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# THE ROLE OF ESG RATINGS IN ENHANCING FINANCIAL STABILITY: EVIDENCE FROM THE EUROPEAN TECHNOLOGY SECTOR

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ABSTRACT OF THE MASTER'S THESIS

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Abstract

This thesis investigates the relationship between environmental, social, and governance (ESG) ratings and financial stability in the European Union's technology sector. Using the Altman Z''-Score as a measure of firm-level solvency, the study analyzes whether higher ESG performance is associated with reduced bankruptcy risk. The data comprises 162 firm-year observations from publicly listed technology companies across 15 EU member states, using financial and ESG data sourced from Refinitiv Workspace for the period 2018–2024.

Ordinary Least Squares (OLS) regression analysis is employed to test two hypotheses: (1) that firms with higher ESG ratings exhibit greater financial stability, and (2) that the governance pillar has a stronger influence on financial stability than the environmental and social components. Control variables include return on assets, leverage, firm size, R&D intensity, and GDP per capita.

The results indicate that ESG ratings—both composite and pillar-level—do not have a statistically significant impact on financial stability in the short term. In contrast, profitability (ROA) and leverage are found to be strong predictors of solvency. These findings suggest that while ESG engagement may contribute to long-term resilience, its immediate effect on financial stability is limited. The study highlights the importance of time horizon and industry-specific dynamics in evaluating the role of ESG in financial risk mitigation.



Keywords
ESG, financial stability, Altman Z-Score, technology sector, sustainability, EU,

Additional information

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# 1 INTRODUCTION

## 1.1 Background and Motivation

In today's corporate landscape, Environmental, Social, and Governance (ESG) considerations have transitioned from a secondary concern to a central element of corporate strategy and decision-making. Traditionally, companies were evaluated using financial indicators such as profitability, return on assets (ROA), and stock volatility. However, with increasing global challenges like climate change, financial crises, regulatory pressures, and heightened consumer awareness, companies are now evaluated based on their sustainability practices and ethical governance in addition to their financial strength. ESG integration within corporate frameworks is growing increasingly significant because of investors, authorities, and consumers demanding that businesses be more transparent and accountable (McKinsey & Company, 2022).

The technology sector is a particularly strong example of this amongst all the companies subject to the ESG–date because of rapid innovation cycles, high volatility, and the significant effect on society. Technology companies are not only the torchbearers of the new world economy by virtue of automation, cloud computing, digital banking, and artificial intelligence, these are as vital to expand the world's economy as the United Nations, World Bank, and International Monetary Fund. finance, and automation. But the industry also poses certain ESG concerns that could influence the stability of the financial system. The environmental impacts of data centers (energy use), electronic waste, and carbon emissions arising from cloud computing services are subject to greater regulatory and public attention (Chen et al., 2023).

Moreover, concerns over social responsibility, like data privacy, cybersecurity, and the ethical use of artificial intelligence, have climbed the list of tech sector priorities. These are problems that not only erode public confidence but also potentiate legal and reputational risks for enterprises. Meanwhile, control issues such as executive compensation, company ethics, and shareholder rights emphasize the importance of sound governance structures (Alareeni & Hamdan, 2020). Collectively, these social and governance forces are additional evidence that strong ESG integration is not just

a box-ticking exercise, but it is a matter of strategic imperative for financial resilience and long-term success in technology.

ESG ratings have become standardized as measures of firm sustainability performance. These scores provide investors and regulators with an understanding of how well companies are managing ESG risks and opportunities. Companies with high ESG scores are often perceived as low-risk investments due to their well-developed sustainability strategies and extensive stakeholder engagement (Friede et al., 2015). Then there is the arguable financial utility of ESG. While prioritizing high ESG firms might potentially lead to superior financial health and lower risk (Friede et al., 2015), other researchers caution that ESG investing might also be associated with trade-offs, especially in heavy capital investments such as technology-intensive industries (Barnett & Salomon, 2018).

