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Utilising Environmental Social Governance Rating for Predicting Financial Risk: FTSE 100

Finansal Riski Öngörmede Çevresel, Sosyal ve Yönetişim Derecelendirmesinin Kullanımı: FTSE 100 Örneği

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ABSTRACT

The focus of this research is on evaluating the ESG ratings of various FTSE 100 companies and their impact on financial risk. The study aims to analyze how ESG ratings affect the financial risk of FTSE 100 companies and to reveal the impact of profitability and liquidity on ESG ratings. Therefore, we examine the relationship between ESG ratings (Environmental, Social, and Governance) and financial risk for FTSE 100 companies. ESG factors are increasingly recognized as indicators of a company's ability to sustain itself and its financial performance. The utilization of ESG rating data offers several potential benefits, including providing investors and analysts with insights to evaluate companies' long-term sustainability and resilience. The study aims to reveal the connection between ESG ratings and financial risk, as well as investigate the influence of profitability and liquidity on ESG ratings. The research utilizes quantitative methodologies, including regression analysis and panel unit root tests, to analyze the data collected from FTSE 100 companies. The findings suggest a positive association between higher ESG ratings and better financial health, as well as a positive impact of profitability on ESG ratings. However, liquidity metrics do not significantly affect ESG ratings.

Anahtar Kelimeler
ESG Derecelendirmeleri, Finansal Risk, Kârlılık, Likidite, FTSE 100

ÖZ

Bu araştırmanın odak noktası, çeşitli FTSE 100 şirketlerinin ESG derecelendirmelerinin değerlendirilmesi ve finansal risk üzerindeki etkileridir. Çalışmanın amaçları, ESG derecelendirmelerinin FTSE 100 şirketlerinin finansal riskini nasıl etkilediğini analiz etmek ve kârlılık ve likiditenin ESG derecelendirmeleri üzerindeki etkisini ortaya koymaktır. Bu nedenle, FTSE 100 şirketleri özelinde (Çevresel, Sosyal ve Yönetişim) ESG derecelendirmeleri ile finansal risk arasındaki ilişki incelenmektedir. ESG faktörleri, bir şirketin sürdürülebilirliğini ve finansal performansını devam ettirme kapasitesinin göstergeleri olarak giderek daha fazla kabul görmektedir. ESG derecelendirme verilerinin kullanımı, yatırımcılara ve analistlere şirketlerin uzun vadeli sürdürülebilirlik ve dayanıklılıklarını değerlendirmede çeşitli faydalar sunmaktadır. Bu çalışmanın amacı, ESG derecelendirmeleri ile finansal risk arasındaki ilişkiyi ortaya koymak ve kârlılık ile likiditenin ESG derecelendirmeleri üzerindeki etkisini araştırmaktır. Araştırmada, FTSE 100 şirketlerinden elde edilen veriler, regresyon analizi ve panel birim kök testleri gibi nicel yöntemler kullanılarak analiz edilmiştir. Bulgular, yüksek ESG derecelendirmeleri ile daha iyi finansal sağlık arasında pozitif bir ilişki olduğunu ve kârlılığın ESG derecelendirmeleri üzerinde olumlu bir etkisi bulunduğunu göstermektedir. Ancak, likidite ölçütlerinin ESG derecelendirmeleri üzerinde anlamlı bir etkisi bulunmamıştır.

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1. Introduction

Environmental, Social, and Governance (ESG) factor analysis is an approach that integrates non-financial performance indicators related to environmental stewardship, social responsibility, and corporate governance into the evaluation of a company's sustainability and long-term value (Ahmad et al., 2021; Singhania and Saini, 2023). In financial research, ESG factor analysis is used to assess the risks and opportunities that companies face beyond traditional financial metrics, providing a more comprehensive understanding of their operational impact and potential for long-term performance.

ESG factor analysis is grounded in stakeholder theory, which posits that a firm's success is not solely dependent on its financial stakeholders (e.g., shareholders), but also on its ability to address the concerns of a broader range of stakeholders, including employees, customers, governments, and the environment (Freeman, 2010). By addressing these concerns, companies can achieve sustained competitive advantage, reduce operational risks, and create value over the long term.

ESG ratings assess a company's performance across three key areas: environmental sustainability, social responsibility, and corporate governance. These ratings are based on a combination of qualitative and quantitative data, such as a company's carbon footprint, labor practices, and board structure. By evaluating these factors, ESG ratings provide insights into a company's ethical and sustainability practices, as well as its long-term risk management strategies (Zhanbayev et al., 2023). The growing reliance on ESG ratings reflects a shift in the financial sector, where non-financial factors are increasingly viewed as essential indicators of a company's long-term resilience and viability.

Environmental factors, including climate change, depletion of natural resources, and pollution, can lead to both direct and indirect financial consequences for companies (Shakil, 2021; Liu et al., 2024). For instance, the implementation of more rigorous environmental regulations can result in escalated expenses related to compliance and the possibility of financial penalties, thereby exerting adverse effects on a company's profitability. Similarly, companies that heavily depend on natural resources may face supply chain disruptions or price volatility, affecting their operational efficiency and financial stability (Guan et al., 2021).

Social factors, such as labor practices, human rights, and community relations, can likewise affect a company's financial risk. Insufficient labor practices or transgressions against human rights can give rise to detrimental consequences such as reputational damage, legal disputes, and potential consumer boycotts. These outcomes have the capacity to erode a company's brand equity and market position (Suciu et al., 2020; Suganda and Kim, 2023). Additionally, companies with weak community relations may face resistance to their operations, leading to delays or cancellations of projects, thus affecting their revenue streams and profitability (Yuan et al., 2022).

The assessment of governance factors encompasses the evaluation of an organization's management, board structure, and internal controls, with the aim of evaluating their quality and effectiveness (Singh and Pillai, 2022). Weak governance practices, such as inadequate transparency, ineffective risk management, or instances of conflicts of interest, can diminish investor confidence and heighten the likelihood of financial improprieties or mismanagement. These governance deficiencies can lead to substantial financial setbacks and tarnish a company's reputation (Zaman et al., 2022).

