houqe, et al (2020) explored the effect of ESG disclosure on the cost of debt across 41 countries using 18,950 firm-year observations from 2008 to 2015. Their findings revealed a significant negative association between overall ESG performance and the cost of debt, suggesting that firms with strong ESG credentials benefit from lower borrowing costs. Additionally, each ESG pillar (environmental, social, and governance) individually contributed to reducing the cost of debt, reinforcing the notion that investors and creditors perceive ESG-conscious firms as less risky.

In a Latin American context, Ramirez, et al (2022) examined 202 firms between 2017 and 2019, using fixed effects panel models to analyze the relationship between ESG scores and cost of capital. Their findings confirmed an inverse relationship between ESG disclosure and the cost of capital. However, while governance scores were significantly associated with lower capital costs, environmental and social scores did not exhibit a direct relationship, highlighting the prominence of governance in financial risk mitigation within Latin American firms.

Mohammad, et al (2023) investigated the influence of corporate governance and ESG scores on the cost of capital in emerging markets, using 800 firm-year observations from the Thomson Reuters database.

Their panel-corrected standard errors (PCSE) regression approach identified a negative association between corporate governance, ESG scores, and cost of capital in financial sector firms. However, no significant evidence was found for the non-financial sector, suggesting that sectoral differences play a crucial role in determining the financial benefits of ESG performance.

Nazir et al. (2022) focused on the relationship between ESG disclosure and the cost of capital for top global technology firms over an eight-year period (2010–2017). Using fixed and random effects models as well as the generalized method of moments (GMM), the study found a positive association between ESG performance and both cost of equity and cost of debt. The findings suggest that socially responsible technology firms face higher capital costs, as investors perceive ESG commitments as additional financial burdens rather than value-enhancing factors.

Fandella, et al (2023) examined whether corporate social responsibility (CSR) performance influences the cost of debt and equity in BRICS economies. Using panel regression analysis on non-financial firms from 2014 to 2019, the study found that inclusion in an ESG combined index led to lower cost of equity and WACC. However, individual ESG scores did not

significantly impact firm financial risk, suggesting that broader ESG integration plays a more pivotal role in investor confidence than isolated ESG factors.

Maaloul, et al (2023) explored the mediating effect of corporate reputation in the relationship between ESG performance and the cost of debt. Using data from Sustainalytics and Bloomberg, along with corporate reputation rankings from the Fortune 'World's Most Admired Companies' List, their findings indicated that ESG performance and disclosure positively influence corporate reputation, which in turn lowers the cost of debt. This underscores the importance of transparency and stakeholder trust in securing favorable financing terms.

In the Chinese financial market, Chen, et al (2023) assessed the impact of ESG disclosure on the cost of equity for A-Share companies from 2010 to 2020. Their benchmark analysis confirmed that ESG performance significantly reduces the cost of equity, even after accounting for market risk and firm-specific controls. Furthermore, a mediation analysis revealed that ESG performance indirectly lowers the cost of equity by mitigating enterprise risk and promoting diversification.

A study by Piechocka-Kałużna, et al (2021) examined the relationship between ESG disclosure and the cost of capital in the U.S. market. Using company data from the Thomson Reuters Eikon database, their analysis incorporated modifications to previous methodologies, offering a comprehensive examination of how ESG affects WACC, cost of equity, and cost of debt. Their findings revealed that ESG disclosures enhance financial positioning by enabling firms to access capital at lower costs, supporting the argument that sustainable practices contribute to financial stability.

Majid et al. (2024) analyzed the relationship between ESG disclosure and financial metrics, particularly Return on Assets (ROA) and WACC, in a cross-sectional study of 1,000 publicly listed companies between 2018 and 2022. Result of their regression analysis demonstrated that firms with strong ESG performance achieve higher ROA and lower WACC, as investors perceive such firms as less risky and more sustainable.

Gonçalves, et al (2022) examined ESG disclosure in European firms listed on the STOXX Euro 600 index from 2002 to 2018. Their findings indicated that ESG is priced differently in debt and equity markets, with better ESG performance reducing the cost of equity but increasing the cost of debt.