In this context, financial stability is measured through a firm's ability to maintain an ongoing concern status. The Altman Z-Score is a commonly used method used to assess financial health and predict bankruptcy risk (Altman et al., 2017). According to the empirical evidence, a strong ESG performance may increase financial stability by mitigating the distress risk and increasing the capital access (Eliwa et al., 2021). Firms with higher ESG scores were found to be more robust to market shocks during the COVID-19 pandemic (Demers et al., 2021).

To fully understand the relationship between ESG performance and firm financial stability, one must acknowledge the overall economic environment in which firms exist. GDP per capita is one such dimension and shows the degree of the market development and demand in the firm’s operating country. Higher GDP is typically associated with higher economic activity, more consumer spending, and, in many cases, more investment opportunities, all of which can contribute to a firm's performance and resilience. By adding GDP per capita to the model, it is possible to filter out the influence of ESG performance on financial stability by considering that the overall country macroeconomic conditions could mask the real effect.

However, the empirical relationship between ESG and financial stability remains inconclusive. Some argue that ESG activities could strain financial resources or crowd

out strategically important investments like R&D (Barnett & Salomon, 2012; Lin & Dong, 2018). These contrasting perceptions indicate that more empirical research is necessary in particularly in the context of EU technology, where new regulations, such as the CSRD and the EU Taxonomy (European Commission, 2023), for instance, are being imposed on firm behaviour.

This study contributes to the literature by empirically examining the association of ESG scores with financial stability in a cross-sectional sample of listed technology companies in the EU. Unlike some previous research on multiyear panel data or based on performance-oriented scores, this study employs the latest available by firm-year observation to assess whether ESG scores are associated with the Altman Z"-Score, offering a focused snapshot of sustainability's role in corporate resilience.

## 1.2 Purpose of the research

This thesis examines the relationship between Environmental, Social, and Governance (ESG) ratings and financial stability in the European Union (EU) technology sector. As ESG considerations become increasingly integral to investment decision-making and regulatory frameworks, firms face growing expectations to demonstrate sustainable and responsible corporate behavior (Eccles, Ioannou, & Serafeim, 2014). While prior research has focused extensively on ESG's influence on profitability and market valuation, comparatively little attention has been given to its effect on financial stability indicators such as solvency and distress risk.

This research addresses this gap by assessing whether firms with higher ESG ratings exhibit stronger financial stability, as measured by the **Altman Z"-Score**, a widely accepted indicator of bankruptcy risk and solvency. The technology industry represents a particularly relevant sector for this analysis due to its high degree of innovation, reliance on intangible assets, and exposure to reputational and regulatory risks (Okafor, Adeleye, & Adusei, 2020). These characteristics make financial stability a critical concern and raise important questions about the role ESG performance plays in enhancing or compromising that stability.

In addition to examining the overall ESG score, this study explores the disaggregated effects of the Environmental, Social, and Governance pillars on financial stability. The regression model controls for key firm-level financial characteristics like profitability (ROA), leverage, firm size, and R&D intensity, and incorporates GDP per capita to account for macroeconomic differences across countries.

**Research Questions:**

- RQ1: Do higher ESG ratings correlate with greater financial stability in the EU technology sector?

- RQ2: How do the individual ESG pillars (Environmental, Social, Governance) relate to firm-level financial stability as measured by the Altman Z"-Score?

By integrating ESG scores with conventional financial indicators, this study aims to provide empirical insights into the financial implications of sustainable business practices. It further investigates whether ESG integration contributes to corporate resilience in a high-growth, innovation-driven sector.

## 1.3 Significance and Contributions

The research extends and integrates established theoretical frameworks, including Stakeholder Theory, Shareholder Theory, and Agency Theory to explore the relationship between ESG performance and financial stability. While prior research has primarily examined the effect of ESG on profitability and market valuation (Friede, Busch, & Bassen, 2015), this thesis shifts the focus toward long-term stability indicators such as solvency and distress risk (Eccles, Ioannou, & Serafeim, 2014). This perspective is particularly relevant in the context of the EU technology sector, which is characterized by rapid innovation, reliance on intangible assets, and heightened exposure to ESG-related risks (Barnett & Salomon, 2012).