Quantitative data employed in ESG rating methodologies encompass various metrics, including greenhouse gas emissions, energy usage, waste production, employee turnover rates, and the diversity of the board of directors. These data points are often collected from public disclosures, regulatory filings, and company reports (Berg et al., 2020). Qualitative data, on the other hand, involves the assessment of company policies, practices, and management systems through questionnaires, surveys, and interviews (Peixoto et al., 2022). These qualitative assessments aim to capture the quality and efficiency of a business's ESG practices and corporate governance structure. The integration of both quantitative and qualitative data enables rating agencies to generate comprehensive ESG ratings that reflect the overall risk profile and sustainability of a company.

The utilization of ESG rating data for predicting financial risk offers several potential benefits. Initially, it gives investors and analysts with extra insights to evaluate companies' long-term sustainability and resilience. Through ESG factor analysis, investors can gather perspectives on a company's capacity to navigate environmental and social challenges, respond to regulatory shifts, and uphold robust governance standards (Tarigan et al., 2021; Singhania and Saini, 2023; Cao and Whyte, 2023). This comprehensive assessment of a company's risk landscape can elevate investment decision-making and facilitate more informed portfolio management strategies.

Furthermore, the utilization of ESG rating data can aid in the recognition of prospective hazards and prospects that may avoid exposure through traditional financial measures. By incorporating ESG factors into risk assessment models, analysts can uncover hidden vulnerabilities or strengths within a company's operations and supply chains (Tickner et al., 2021; Tarigan et al., 2021; Care, 2023). For instance, companies with robust environmental management practices may be more adept at mitigating climate-related risks, whereas those with strong labor practices may experience heightened employee productivity and reduced turnover rates.

In this research, the Financial Times Stock Exchange 100 (FTSE 100) is a key benchmark for understanding the relationship between ESG ratings and financial risk. The FTSE 100, provided by the London Stock Exchange (LSE), comprises the 100 largest companies by market capitalization listed on the LSE. As a leading index, the FTSE 100 reflects the financial performance of the largest UK-based companies, spanning multiple sectors such as energy, finance, consumer goods, and technology. Its composition includes globally recognized corporations with significant economic influence by making the FTSE 100 an important indicator of both the UK's economic health and the global corporate landscape (Ahmad et al., 2021; Rompotis, 2022). In the financial literature, the FTSE 100 serves as a reference point for studies examining corporate governance, sustainability, and risk management due to the size, visibility, and influence of its constituent companies (Ceesay et al., 2021; Owadally et al., 2021; Rompotis, 2022).

FTSE 100 companies are subject to substantial investor scrutiny, regulatory oversight, and media attention. This makes it ideal target for exploring the relationship between ESG ratings and financial risk (Berg et al., 2022; Zaman et al., 2022). The large market capitalizations and global operations of these companies mean that they are both highly exposed to ESG-related risks and under constant pressure to demonstrate strong ESG performance. As a result, its prominence in the financial sector, understanding the role of ESG ratings in the FTSE 100 provides valuable insights into how large, publicly traded companies manage long-term risks and opportunities related to ESG factors.

The primary objective of this research is to reveal the association between ESG ratings and financial risk within (FTSE 100) companies. Despite a growing body of literature investigating the association between ESG performance and financial results (Suciu et al., 2020; Capelli et al., 2021; Shakil, 2021; D'Amato et al., 2022), there exists a significant gap in understanding the specific link between ESG ratings and financial risk within the FTSE 100 framework. Many studies have explored into the broader association between ESG factors and financial performance, often discovering positive correlations between higher ESG ratings and improved financial outcomes (Giese et al., 2019; Atz et al., 2020; Kim and Lee, 2021). However, the precise impact of ESG ratings on financial risk, particularly within the FTSE 100 context, remains less explored.

Recent studies have primarily concentrated on the overall association between financial performance and (Atz et al., 2020; D'Amato et al., 2022; Suganda and Kim, 2023; Liu et al., 2024) ESG ratings, without adequately disaggregating the specific contributions of profitability and liquidity to ESG performance within the FTSE 100 context. Understanding how these financial metrics influence ESG ratings is crucial for investors seeking to identify the key drivers of ESG performance in large-cap companies.

The research questions are presented as follows based on the above discussions.

RQ1: What kind of connection exists between the ESG ratings and financial risk within FTSE 100?

RQ2: How do profitability and liquidity affect ESG rating in the FTSE 100?

This research aims to bridge the gap by utilizing a quantitative methodology to analyse the connection between ESG ratings and financial risk within FTSE 100 companies. Additionally, it will explore the direct and indirect impacts of profitability and liquidity on ESG ratings, while controlling for other relevant factors such as company size.

By filling these gaps in the literature, researchers can provide valuable insights into the mechanisms underlying the relationship between ESG ratings, financial risk, profitability, and liquidity within the FTSE 100 context, thus informing investment decisions and corporate strategies aimed at sustainable value creation.

2. Literature Review

Automation ESG rating data pertains to the systematic gathering and examination of pertinent information concerning a corporation's environmental, social, and governance practices (Liu et al., 2024). ESG ratings are typically assigned by specialized rating agencies or data providers, who evaluate companies based on predetermined criteria. These criteria can vary among agencies but generally include factors such as greenhouse

gas emissions, waste management, workforce policies, diversity in leadership, executive compensation, and transparency in operations (Berg et al., 2020).

The significance of ESG rating data extends beyond merely assessing corporate practices. It offers essential insights regarding the sustainability and long-term viability of corporations. Numerous studies have highlighted a strong correlation between robust ESG ratings and improved financial performance. For instance, Zhao et al. (2018) provide empirical evidence from China's power generation sector, suggesting that superior ESG performance can enhance financial outcomes. Additionally, Kraussl et al. (2023) find that investors who integrate ESG considerations into their decision-making processes tend to achieve better financial results.

Beyond its impact on financial performance, ESG rating data plays a crucial role in risk management. Gorzen-Mitka (2023) emphasizes the importance of integrating ESG factors into investment decisions for effective risk assessment and management. Hubel and Scholz (2019) further support this by demonstrating how ESG risk factors can improve asset pricing models, suggesting that strategic management of ESG risks can lead to enhanced risk-adjusted returns and greater portfolio resilience.

In a related line, Dunn et al. (2018) present empirical evidence showing that stocks with inadequate ESG exposures often exhibit higher volatility and betas. This highlights the predictive power of ESG scores in forecasting risk levels. By incorporating ESG considerations into risk management frameworks, investors can better anticipate and mitigate financial risks while identifying opportunities aligned with sustainable business practices.