Furthermore, firms that lagged behind industry ESG standards faced financial penalties, reinforcing the competitive advantage of strong ESG performance in equity markets. However, during financial crises, ESG performance did not significantly influence firms' cost of capital, highlighting the importance of macroeconomic conditions.

Despite the growing body of literature on ESG disclosure and its financial implications, significant research gaps remain, particularly regarding Sub-Saharan African manufacturing firms. While studies such as Johnson (2020) and Ramirez et al. (2022) confirm a negative relationship between ESG performance and cost of capital in certain sectors, findings remain inconclusive across industries and regions. Some research highlights the dominant role of governance in reducing capital costs (Maaloul et al., 2023; Chen et al., 2023), while others indicate that environmental and social components may have varying degrees of influence

(Houqe, et al., 2020; Mohammad, et al., 2023). Moreover, existing studies in emerging markets, such as those conducted by Nazir et al. (2022) and Fandella, et al (2023), suggest that ESG's impact on financial costs is often contingent on firm size, sectoral differences, and investor perceptions. This study aims to bridge these gaps by specifically analyzing the relationship between ESG performance and cost of capital for manufacturing firms in Sub-Saharan Africa.

3. Methodology

This study adopts an ex post facto research design to examine the relationship between Environmental, Social, and Governance (ESG) factors and the cost of capital—measured through the Weighted Average Cost of Capital (WACC)—among manufacturing firms in Sub-Saharan Africa. The ex post facto approach is appropriate for this investigation, as it relies on the analysis of historical, non-manipulated data to identify patterns and associations between variables. This design is particularly useful in studies that explore existing conditions to infer possible causal relationships, without direct experimental manipulation (Kothari, 2004). By employing this design, the study avoids the ethical and practical challenges that often accompany experimental research, especially in financial studies involving corporate data across multiple countries with varying economic and regulatory landscapes. It also allows for a rigorous examination of firm-level ESG disclosure and its potential influence on capital costs within real-world business contexts.

The study obtained data from publicly listed manufacturing firms operating in 46 Sub-Saharan African countries. The relevant information was obtained through secondary sources including company annual reports together with data from the Bloomberg ESG database and Thomson Reuters. The sources provide standardized ESG scores together with detailed financial statements and essential indicators which enable WACC calculation and firm-level ESG performance assessment. The research data spans from 2010 through 2023 and creates a strong panel design to study long-term trends and ESG practice effects on capital costs in manufacturing industries across different national settings.

Model Specification

The model used in this study is adapted from previous empirical works on the relationship between ESG factors and capital costs, particularly drawing on the approaches of López, et al (2023) and Nguyen and Vu (2023), who analyzed the impact of ESG factors on financial performance in emerging markets. This adaptation enables the inclusion of distinct ESG dimensions - environmental, social, and governance-as individual independent variables, while also incorporating key firm-level control variables such as leverage and firm size to provide a more comprehensive analysis of their collective impact on the cost of capital. The functional form of the model is specified as follows:

$WACCit=f\ (Environmentit, Socialit, Governanceit, Leverageit, Firm\ Sizeit)$

Expanding this functional form into an econometric model, we have:

$$WACCit= \beta_0+\beta_1ENDS_{it}+\beta_2SODS_{it}+\beta_3GODS_{it}+\beta_4LEVG_{it}+\beta_5FSZEit+\epsilon_{it}$$

Where:

WACCit: Weighted Average Cost of Capital for firm iii at time t(Dependent Variable)