Methodologically, this paper contributes with an innovative concept by integrating complete ESG performance matters into the traditional financial measures, applying the Altman Z''-Score as a financial health proxy. This is particularly relevant in the

tech industry, where traditional financial metrics may not fully reflect strength in the long term. Using an OLS regression, this study presents a replicable empirical model to estimate the possible link between sustainability and firm-level financial health

From a practical standpoint, the findings offer valuable insights for investors, regulators, and corporate decision-makers. As the European Union advances regulatory initiatives such as the Corporate Sustainability Reporting Directive (CSRD) and the European Green Deal (European Commission, 2023), understanding the implications of ESG integration becomes increasingly important. Even though the empirical results do not reveal significant evidence to support the idea that ESG scores increase short-term financial stability, we highlight sectoral and methodological nuances that can shape the ESG–stability nexus. The results can also help the managers of firms on the corporate and investment sides who need to assess the strategic significance of ESG adoption, and the worth becomes known to the investors in the context of the risks of the sustainability dimension.

While the relationship between ESG ratings and financial stability wasn't statistically significant, the analysis underscores the need for clear ESG standards and for ongoing development of synthesis in regulatory rulemaking. Policy makers can use these findings to calibrate disclosure mandates to reconcile sustainability objectives with firms' practical constraints.

In summary, this study contributes to theory by extending our understanding of the functioning of an economic system through the use of a customized empirical model and on the importance of ESG in stimulating financial resilience, which refers to a firm's ability to improve solvency, reduce financial distress, and attract sustainability-focused investors. and provides meaningful policy lessons. By linking non-financial sustainability indicators with financial stability outcomes, it promotes a more nuanced and evidence-based method of assessing corporate sustainability in the dynamic EU technology-based economy.

# 2 LITERATURE REVIEW

The relationship between Environmental, Social, and Governance (ESG) performance and financial stability has been a significant area of academic research, with scholars presenting mixed findings. Although some researches suggest that ESG activities improve financial resilience, other ones indicate the costs and difficulties of ESG implementation. In this regard, the present work reviews the current ESG and financial stability literature by concentrating on empirical studies and theoretical viewpoints.

## 2.1 ESG and Financial Performance

The link between ESG performance and financial performance has been researched in depth, and the findings tend to be conflicting. In a landmark meta-study conducted by Friede, Busch, and Bassen (2015), which included over 2,000 empirical studies, over 60% of studies found a positive association between ESG performance and financial performance, 35% reported neutral findings, and only 5% reported a negative association. This would be an indication that, across the board, good ESG performance is a good indicator for financial performance. The nature and level of association between the two perspectives, however, may depend on the nature of the ESG factors, the industry, and the geographic area (Barnett & Salomon, 2012).

Another research Alareeni and Hamdan (2020), examined the effect of ESG performance on S&P 500 index-listed companies. They discovered a positive relationship between ESG scores and firm performance, meaning high-ESG-rated companies are likely to be more profitable, with less financial risk and higher investor confidence. Strong governance practices specifically were found to provide a key mechanism for mitigating financial risk and promoting long-term stability.

Likewise, Eccles, Ioannou, and Serafeim (2014) empirically analyzed the effect of sustainability on financial performance in companies from around the world during an 18-year span. Their results show that firms with good ESG practices compared to firms with poor ESG practices exhibit higher operational efficiency,lower capital constraint, and greater profitability. The evidence demonstrates strong support for the

proposition that ESG adoption boosts financial sustainability and solidifies the stakeholder relationship.

However, not all studies are fully encouraging as to ESG's financial advantages. Barnett and Salomon (2012) identify a nonlinear relationship between ESG investment and financial performance, meaning that moderate levels of ESG investment generate favorable financial results, but that excessive ESG investment can result in reduced returns as well. Their research highlighted that ESG can improve both reputation and reduce risk, however the costs need to be carefully controlled in order to avoid financial detriment.