Atz et al. (2020) finds a correlation between financial performance and ESG ratings, aligning with earlier research by Kumar et al. (2016), which observed that high ESG-rated companies have lower stock volatility and higher returns. Filbeck et al. (2019) reinforces this argument by demonstrating that firms with higher ESG ratings outperform the S&P 500 index, particularly in governance and social dimensions. Their findings suggest that ESG integration, rather than merely screening or divestment, is more effective for achieving superior financial performance.

However, the study by Do and Kim (2020) presents a contrasting perspective. Their research indicates that while changes in ESG ratings can have short-term positive effects on stock returns, these effects tend to diminish over time. This suggests that market dynamics and investor sentiment may influence the long-term relationship between ESG ratings and financial performance. The short-term gains observed might be driven more by market reactions to ESG changes rather than sustainable improvements in company performance.

Engelhardt et al. (2021) support the view that high ESG-rated European firms are associated with higher abnormal returns and lower stock volatility, with social scores playing a crucial role. Conversely, Demers et al. (2020) did not find significant explanatory power of ESG scores on stock returns during the same period. Broadstock et al. (2020) highlight ESG performance's potential to mitigate financial risk during the COVID-19 pandemic in China, further emphasizing the context-dependent nature of ESG impacts.

These differing findings emphasize the importance of considering geographical and contextual variations. Engelhardt et al. (2021) focus on high ESG-rated European firms, while Demers et al. (2020) analyze a broader sample. Broadstock et al. (2020) explores the Chinese market, which may exhibit unique dynamics compared to other regions. Such variations could be attributed to differences in sample composition, methodologies, and data sources used in each study.

Additionally, the measurement and interpretation of ESG ratings play a significant role. Variations in ESG rating criteria among agencies can lead to discrepancies in how ESG characteristics are assessed, impacting financial performance outcomes. To fully understand these complexities, it is crucial to account for the specific ESG rating agencies and methodologies employed in each study.

Supporting the positive relationship between high ESG ratings and financial performance, Ahmad et al. (2021) find that high ESG-rated firms in the UK outperform their peers. Similarly, Chininga et al. (2023) observe comparable results in South Africa. These studies suggest that the positive correlation between high ESG ratings and financial success is not confined to specific regions. Bag and Mohanty (2021) further expand on this by examining the impact of changes in ESG ratings on stock performance within the S&P 100, highlighting the significance of ESG ratings as predictors of financial success. Aybars et al. (2019) also report a positive relationship between ESG scores and operating performance for S&P 500 firms, indicating that firms with strong ESG practices exhibit better overall business performance.

In contrast, Landi and Sciarelli (2019) found no significant impact on abnormal returns for Italian firms, suggesting that ESG initiatives may not directly influence stock prices in the Italian market. This does not necessarily imply an absence of correlation but may reflect specific market conditions or characteristics. Conversely, Lo and Kwan (2017) report a positive market response to ESG initiatives in Hong Kong, indicating that ESG performance can positively affect stock prices in that region. Zhou et al. (2022) corroborate the positive association between ESG ratings and market value, highlighting the mediating role of financial performance.

The examination of the intricate dynamics between ESG ratings and stock prices requires careful consideration. Latino and Pelizzon (2021) suggest that changes in ESG ratings can create price pressure and alter stock ownership, reflecting the market's response to new ESG-related information. Pedersen et al. (2021) introduce the ESG-efficient frontier framework, which illustrates the trade-offs between ethical investing and financial performance, showing that responsible investing can be achieved with minimal financial sacrifice. Their ESG-adjusted CAPM further accounts for varying investor preferences towards ESG factors by highlighting the complex interaction between ESG criteria and financial returns.

Cesarone et al. (2022) explores the effects of integrating ESG criteria into portfolio management, using a multi-objective optimization model. They find that incorporating ESG factors can yield different results depending on the market, with US markets benefiting more from higher ESG targets compared to European markets. Cerqueti et al. (2021) investigate the impact of portfolio liquidation on funds with varying ESG ratings and find that high ESG-rated funds experience less market value loss during low volatility periods, though the advantage diminishes in high-volatility environments.

Billio et al. (2021) reveal that inconsistencies in ESG rating criteria among agencies result in significant variations in ESG assessments, affecting the measurement of fund managers' performance. Such discrepancies can undermine the effectiveness of ESG ratings in guiding investment decisions. Wang et al. (2024) examine the impact of ESG rating discrepancies on the Chinese stock market, finding that disagreements among ratings agencies reduce stock returns, particularly for non-state-owned enterprises. They suggest that improving consistency and transparency in ESG ratings could enhance investor confidence and market stability.

Lastly, Vivel-Bua et al. (2023) study the impact of ESG factors on default risk across non-financial firms in the Eurozone, finding that high ESG scores reduce default risk for smaller and medium-sized firms, while larger firms may face increased risk. Bonacorsi et al. (2024) use Supervised Machine Learning techniques to analyze the relationship between credit risk and ESG dimensions in European companies by showing that incorporating ESG factors alongside traditional financial ratios improves the prediction of default probability. This approach highlights the potential for ESG factors to enhance risk evaluation, though the focus on European firms and data quality may limit broader applicability.energy.

3. Methodology

Automation The data for this study was collected from the FTSE 100 for the period spanning from 2020 to 2023. The FTSE 100 encompasses a diverse range of sectors within the United Kingdom, including but not limited to finance, energy, healthcare, and technology. The choice of the FTSE 100 companies as the data source for this study ensures a diverse representation of industries and provides a comprehensive dataset for analysis.

The primary objective of the research is to investigate the relationship between financial risk and ESG ratings in the FTSE 100 businesses. The dependent and independent variables are therefore chosen, as indicated in Table 1.

Table 1 presents the dependent and independent variables lists and sources for research question 1.

Table 1: Variable lists and sources for research question 1

Variables used for RQ1	***Measure***	***Source***
Dependent Variable		
Z-Score	Finbox database was used based on the below methodology. Non-Financial Institution: $Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5$ Financial Institution: $Z'' = 6.56A_1 + 3.26A_2 + 6.72A_3 + 1.05A_4 + 3.25$	www.finbox.com

Independent Variables		
ESG Score	Morningstar database was used.	www.morningstar.com
Asset Growth Rate	$\frac{\text{Total Assets at the end} - \text{Total Assets at the begining}}{\text{Total Assets at the begining}}$	Annual Reports
Return on Equity (ROE)	$\frac{\text{Net Income}}{\text{Average Shareholder's Equity}}$	Annual Reports
Size	Ln (Total Assets)	Annual Reports
Current Ratio	$\frac{\text{Current Assets}}{\text{Current Liabilities}}$	Annual Reports
Quick Ratio	$\frac{\text{Current Assets} - \text{Invetory}}{\text{Current Liabilities}}$	Annual Reports

Another aim of the study is to reveal the impact of profitability and liquidity on the ESG rating. Table 2 presents the variable lists and source data.