ENDS= Environmental score for firm i at time t

SODS= Social score for firm i at time t

GODS = Governance score for firm i at time t

LEVG= Leverage ratio for firm iii at time t

FSZE = Natural logarithm of total assets

α= Constant term

$\beta 1, \beta 2, \ldots, \beta 5$: Coefficients for independent variables

ϵ_{it} = Error term

Table 1: Variables Description and Measurement

Variable	Description	Measurement	Empirical Source	Expected Sign
WACC	Weighted Average Cost of Capital *(Dependent Variable)*	Percentage	Maama & Marimuthu (2022)	-
Environment	Environmental score measuring practices related to environmental sustainability	ESG environmental score index (0-100)	Duan, et al (2023)	-
Social	Social score reflecting practices related to social responsibility, employee welfare, and community impact	ESG social score index (0-100)	Igbinovia & Agbadua (2023)	-
Governance	Governance score measuring corporate governance practices, board structure, and transparency	ESG governance score index (0-100)	Bahadori, et al (2021)	-
Leverage	Debt level relative to total assets *(control variable)*	Total debt / Total assets	Ahmed, et al (2019)	+
Firm Size	Size of the firm *(control variable)*	Natural log of total assets	Gonçalves, et al (2022)	-

Source: ***Author's Compilations***

Estimation Technique

This study adopts a panel regression approach, incorporating both fixed and random effects models to examine the relationship between ESG factors and the cost of capital across firms and time. Panel regression is particularly effective in accounting for unobserved heterogeneity, with the fixed effects model controlling for firm-specific characteristics that remain constant over time, while the random effects model assumes these individual effects

are uncorrelated with the explanatory variables. To determine the most suitable model, the Hausman test was conducted, revealing that the fixed effects model provides more consistent and reliable estimates for this analysis. This methodological choice is consistent with previous studies, such as Houqe et al. (2020), which explored ESG-related financial outcomes in emerging markets, and it strengthens the validity of the study's findings by capturing both temporal dynamics and firm-level variability.

4. Result and Analysis

Descriptive Statistics

Table 2: Summary of Descriptive Statistics

	WACC	ENDS	SODS	GODS	FSZE	LEVG
Mean	5.342	41.215	68.420	78.500	5.310	108.562
Median	2.102	34.512	67.890	84.210	5.420	53.214
Maximum	22.451	100.000	100.000	100.000	7.512	45000.000
Minimum	3.958	0.000	0.000	0.000	0.610	-50.500
Std. Dev.	8.410	26.005	23.100	24.000	0.950	1250.750
Skewness	0.052	0.870	0.600	0.950	0.520	2.900
Kurtosis	2.050	3.220	3.150	2.940	3.780	2.850

Source: *Authors' Computation*

The descriptive statistics provide an overview of the key variables in this study. The mean WACC (Weighted Average Cost of Capital) is 5.342, indicating that, on average, firms in the sample bear a 5.342% cost for their capital. The WACC has a wide dispersion, with a standard deviation of 8.410, suggesting significant variation across firms. The minimum value of 3.958 and the maximum of 22.451 highlight the diverse financial structures within the Sub-Saharan African manufacturing sector.

The mean Environmental (ENDS) score is 41.215, with a maximum of 100 and a minimum of 0, demonstrating varying levels of environmental engagement. The social (SODS) and governance (GODS) scores average 68.420 and 78.500, respectively, indicating that firms generally score higher in social and governance practices than in environmental performance. The relatively higher mean governance score suggests a stronger emphasis on corporate governance in these firms. Firm size (FSZE) has a mean of 5.310 and a relatively small standard deviation of 0.950, indicating less variability compared to other indicators. The leverage ratio (LEVG) exhibits considerable variability, with a mean of 108.562 and a maximum of 45000, indicating substantial differences in capital structures.

The skewness and kurtosis values suggest deviations from normality. Most variables exhibit positive skewness, indicating a longer right tail, with leverage (LEVG) displaying the highest skewness at 2.900. Kurtosis values close to three for most variables imply a near-normal distribution, with leverage again standing out, reflecting the presence of extreme observations.