While research has consistently confirmed that ESG is positively related to financial performance, relatively less attention has been paid to the direct influence on financial stability. We will investigate next if ESG engagement helps firms to become more resilient to economic downturns, to control its solvency and to reduce distress risks.

## 2.2 ESG and Financial Stability

Financial stability is a cornerstone for the long-term health of a company, particularly in dynamic, innovation-driven fields like technology. According to Altman et al. (2017), financial solidity can be defined as the firm's ability to withstand economic threats, avoid insolvency, and achieve long-term survival. While the majority of literature concentrates on the relationship between ESG performance and financial performance, there is a relatively new focus on whether ESG integration into a business improves the resilience of a company and improves its risk management approach. It is also distinguished from financial performance, as profitability and market value, because financial stability concentrates on a firm's resilience to external shocks, its capacity to manage insolvency risks, and to maintain operations. This section discusses empirical evidence on the potential that ESG adoption induces financial stability through enhancing risk reduction and regulatory compliance.

A structured ESG framework can contribute to financial stability by reducing corporate risk and improving long-term resilience. Albuquerque et al. (2020) argues

that strong ESG performance can contribute to greater financial resilience through enhanced risk management processes, a decrease in operational risk and by tapping into the abundance of capital available from sustainability-minded investors. Their findings emphasize that firms that have good ESG ratings show lower risk of default, lowered volatility, and heightened investor confidence.

Additionally, the systematic integration of ESG principles in the EU technology sector is consistent with similar embodiments across industries. Implementation roadmaps that are evident and clearly defined facilitate optimal implementation of sustainable initiatives, which is also in keeping with recent developments in European financial markets where there is an increased imposition by regulatory frameworks, to adhere to ESG for economic resilience (European Commission, 2023).

A study by Atif and Ali (2021) investigated the association between ESG disclosure and the risk of default. In their study, they also highlighted that companies with higher ESG scores have lower default risk and a stronger financial profile, mainly driven by stronger risk management practices and adherence to regulation. The research also found that companies with good governance are more likely to withstand periods of financial decline.

Similarly, Boubaker et al. (2020) empirically examine whether CSR activities mitigate the financial distress risk. Their analysis indicates that firms that have strong ESG policies are less likely to go bankrupt because they have stronger relationships with their stakeholders, better financing terms, and less reputational risk.

Conversely, Demers et al. (2021) challenged the assumption that ESG leads firms to suffer less financial distress. When the researchers looked at the studies that probed ESG-focused stocks' performance during the COVID-19 crisis, they learned that embracing ESG didn't exactly insulate firms from financial turmoil. Instead, intangible capital and technology were significantly more important sources of resilience during economic downturns.

### 2.3 ESG in the Technology Sector

The tech industry provides an interesting case through which to systematically analyze ESG, given rapid rates of innovation, large market swings, and regulation. Despite having what are usually good governance and social responsibility numbers for tech companies, their environmental numbers are much more of a mixed bag. Data center energy consumption, carbon emissions, and complicated supply chains are major challenges.

Unlike traditional industries with heavy physical assets, tech firms are based on intangibles like IP, software and human capital. “It is what makes the contribution of ESG to financial stability distinct. For instance, reputation, regulatory compliance and access to financing may increasingly depend on how effectively a company communicates and fulfills ESG goals.

A study by Okafor, Adeleye, and Adusei (2020) focused on the correlation between ESG and financial performance in the U.S. technology industry. What they found suggests that companies with high ESG scores have had lower stock volatility and higher investor confidence, especially during periods of economic instability. They attributed this stability to good corporate governance and ethical leadership.

A European-based investigation by Eliwa et al. (2021) had similar findings. What they found was that strong ESG policies lead to lower borrowing costs and higher credit ratings. They also highlighted how stringent EU regulations steer firms toward better sustainability practices than in many other regions.

Despite these positive findings, some research suggests that there are trade-offs and compromises involved in the adoption of ESG strategies within technology companies. Lin and Dong (2018) found that firms with high ESG investment would have less resources invested in R&D, which may influence the long-run innovation and competitiveness. This indicates that techs need to walk a tightrope between sustainability and growth driven by innovation.