Table 2: Variable lists and sources for research question 2

Variables used for RQ2	***Measure***	***Source***
Dependent Variable		
ESG Score	Morningstar database (sustainalytics) was used.	www.sustainalytics.com
Independent Variables		
Asset Growth Rate	$\frac{\text{Total Assets at the end} - \text{Total Assets at the begining}}{\text{Total Assets at the begining}}$	Annual Reports
Return on Equity (ROE)	$\frac{\text{Net Income}}{\text{Average Shareholder's Equity}}$	Annual Reports
Size	Ln (Total Assets)	Annual Reports
Current Ratio	$\frac{\text{Current Assets}}{\text{Current Liabilities}}$	Annual Reports
Quick Ratio	$\frac{\text{Current Assets} - \text{Invetory}}{\text{Current Liabilities}}$	Annual Reports

The choice of databases and reports ensures that the financial and ESG data is accurate, consistent, and relevant for FTSE 100 companies. Finbox for the Z-Score calculation provides detailed financial data and advanced analytical tools, ensuring accurate risk assessment for financial and non-financial firms. Morningstar (Sustainalytics) for ESG scores is a reputable provider with a consistent methodology that is widely used in the industry. Annual Reports are primary sources of financial data, audited and verified, offering the most accurate reflection of a company's financial performance.

While other methods and data sources were considered, the variables and sources chosen were based on their robustness, relevance to the research question, and widespread acceptance in both academic and professional practice. For example, credit ratings or default probability models could have been used to assess financial risk, but these would not provide the same granularity as the Z-Score. Similarly, while other ESG data providers exist, Morningstar was selected for its focus on transparency and thoroughness in ESG evaluation.

3.1 Theoretical Foundations of Variables Selection

The selection of dependent and independent variables in Table 1 and Table 2 is grounded in well-established theoretical frameworks from finance, sustainability, and risk management.

The dependent variable, the Z-Score, is based on Altman's Z-Score model (Altman, 1968), a widely accepted financial distress prediction model. The Z-Score assesses the likelihood of a firm's bankruptcy by combining several financial ratios, including profitability, liquidity, leverage, and operational efficiency. These elements are central to financial distress theory, which posits that financial risk is closely tied to a firm's ability to generate profits, maintain liquidity, and manage its debt.

The Z-Score is suitable for both financial and non-financial companies, with distinct formulas tailored for each type. For non-financial firms, the model emphasizes liquidity and asset turnover, while for financial institutions, the focus is on equity and retained earnings. This distinction ensures that the model captures sector-specific financial risks effectively (Finbox, 2024). A higher Z score indicates a lower probability of bankruptcy. Alternative measures of financial distress, such as probability of default models or credit risk scores, were available but the Z-Score was chosen for its robust historical use and adaptability across industries (Irawan *et. al.*, 2021; Purwanti and Syarif, 2022).

The Altman Z-score advantages include simplicity, effectiveness in predicting distress within two years, and its applicability across manufacturing firms.

It is typically categorized into three zones:

- $Z > 2.99$: The "Safe Zone" – indicates low bankruptcy risk.
- $1.81 < Z < 2.99$: The "Grey Zone" – indicates moderate risk.
- $Z < 1.81$: The "Distress Zone" – indicates high bankruptcy risk.

The Altman Z-score model has been widely utilized in predicting the likelihood of bankruptcy and financial distress, with numerous studies examining its efficacy globally. Among the benefits of the Z-score model, Altman *et al*. (2014) found it to be reasonably effective internationally, with prediction accuracy levels of about 75% across a large sample of European and non-European countries. In some cases, accuracy exceeded 90%, particularly when country-specific adjustments and additional variables were incorporated. The model is also straightforward to apply and provides quick insights, making it popular among financial analysts, as noted by Dolinsek and Kovac (2024). Additionally, the model can predict financial distress up to two or three years in advance, as highlighted by Anjum (2014), allowing companies and investors to act proactively to mitigate risks.

While the model generally performs well, its accuracy can vary significantly depending on the region and the specific companies being analyzed. Altman *et al*. (2014) observed that a general international model may perform adequately but would benefit from country-specific modifications, indicating that the model's one-size-fits-all approach may not work universally. Dolinsek and Kovac (2024) also found the Z-score's reliability to be around 71-80% for Slovenian companies, suggesting that it does not always provide foolproof predictions. Additionally, the model's reliance on historical financial data can sometimes overlook future market dynamics or industry-specific factors that could affect a company's financial health. As noted by Anjum (2014), while the Z-score model can forecast bankruptcy relatively well, it should be used in conjunction with other analytical methods for more comprehensive risk assessments.

ESG Score: The inclusion of ESG scores is driven by stakeholder theory (Freeman, 2010) and sustainable finance theory (Sandberg, 2018). These theories suggest that companies engaging in responsible environmental, social, and governance practices are less exposed to risks like regulatory penalties, reputational damage, and operational inefficiencies. The ESG score used in this study is derived from Morningstar's database which is called as Sustainalytics. The score represents the level of ESG risk that could affect the company's value and financial performance. The scores typically range from 0 to 100, with lower scores

indicating better ESG performance (ESG Risk Rating, 2024): 0-10: Negligible Risk, 10-20: Low Risk, 20-30: Medium Risk, 30-40: High Risk and 40+: Severe Risk.

The use of Morningstar is considered reliable due to its comprehensive methodology and widespread industry acceptance. Alternative sources for ESG data include Bloomberg or Refinitiv, which also provide similar ratings. However, Morningstar was selected for its detailed classification of ESG factors and alignment with the scope of FTSE 100 companies.

Asset Growth Rate: This variable captures the annual rate of growth in a company's assets, grounded in the theory of firm growth (Penrose, 2009). Asset growth can indicate both expansion opportunities and financial risks, as rapid growth may strain resources. Measuring asset growth through changes in total assets, as derived from annual reports, provides insight into the firm's scalability and financial stability. Other metrics, such as revenue growth or capital expenditure growth, could have been used, but asset growth directly reflects balance sheet dynamics by making it more appropriate for understanding long-term risk (Trainor and Shelley, 2022).