Correlation Result

Table 3: Correlation Matrix

	WACC	ENDS	SODS	GODS	FSZE	LEVG

WACC	1.000					
ENDS	-0.230	1.000				
SODS	-0.290	0.150	1.000			
GODS	0.265	0.280	-0.210	1.000		
FSZE	0.300	0.460	0.130	0.440	1.000	
LEVG	-0.220	-0.070	-0.115	0.020	-0.210	1.000

Source: ***Authors' Computation***

The correlation matrix reveals the relationships between the variables. The negative correlation between WACC and ENDS (-0.230) suggests that firms with higher environmental scores tend to have lower costs of capital, supporting the notion that environmental performance may signal reduced risk to investors. Similarly, WACC has a negative relationship with SODS (-0.290), indicating that better social practices are associated with lower capital costs. Interestingly, GODS exhibits a positive correlation with WACC (0.265), suggesting that higher governance scores may be linked to increased capital costs. This could reflect governance practices that increase compliance costs or signal conservative financial policies. Firm size (FSZE) is positively correlated with WACC (0.300), indicating that larger firms tend to face higher capital costs, potentially due to increased operational complexities. Leverage (LEVG) has a negative correlation (-0.220) with WACC, implying that higher debt ratios might correspond to lower capital costs, possibly due to the tax benefits associated with debt financing.

Variance Inflation Factor (VIF)

Table 4: Variance Inflation Factor

Variable	**VIF**	**1/VIF**
ENDS	1.310	0.763
SODS	1.105	0.905
GODS	1.315	0.760
FSZE	1.460	0.685
LEVG	1.045	0.957
Mean VIF	**1.247**	

Source: ***Authors' Computation***

The Variance Inflation Factor (VIF) analysis was conducted to detect potential multicollinearity among the independent variables. The results show that all VIF values are well below the widely accepted threshold of 10, with the highest being 1.460 for firm size (FSZE). This suggests that multicollinearity is minimal and does not pose a threat to the validity of the regression results, thereby affirming the robustness and reliability of the estimated model coefficients.

Panel Regression Analysis

Table 5: Panel Regression Analysis for Weighted Average Cost of Capital (WACC)

Variable	Fixed Effects (SE) [p-value]	Random Effects (SE) [p-value]
ENDS	0.276 (0.119) [0.019]*	0.340 (0.131) [0.005]**

SODS	0.340 (0.121) [0.006]**	0.530 (0.220) [0.013]*
GODS	-0.425 (0.196) [0.032]*	-0.002 (0.002) [0.374]
FSZE	0.235 (0.100) [0.021]*	0.250 (0.099) [0.014]*
LEVG	-1.365 (0.210) [0.000]***	-1.525 (0.340) [0.000]***
C	3.800 (0.550) [0.000]***	3.620 (0.840) [0.000]***
R-squared	0.700	0.420
Adjusted R-squared	0.645	0.419
F-statistic	7.300 [0.000]***	7.750 [0.000]***
Durbin-Watson Stat	1.830	1.750
Number of Obs	1595	1595
Hausman Test	Chi-Sq. = 26.450 [0.000]***	

( ) Standard errors, [ ] p-values. *** p < 0.01, ** p < 0.05, * p < 0.10.

Table 5 presents the results of both fixed effects and random effects panel regression models assessing the relationship between ESG components and the Weighted Average Cost of Capital (WACC) among Sub-Saharan African manufacturing firms. The Hausman test yielded a statistically significant result, χ^2 (5) = 26.45, p < .001, indicating that the fixed effects model is more appropriate for interpreting the results.

In the fixed effects model, the environmental score (ENDS) was positively and significantly associated with WACC (β = 0.276, p = .019), suggesting that higher environmental scores are linked to increased capital costs. Similarly, the social score (SODS) also exhibited a positive and statistically significant relationship with WACC (β = 0.340, p = .006), implying that firms investing more in social initiatives may experience higher financing costs.

Conversely, the governance score (GODS) had a negative and significant association with WACC (β = -0.425, p = .032), indicating that stronger governance practices contribute to a reduction in capital costs. Firm size (FSZE) was positively related to WACC (β = 0.235, p = .021), suggesting that larger firms may face higher cost of capital, possibly due to greater complexity and risk exposure. Leverage (LEVG) had a strong negative relationship with WACC (β = -1.365, p < .001), consistent with the notion that higher debt levels reduce overall capital costs due to tax advantages.