# 3 THEORITICAL FRAMEWORK

## 3.1 Understanding Environmental, Social, and Government

### 3.1.1 Evolution and Institutionalization of ESG

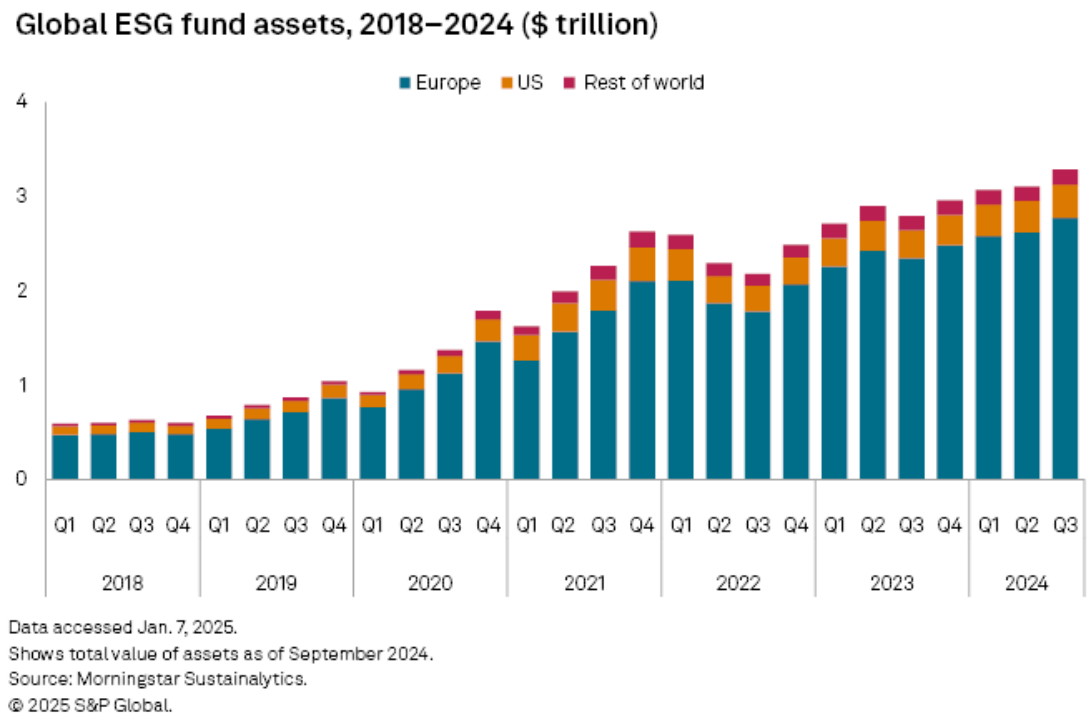
The origins of Environmental, Social, and Governance (ESG) principles can be traced back to early 20th-century corporate responsibility movements, but the term "ESG" was first named in a 2004 groundbreaking report, "Who Cares Wins," authored by financial institutions and the United Nations Global Compact. This report emphasized the importance of integrating environmental, social, and governance considerations into investment decision-making, arguing that such integration leads to more sustainable markets and better societal outcomes (UN Global Compact, 2004). The United Nations later introduced the Principles for Responsible Investment (UN PRI) in 2006, which became a voluntary guideline for investors to integrate ESG into their investment offering. By 2023, more than 5,000 investment institutions had become signatories, a number that included some of the largest asset managers in the world, controlling more than USD 121 trillion of assets under management (UN PRI, 2023).

The institutionalization of ESG was further progressed by the introduction of uniform reporting frameworks such as the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB), which have offered companies structured guidance in the disclosure of ESG performance indicators. ESG became further embedded in financial risk analysis when the Financial Stability Board established the Task Force on Climate-related Financial Disclosures (TCFD) in 2015, which recognized climate risk as material to global markets (TCFD, 2017). In the European context, the European Union's (EU) Sustainable Finance Action Plan (2018) generated legal requirements including the Sustainable Finance Disclosure Regulation (SFDR) and the EU Taxonomy with the addition of the Corporate Sustainability Reporting Directive (CSRD) in 2022, where thousands of EU based companies are legally required to disclose ESG activities (European Commission, 2022).