Return on Equity (ROE): ROE was selected for this study based on Modigliani and Miller's Theorem (1958) and it assesses how effectively a firm generates profits from its shareholders' equity. Higher ROE values typically signal efficient management and profitability, reducing the likelihood of financial distress (Modigliani-Miller, 1958; Pathak and Liang, 2021; Willey (2023). The decision to include ROE, derived from annual reports, is based on its strong historical association with firm profitability and financial health. While other profitability metrics like Return on Assets (ROA) or Net Profit Margin could have been considered, ROE specifically ties financial performance to shareholder value, aligning with the study's focus on risk.

Size: The choice of firm size, measured by the natural logarithm of total assets, is informed by the theory of economies of scale. Larger firms tend to have more resources, better access to capital markets, and greater risk diversification capabilities, reducing their financial vulnerability (Trainor *et al*., 2022). The use of total assets as a size measure is standard practice in financial research. While market capitalization could have been an alternative, total assets offer a more stable and less market-dependent measure of size, particularly in the context of financial stability.

Current Ratio and Quick Ratio: Both the current and quick ratios are chosen as measures of liquidity, reflecting the company's ability to meet short-term obligations. Liquidity preference theory (Keynes, 1937) underlies the importance of these metrics, where higher liquidity reduces the likelihood of financial distress. The current ratio measures a company's overall liquidity by dividing current assets by current liabilities, while the quick ratio offers a more stringent test by excluding inventory from current assets (Capelli *et al*., 2021; Purwanti and Syarif, 2022; Liu *et al*., 2024). These ratios are sourced from annual reports, ensuring that the data reflects accurate and updated financial conditions. Alternatives like the cash ratio or working capital ratio could have been used, but the current and quick ratios provide a balance between comprehensiveness and stringency by making them ideal for assessing liquidity risk in both financial and non-financial firms.

3.2 Econometric Model

The first econometric model suggests that the Altman Z-score is influenced by ESG performance and financial variables, while the second model posits that the ESG score is influenced by financial performance indicators. Both models are grounded in the idea that there may be an interrelationship between financial stability and ESG performance—financially sound companies may have the resources to invest in sustainable practices, while companies with strong ESG performance may enjoy enhanced financial stability over time.

The below econometric model explores how ESG performance and financial variables influence a company's Z-score, a measure of financial stability based on research question 1.

$$Z - Score_{it} = B_0 + B_1 ESG_{it} + B_2 Asset\ Growth_{it} + B_3 ROE_{it} + B_4 Size_{it} + B_5 Current\ Ratio_{it} + B_6 Quick\ Ratio_{it} + e_{it}$$

Where, i represents the company index, T represents the time index (year), B_0 is the constant term, $B_1, B_2, \ldots, B_6$ are the coefficient term for the explanatory variables,

e is the error term, capturing unobserved factors affecting the Z-score for company i at time t.

For the second research question, the ESG score is used as a dependent variable to investigate the impacts of profitability and liquidity on a company's ESG score. This research question focuses on understanding whether

financially stable companies (in terms of profitability and liquidity) tend to perform better on ESG metrics. The following econometric model is proposed:

$$ESG\ Score_{it} = B_0 + B_1 Asset\ Growth_{it} + B_2 ROE_{it} + B_3 Current\ Ratio_{it} + B_4 Quick\ Ratio_{it} + B_5 Size_{it} + e_{it}$$

Where, i represents the company index, T represents the time index (year), B_0 is the constant term, $B_1, B_2, \ldots, B_5$ are the coefficient term for the explanatory variables, e is the error term, capturing unobserved factors affecting the ESG score for company i at time t.

The second research question flips the traditional focus of ESG-related studies, which typically examine how a company's ESG performance impacts its financial outcomes. The rationale behind flipping this question is to explore the potential reverse relationship by considering whether financially robust companies have the capacity and willingness to invest more in ESG initiatives. This exploration is rooted in the theory that companies with higher profitability and stronger liquidity may have more resources to allocate toward ESG efforts, such as improving environmental sustainability, social responsibility, and corporate governance practices.

While the proposed econometric model focuses on financial variables such as Asset Growth, Return on Equity, Size, Current Ratio, and Quick Ratio, it is important to recognize that non-financial factors, such as regulatory pressures, company culture, and industry-specific ESG risks, also play a significant role in determining a company's ESG performance. To strengthen the model, future iterations could incorporate these additional variables to provide a more holistic analysis of the factors influencing ESG ratings. For instance, companies operating in highly regulated industries, such as energy or utilities, may have strong ESG scores due to external regulatory pressure, regardless of their financial performance. Similarly, firms with strong leadership in sustainability, regardless of financial status, might prioritize ESG initiatives. As a result, the impact of profitability and liquidity on ESG ratings is likely to be just one part of a broader set of influences.

3.3 Findings

The descriptive statistics presented in Table 3 summarize the dataset, which includes yearly data from FTSE 100 companies collected over the period from 2020 to 2023. The minimum and maximum values reflect the lowest and highest observations recorded for any company in any given year during the period, while the standard deviation captures the variability in the data across companies and over time. Specifically, the mean values for each variable are the averages over all the companies and years.

Table 3: Descriptive Statistics

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Z score	300	1.40	7.30	2.98	0.83
ESG Score	300	50.00	88.00	67.56	7.54
Asset Growth Rate	300	-17.90	58.30	5.96	7.53
ROE	300	-13.09	49.00	14.14	7.89
Size	300	0.62	46.50	33.45	29.01
Current Ratio	300	0.57	2.82	1.42	0.44
Quick Ratio	300	0.40	2.82	1.29	0.54
Valid N (listwise)	300				

N: Number of observations,

Starting with the Z score, the average value of 2.985 suggests that the companies in the sample generally have a Z score close to 3, indicating a relatively low risk of bankruptcy. The standard deviation of 0.8388 shows that there is some variability in the Z score among the companies. As for the ESG score, the average value of 67.56 indicates that, on average, the companies in the sample have a relatively high ESG score. The standard deviation of 7.544 suggests some variability in the ESG scores among the companies. The range of the ESG score, spanning from a minimum of 50 to a maximum of 88, highlights the diversity of ESG performance within the sample.