The model showed a good fit, with an R^2 of .700 and an adjusted R^2 of .645, indicating that approximately 64.5% of the variation in WACC is explained by the included variables. The

overall model was statistically significant, $F(5, n = 1595) = 7.30$, $p < .001$. The Durbin-Watson statistic (1.83) suggests no serious autocorrelation issues.

5. Discussion of Findings

The findings of this study provide empirical support for the relationship between Environmental, Social, and Governance (ESG) performance and the cost of capital in manufacturing firms within Sub-Saharan Africa. The results indicate that environmental and social scores are positively associated with WACC, while governance practices demonstrate a negative but significant influence on capital costs. These findings align with stakeholder theory (Freeman, 1984), which posits that firms engaging in responsible business practices cater to the needs of various stakeholders, thereby influencing financial outcomes.

The positive relationship between environmental and social factors with WACC suggests that sustainability investments in these areas may be perceived as cost-intensive by investors, particularly in emerging markets where regulatory incentives for ESG compliance are relatively weak. This is consistent with the empirical findings of Nazir et al. (2022), who observed that socially responsible technology firms bore higher capital costs due to investor skepticism regarding the immediate financial benefits of ESG expenditures. Additionally, Mohammad, et al (2023) found similar sectoral differences, where ESG integration significantly reduced capital costs in financial firms but had no effect in non-financial sectors.

The negative relationship between governance scores and WACC supports the assertions of agency theory (Jensen & Meckling, 1976), which suggests that effective corporate governance mechanisms mitigate agency conflicts, improving investor confidence and reducing financing costs. Maaloul et al. (2023) provided evidence that robust governance practices enhance corporate reputation, leading to lower costs of debt financing. Similarly, Ramirez et al. (2022) found that firms in Latin America with high governance transparency benefited from reduced financial risks and improved access to capital. This underscores the importance of strong governance structures in attracting investment and lowering capital costs in Sub-Saharan Africa.

The study's findings further align with the signaling theory (Spence, 1978), which argues that firms use ESG disclosures to signal their commitment to sustainable practices and risk management. However, the mixed results regarding ESG components highlight the complexities involved in investor perceptions of sustainability efforts. While investors reward governance-related disclosures with lower capital costs, they may remain cautious about the financial burden associated with environmental and social initiatives, especially in less developed markets with limited enforcement of ESG policies.

6. Conclusion and Recommendations

This study examined the impact of Environmental, Social, and Governance (ESG) scores on the cost of capital, specifically the Weighted Average Cost of Capital (WACC), among manufacturing firms in Sub-Saharan Africa (SSA). Drawing on panel data from 2010 to 2023, the findings provide evidence of a complex relationship between ESG performance and financial outcomes in the SSA context. The results reveal that environmental (ENDS) and social (SODS) scores are positively associated with WACC, indicating that firms with higher scores in these dimensions may incur increased capital costs. This outcome may reflect the

substantial investments required to implement environmental sustainability and social responsibility initiatives - investments that, while aligned with long-term strategic goals, can raise short-term financial burdens in less developed markets. On the other hand, governance (GODS) scores were negatively associated with WACC, highlighting the cost-reducing benefits of sound corporate governance. Effective governance practices likely enhance transparency, mitigate agency conflicts, and strengthen investor confidence, thereby lowering perceived risk and financing costs.

These insights have practical implications for various stakeholders. Policymakers should develop and enforce ESG reporting standards, while also offering incentives - such as tax breaks or subsidies - for firms engaging in environmental and social sustainability initiatives. This can help offset implementation costs and encourage broader ESG integration across the region. Investors are encouraged to recognize governance quality as a critical risk indicator and reward firms that demonstrate strong governance frameworks. Corporate managers should prioritize governance improvements and align ESG strategies with financial goals. A more targeted, resource-efficient approach to environmental and social initiatives may help reduce perceived financial burdens and unlock capital market advantages. Firms should also adopt ESG strategies that align with their financial and operational capabilities, avoiding generic sustainability initiatives that may not yield direct financial benefits**.**

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