Moreover, green credentials have a material impact on brand equity, investor appeal, and long-term capital access, given the emergence of ESG investing as a dominant

force in the world's capital markets. For instance, as per a recent S&P Global (2025) analysis, the AUM of the global ESG fund market has expanded strongly and consistently, to surpass $3.5 trillion as of Q3 2024, and Europe still leads both by size and rate. The study highlights that ESG investing is expanding not only in highly regulated environments but also in regions where political leadership may be less supportive of sustainability agendas. For instance, analysts noted that despite the re-election of former U.S. President Donald Trump, widely regarded as skeptical toward climate regulation, the institutional momentum behind ESG investing remains robust. Key drivers include long-term risk mitigation, pressure from asset owners, fiduciary obligations, and the alignment of ESG with value creation strategies. As shown in **Figure 1**, ESG fund assets have grown steadily from 2018 to 2024, with increasing participation from the U.S. and other global regions alongside Europe's dominance.

**Figure 1.Global ESG fund assets by region, 2018–2024 (in $ trillion). Adapted from S&P Global,2020**




Thus, ESG is not only a sustainability framework—it is a strategic imperative that directly impacts a firm's financial stability, market access, and long-term viability. This is especially important for the European tech industry, working in a fast-evolving regulatory environment and under pressure on digital ethics, energy consumption, and

diversity of labour force. By incorporating ESG into strategic planning and financial risk analysis, companies can meet growing requirements, future-proof their business, and bolster investor confidence even in an economically uncertain climate. For these reasons, this thesis investigates whether ESG performance is positively related to financial stability among European technology firms, using metrics like the Altman Z"-Score and macroeconomic control like GDP per capita.

### 3.1.2 The Environmental Pillar in the Tech Sector

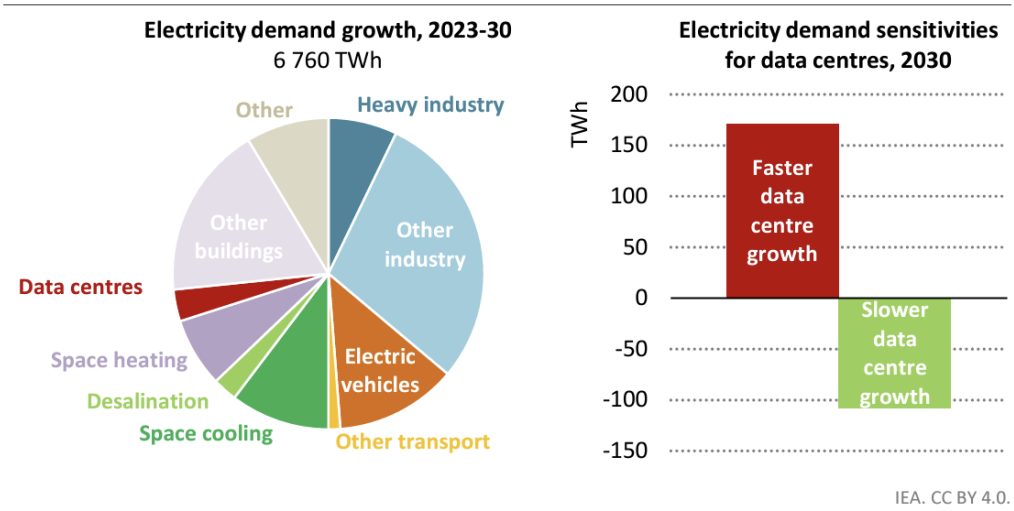
The Environmental pillar of ESG assesses how an organization manages its interaction with the natural environment, including both operational impact and adaptation to climate-related risks. Key components of environmental performance include greenhouse gas (GHG) emissions, energy consumption, waste management, water usage, climate change resilience, and biodiversity preservation. These factors are no longer peripheral considerations; they are now widely recognized as financially material risks that can affect a company's long-term stability, cost of capital, regulatory compliance, and overall market valuation (Task Force on Climate-related Financial Disclosures, 2017).