Regarding the asset growth rate, the average value of 5.963% suggests that, on average, the companies in the sample experience a positive growth rate. The standard deviation of 7.533% indicates some variability in the asset growth rates among the companies. The range of the asset growth rate, spanning from a minimum of -

17.90% to a maximum of 58.30%, illustrates the wide spectrum of growth rates observed. Moving on to the ROE, the average value of 14.1448 indicates that, on average, the companies in the sample have a positive ROE. The standard deviation of 7.89334 suggests some variability in the ROE among the companies. The range of the ROE, from a minimum of -13.09 to a maximum of 49.00, showcases the diversity of profitability levels within the sample.

The average size of FTSE 100 companies is reflected in a mean value of 33.454, indicating their typical size. With a standard deviation of 29.018328, there is notable variability in company size within the FTSE 100, ranging from a minimum of 0.620 to a maximum of 46.5, showcasing the wide diversity in sizes among the sample. Moving on to liquidity ratios, the mean value of 1.421 for the current ratio suggests that, on average, companies in the sample possess a slightly higher ratio of current assets to current liabilities. The standard deviation of 0.446 indicates some variation in the current ratio among the companies. The range of the current ratio, spanning from 0.57 to 2.82, highlights the range of liquidity levels within the sample. Regarding the quick ratio, the mean value of 1.299 indicates that, on average, companies in the sample maintain relatively high ratios of quick assets to current liabilities. The standard deviation of 0.542 suggests variability in the quick ratio among the companies. The range of the quick ratio, from 0.40 to 2.82, further illustrates the diversity of liquidity levels within the sample.

Table 4 presents the results of the correlation analysis conducted among the ESG Score, Z score, Asset Growth Rate, ROE, Size, Current Ratio, and Quick Ratio. The objective of this analysis was to explore the relationships between these variables and assess their significance.

Table 4: Pearson Correlation

		ESG Score	**Z score**	**Asset Growth Rate**	**ROE**	**Size**	**Current Ratio**	**Quick Ratio**
ESG Score	Pearson Correlation	1	0.256**	0.042	0.345**	0.167**	0.048	0.103
	Sig. (2-tailed)		<0.001	0.449	<0.001	0.002	0.388	0.062
Z score	Pearson Correlation	0.256**	1	0.162**	0.297**	0.141*	0.106	0.083
	Sig. (2-tailed)	<.001		0.003	<0.001	0.010	0.054	0.133
Asset Growth Rate	Pearson Correlation	0.042	0.162**	1	0.307**	-0.047	0.152**	0.083
	Sig. (2-tailed)	0.449	0.003		<0.001	0.393	0.006	0.133
ROE	Pearson Correlation	0.345**	0.297**	0.307**	1	0.467**	0.312**	0.437**
	Sig. (2-tailed)	<.001	<.001	<0.001		<0.001	<0.001	<0.001
Size	Pearson Correlation	0.167**	0.141*	-0.047	0.467**	1	0.100	0.260**
	Sig. (2-tailed)	0.002	0.010	0.393	<0.001		0.070	<0.001
Current Ratio	Pearson Correlation	0.048	0.106	0.152**	0.312**	0.100	1	0.612**
	Sig. (2-tailed)	0.388	0.054	0.006	<0.001	0.070		<0.001
Quick Ratio	Pearson Correlation	0.103	0.083	0.083	0.437**	0.260**	0.612**	1
	Sig. (2-tailed)	0.062	0.133	0.133	<0.001	<0.001	<0.001	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 4 shows the Pearson correlation coefficients among the variables. While there are some statistically significant correlations, they are relatively weak. The ESG Score has a significant but weak positive correlation with the Z score (r =0.256), suggesting a slight association between higher ESG Scores and better bankruptcy risk profiles. It also shows a weak positive correlation with Size (r =0.167), indicating that larger companies may have slightly higher ESG Scores. However, other correlations, such as those between ESG Score and the Current Ratio (r =0.048) or the Quick Ratio (r =0.103), are not significant. Similarly, the correlation between the Z score and Size (r =0.141) is weak, and while there are significant correlations with ROE (r = 0.297), these values are not strong.

Table 5: Collinearity Statistics

Model		Collinearity Statistics	
		Tolerance	**VIF**
1	(Constant)		
	ESG Score	0.866	1.155
	Asset Growth Rate	0.814	1.228
	ROE	0.820	1.723
	Size	0.928	1.373
	Current Ratio	0.599	1.669
	Quick Ratio	0.543	1.841
	a. Dependent Variable: Z score		

Table 5 provides collinearity statistics for a regression model aimed at predicting Z scores, with independent variables including ESG Score, Asset Growth Rate, ROE, Size, Current Ratio, and Quick Ratio. The Tolerance values, indicating the proportion of variance in each independent variable not explained by others, reveal that ESG Score, Asset Growth Rate, ROE, Size, Current Ratio, and Quick Ratio all have tolerances above 0.5, suggesting they contribute unique information to the model. The Variance Inflation Factor (VIF) values, which quantify the extent of collinearity, remain below 2 for all variables, suggesting generally low collinearity. Specifically, ROE has a VIF of approximately 1.723, indicating some degree of collinearity, although not excessively high. These findings imply that the model's predictors demonstrate acceptable levels of collinearity, supporting the reliability of the regression analysis in predicting Z scores.

Table 6: Panel Unit Root Analysis at Level

Method	**Statistics**	**Prob.****
Null: Unit Root (assumes common unit root process)		
Levin, Lin & Chu t**	-1.071	0.142
Null: Unit Root (assumes individual unit root process)		
Im, Pesaran and Shin W-stat	2.653	0.996
ADF - Fisher Chi-Square	31.733	0.999
PP - Fisher Chi-Square	39.413	0.981

Table 6 presents unit root test results for examining the stationarity of a time series. Two null hypotheses are tested: one assuming a common unit root process and the other assuming individual unit root processes. Under the assumption of a common unit root process, the Levin, Lin & Chu test statistic is -1.071 with a corresponding probability (Prob.) of 0.142, suggesting insufficient evidence to reject the null hypothesis of a unit root. Under the assumption of individual unit root processes, three tests are conducted: the Im, Pesaran, and Shin W-stat, the Augmented Dickey-Fuller (ADF) test, and the Phillips-Perron (PP) test. The Im, Pesaran, and Shin W-stat yield a test statistic of 2.653 with a high probability of 0.996, indicating no significant evidence to reject the null hypothesis of a unit root. Similarly, the ADF and PP tests provide high test statistics (31.733 and 39.413, respectively) with probabilities close to 1, indicating no evidence against the null hypothesis of a unit root across individual cross-sections.