The global shift toward decarbonization, as reflected in international agreements such as the Paris Climate Accord and national climate goals like the EU Green Deal, places increasing pressure on companies, particularly large, listed firms, to disclose and improve their environmental footprints. The Corporate Sustainability Reporting Directive (CSRD) in the EU mandates enhanced environmental reporting, including scope 1–3 emissions disclosures, energy intensity ratios, and climate-related risk scenarios (European Commission, 2022). Failure to comply may result in penalties, investor withdrawal, or reputational damage.

While the technology sector is often perceived as environmentally lighter than industries like manufacturing or energy, it faces mounting ecological risks, particularly from data center operations. According to the International Energy Agency (IEA, 2024), global data center electricity consumption is projected to more than double, rising from 460 terawatt-hours (TWh) in 2022 to over 1,000 TWh by 2026. This surge is primarily driven by AI model training, cloud computing, streaming, and

cryptocurrency mining. Though this represents only about 4% of global electricity demand, it exerts substantial pressure on local energy grids, particularly in Europe. As a result, some EU policymakers are now considering limits on hyperscale data center development, reflecting the increasing regulatory scrutiny on environmental sustainability in the tech sector (Data Center Dynamics, 2024).

**Figure 2.Electricity demand growth and sensitivity scenarios for data centers, 2023–2030. Adapted from International Energy Agency (IEA), 2023.**




Note: Other includes electricity demand from agriculture. Electricity demand does not include any own use for generation, nor transmission or distribution losses.

In response, many tech firms have initiated carbon reduction strategies and committed to ambitious environmental goals. For example, Google operates the world's largest corporate purchaser of renewable energy and aims to run entirely on carbon-free energy by 2030 (Google Sustainability Report, 2022). Microsoft pledged to become carbon negative by 2030 and to remove all historical carbon emissions by 2050 (Microsoft, 2021). SAP, a leading European enterprise software firm, integrates circular economy principles in its operations and reports its entire product lifecycle emissions (SAP Integrated Report, 2022).

These companies view environmental responsibility not just as compliance, but as a strategic asset, helping reduce long-term operating costs, mitigate carbon pricing risks, and unlock ESG-linked financing opportunities (Belousova et al., 2022).

Environmental performance also influences brand equity and investor appeal, especially as ESG investing accelerates globally.

Research consistently links strong environmental performance to reduced financial risk. Poor environmental management increases exposure to fines, litigation, and asset impairments from climate events, while high ESG performers are more likely to benefit from lower borrowing costs, reduced equity volatility, and inclusion in ESG-focused investment portfolios (Friede, Busch, & Bassen, 2015). Proactive environmental management can therefore enhance a firm's Altman Z-Score, reinforcing its financial health and resilience.

### 3.1.3 Social pillar in the Tech Sector

The Social pillar of ESG evaluates how firms manage their responsibilities to employees, customers, and communities. In the technology sector, where companies rely heavily on human capital, social performance is closely linked to innovation, reputation, and long-term financial resilience.

Google is a typical case of social ESG assimilation. As Hierro (2017) documented, employee engagement is also an area of emphasis that is evidenced in the 20% innovation time rule and internal feedback systems that have resulted in enhanced productivity, better staff retention, and an open workplace—the ingredients for long-term operational stability in any sector. Google also leads the way in diversity and inclusion (D&I) by investing more than $150 million in programs to ensure fairness and opportunity in the workplace. By making publicly available its workforce/composition statistics and continued advocacy for underrepresented groups, it’s increasing interest from investors and potential employees, strengthening its’ strong existing public opinion in ESG’s social dimension (Hierro, J. Á., 2017).

Empirical evidence supports the financial relevance of such strategies. Nazir et al. (2024) found that firms integrating social ESG factors into their core strategy tend to benefit from improved stakeholder relationships, enhanced reputational capital, and greater access to ESG-aligned financing. These factors are positively linked to financial stability metrics, such as the Altman Z"-Score.