In conclusion, the unit root test results suggest that the time series are non-stationary, as evidenced by the inability to reject the null hypotheses of unit root presence. Therefore, the first difference of the data is calculated to transform the data into a stationary form suitable for regression analysis. Table 7 shows the result of the 1st differences.

Table 7: Panel Unit Root Test at 1st Differences

Method	**Statistics**	**Prob.****
Null: Unit Root (assumes common unit root process)		
Levin, Lin & Chu t**	-24.143	0.000
Null: Unit Root (assumes individual unit root process)		
Im, Pesaran and Shin W-stat	-7.117	0.000

ADF - Fisher Chi-Square	133.651	0.000
PP - Fisher Chi-Square	337.349	0.000

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

The unit root test results indicate strong evidence against the presence of unit roots in both the common and individual unit root process assumptions. Under the assumption of a common unit root process, the Levin, Lin & Chu test statistic is -24.143 with a probability of 0.000, suggesting a rejection of the null hypothesis of a unit root. Similarly, under the assumption of individual unit root processes, all three tests—the Im, Pesaran, and Shin W-stat, the Augmented Dickey-Fuller (ADF) test, and the Phillips-Perron (PP) test—yield highly significant test statistics (with probabilities of 0.000), indicating rejection of the null hypothesis of unit root presence.

Given the rejection of the null hypothesis of unit root presence, the data is deemed stationary. This suggests that regression analysis can be performed confidently on the dataset without the concern of non-stationarity. Regression models can be applied effectively to explore relationships between variables, given the stationary nature of the data, ensuring reliable and robust results.

Table 8: ANOVA Analysis for RQ1

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	**Regression**	31.178	6	5.196	8.354	<0.001[b]
	Residual	200.285	322	0.622		
	Total	231.463	328			

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	**(Constant)**	1.118	0.429		2.605	0.010
	ESG Score	0.022	0.006	0.194	3.485	<0.001
	Asset Growth Rate	0.015	0.007	0.124	2.160	0.032
	ROE	0.020	0.008	0.190	2.641	0.009
	Size	0.001	0.002	0.043	0.706	0.481
	Current Ratio	0.087	0.126	0.046	0.689	0.492
	Quick Ratio	-0.108	0.109	-0.070	-0.988	0.324

a. Dependent Variable: Z score

b. Predictors: (Constant), Quick Ratio, Asset Growth Rate, ESG Score, Size (Market Capitalization), Current Ratio, ROE

The results of the ANOVA analysis for the regression model predicting Z score are presented in Table 8. The model as a whole was found to be significant, $F(6, 322) = 8.354$, $p < 0.001$. This indicates that the predictors included in the model collectively explain a significant amount of the variance in Z score. ESG Score ($\beta = 0.194$, $p < 0.001$), Asset Growth Rate ($\beta = 0.124$, $p = 0.032$), and ROE ($\beta = 0.190$, $p = 0.009$) were all found to have positive relationships with Z score. This suggests that companies with higher ESG scores, higher asset growth rates, and higher ROE tend to have higher Z scores. The other predictors, Size ($\beta = 0.043$, $p = 0.481$), Current Ratio ($\beta = 0.046$, $p = 0.492$), and Quick Ratio ($\beta = -0.070$, $p = 0.324$), were not found to have significant effects on Z score. This indicates that these variables do not have a meaningful impact on Z score in this model. Overall, the results of the regression analysis indicate that ESG Score, Asset Growth Rate, and ROE are important predictors of Z score. These findings support the hypothesis that companies with higher ESG scores, higher asset growth rates, and higher ROE are more likely to have higher Z scores.

Table 9: ANOVA Analysis for RQ2

Model		Sum of Squares	df	Mean Square	F	Sig.
1	**Regression**	2466.137	5	493.227	10.008	<0.001[b]
	Residual	15918.112	323	49.282		
	Total	18384.249	328			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	**Std. Error**	**Beta**		
1	**(Constant)**	64.166	1.354		47.384	<0.001
	Asset Growth Rate	-0.145	0.061	-0.135	-2.367	0.019
	ROE	0.400	0.064	0.421	6.208	<0.001
	Size	-0.007	0.016	-0.026	-0.423	0.673
	Current Ratio	-0.154	1.124	-0.009	-0.137	0.891
	Quick Ratio	-0.792	0.969	-0.057	-0.818	0.414

a. Dependent Variable: ESG Score
b. Predictors: (Constant), Quick Ratio, Asset Growth Rate, Size (Market Capitalization), Current Ratio, ROE

The ANOVA analysis conducted on the ESG Score reveals significant results, indicating that the regression model as a whole explains a substantial amount of variance in ESG Scores within the dataset in Table 9. The regression model yielded a significant F-value of 10.008 ($p < 0.001$), indicating that the predictors collectively contribute to the variability observed in ESG Scores. Specifically, examining the coefficients, two predictors were found to have significant effects on ESG Scores. Return on Equity (ROE) exhibited a positive relationship with ESG Scores ($\beta = 0.421$, $p < 0.001$), suggesting that companies with higher ROE tend to have higher ESG Scores. Conversely, Asset Growth Rate displayed a negative relationship with ESG Scores ($\beta = -0.135$, $p = 0.019$), indicating that companies with higher asset growth rates tend to have lower ESG Scores. However, the predictors Size, Current Ratio, and Quick Ratio were not found to have significant effects on ESG Scores, suggesting that these variables do not meaningfully influence ESG performance within the analyzed dataset. Overall, the findings underscore the importance of profitability, as reflected by ROE, in driving higher ESG performance, while also highlighting the potential trade-offs between growth and sustainability metrics within companies.

3.4 Discussion

The findings of this study provide strong evidence for a positive and significant relationship between financial health, as measured by the Z Score, and ESG ratings. This result is consistent with previous research conducted by Kim and Li (2021), who also found a positive impact of ESG factors on corporate financial performance. The research conducted by Champagne et al. (2021) adds further support to this relationship by demonstrating that a firm's extra-financial performance, as indicated by ESG ratings, is negatively related to the likelihood of adverse ESG events. This suggests that companies with higher ESG ratings are more likely to mitigate potential risks associated with ESG events, leading to improved financial health. Additionally, the study by Chen et al. (2023) found a significant negative relationship between ESG ratings and financial restatement, indicating that higher ESG ratings are associated with lower financial risk. These findings collectively suggest that higher ESG ratings are associated with better financial health.

In addition to the relationship between financial health and ESG ratings, this study also found a positive and significant relationship between financial health and asset growth. This finding is consistent with the research conducted by Gray and Johnson (2011), who found that firm asset growth rates are strong predictors of future stock returns. The study by Trainor and Shelley (2022) supports this relationship by finding that Z-scores based on short-term cumulative returns are positively related to subsequent excess returns. This suggests a potential link between financial health, as measured by the Z Score, and asset growth. Together, these findings highlight the significance of asset growth in determining the financial health of a company.

Furthermore, this study found a positive and significant relationship between ROE and financial health. This finding is in line with the research conducted by Willey (2023) on the airline and energy industries, as well as

the study by Pathak and Liang (2021) on Australia's manufacturing companies. Both studies provide support for the positive relationship between ROE and financial health, indicating that companies with higher ROE are more likely to exhibit better financial health. On the other hand, the predictors of Size, Current Ratio, and Quick Ratio were not found to have significant effects on the Z Score in this model. This suggests that these variables do not have a meaningful impact on the financial health of companies, as measured by the Z Score, in the context of this study.

Madhavan *et al*., (2021) and Aybars *et al*., (2019) both identify a robust positive correlation between ESG scores and various financial metrics, including fund alphas and operational profitability. These findings suggest that companies with higher ESG scores tend to outperform their peers in terms of financial returns and operational efficiency. Geczy and Guerard (2021) extend this perspective by demonstrating how firm environmental ratings interact with expected equity returns, leading to excess returns. This suggests that investors are increasingly incorporating ESG considerations into their investment decisions, resulting in superior returns for companies with higher ESG performance.

Pellegrini et al., (2019) add another dimension to the discussion by highlighting the impact of ESG performance on the cost of equity and overall firm profitability. By reducing the cost of equity, companies with better ESG performance can access capital at lower rates, enhancing their financial flexibility and investment opportunities. Moreover, the positive correlation between ESG performance and firm profitability implies that sustainable business practices contribute to long-term value creation.

Collectively, these findings indicate that higher ESG scores are not only associated with improved financial performance but also with enhanced market competitiveness, investor attractiveness, and risk mitigation. Companies that prioritize ESG considerations are likely to reap the benefits of improved financial resilience, stakeholder trust, and access to capital, positioning themselves for sustainable growth and value creation in the evolving business landscape. Therefore, integrating ESG considerations into corporate strategies and decision-making processes is increasingly recognized as essential for driving long-term financial success and creating value for all stakeholders.

4. Conclusion

The focus of this research is the evaluation of ESG ratings among various FTSE 100 companies and their impact on financial risk. The objectives of the study are to analyse how ESG ratings affect the financial risk of FTSE 100 companies and reveal the impact of profitability and liquidity on the ESG ratings. The following research questions were investigated.

The findings suggest a strong association between higher ESG ratings, better financial health, and lower financial risk within the FTSE 100. Companies with higher ESG ratings tend to exhibit more robust financial performance, as evidenced by factors such as higher Z scores, positive asset growth rates, and high ROE. Moreover, these companies are better positioned to mitigate various risks, including regulatory compliance, reputational damage, and operational disruptions, leading to overall lower financial risk profiles. The alignment between superior ESG performance and improved financial health highlights the importance of integrating ESG considerations into business strategies to enhance resilience and sustainability. In summary, within the FTSE 100, higher ESG ratings are indicative of both better financial health and lower financial risk, highlighting the intertwined nature of ESG factors with overall corporate performance.

The analysis conducted on the ESG Score within the FTSE 100 dataset reveals that profitability, particularly Return on Equity (ROE), has a significant positive impact on ESG ratings. Companies with higher ROE tend to exhibit higher ESG Scores, indicating a positive relationship between profitability and ESG performance. Conversely, liquidity, as measured by variables such as Current Ratio and Quick Ratio, does not show a significant influence on ESG Scores within the analyzed dataset. This suggests that while profitability, represented by ROE, plays a crucial role in driving higher ESG performance, liquidity metrics do not meaningfully affect ESG ratings in the context of the FTSE 100 companies.

The result of the study has potential practical and theoretical implications. In terms of the practical implications, investors may consider using ESG ratings in order to understand the FTSE 100 companies' financial risk and performance. Investing in firms with higher ESG ratings may offer the potential for better financial performance and reduced risk exposure. Companies within the FTSE 100 can use their ESG ratings as

indicators of their financial resilience and risk mitigation strategies. Prioritizing ESG considerations in corporate strategies may lead to improved financial health and enhanced market competitiveness.

In terms of the theoretical implications, ESG might be integrated into financial analysis. The study underscores the importance of integrating ESG considerations into financial analysis models to provide a comprehensive assessment of company performance. This highlights the evolving nature of financial analysis paradigms to include non-financial factors for a more holistic evaluation. By demonstrating the positive association between ESG ratings, financial health, and risk reduction, the study contributes to the discourse on value creation through ESG integration. It highlights the potential for companies to create sustainable value by aligning ESG practices with financial objectives.

One limitation of this study is the reliance on time series data from FTSE 100 companies, which may limit the generalizability of the findings to other contexts. Future research could address this limitation by expanding the analysis to include companies from different regions, allowing for a more comprehensive understanding of the relationship between ESG ratings and financial outcomes. Additionally, this study focused primarily on the impact of profitability and liquidity on ESG ratings within the FTSE 100 dataset. Future research could explore other factors that may influence ESG ratings, such as corporate governance practices, industry-specific regulations, or stakeholder engagement strategies.

The findings of this study offer practical recommendations for companies, policymakers, and researchers interested in the intersection of ESG factors, financial performance, and risk management. Firstly, the integration of ESG considerations into business strategies emerges as a critical imperative, with a particular focus on enhancing profitability, engaging stakeholders, and fostering long-term sustainability. Secondly, the significant positive impact of profitability, especially ROE, on ESG ratings highlights the importance of aligning financial and sustainability goals. Thirdly, continuous monitoring and improvement of ESG performance metrics, coupled with collaborative efforts across stakeholders, are essential for driving meaningful change and realizing sustainable business outcomes. By embracing these recommendations, companies can strengthen their financial resilience, mitigate risks, and contribute to sustainable development goals while creating long-term value for all stakeholders.

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