### 3.1.4 Governance Pillar in the Tech Sector

The governance pillar of ESG refers to the systems, principles, and structures that underpin corporate decision-making, accountability, and transparency. These mechanisms include board independence, executive remuneration policies, internal control systems, shareholder engagement, risk oversight, and ethical standards. Within the technology sector, strong governance plays a particularly critical role, given the scale of operations, reliance on intangible assets, and increasing regulatory scrutiny related to data usage, algorithmic systems, and digital infrastructures.

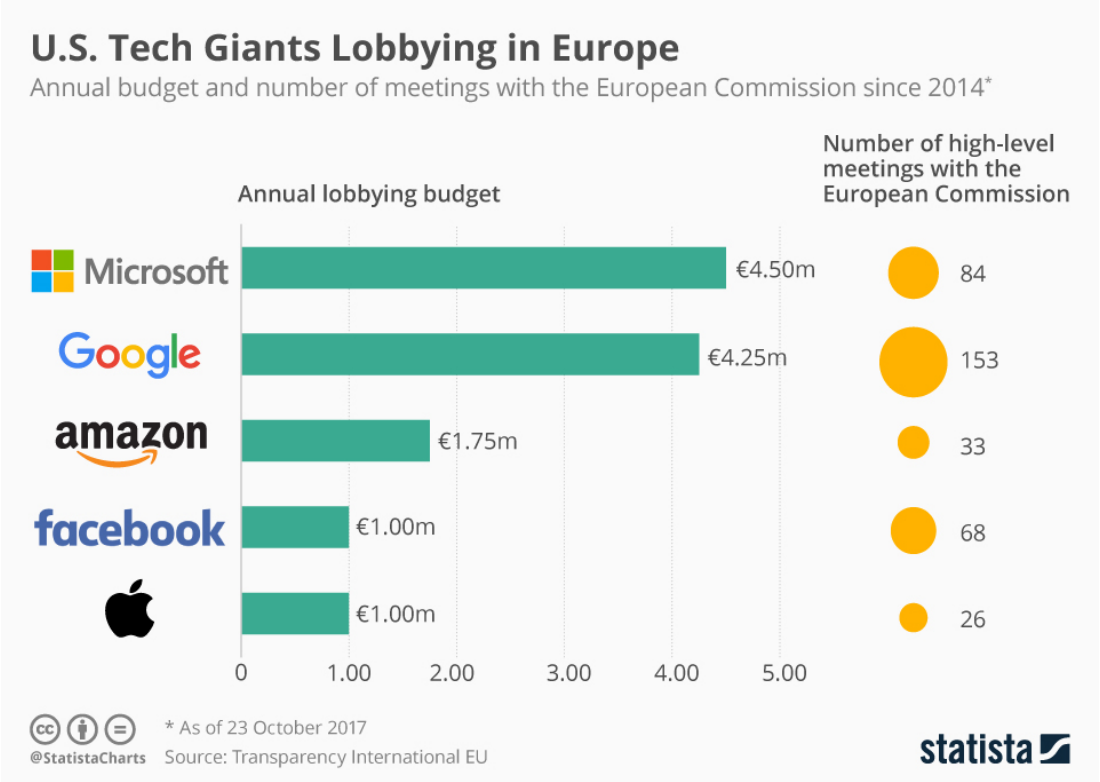
Strong governance systems are commonly associated with better financial stability. The study of Ferrell, Liang, and Renneboog (2016) emphasized that good governance helps the companies to lower their cost of capital, increases the investor confidence in a great extent and increases the Altman Z-Score showing the least likely to become insolvent. Promoting long-term value creation Good governance also makes a positive contribution to long-term value creation by aligning management goals with stakeholder expectations, minimising the risk of abuses and promoting operational oversight.

Unlike other more market-driven governance approaches, Europe's response in this regard has been unique and more proactive, in regulating societal and political implications of Big Tech's increasing influence. It has been emphasized that in European governance, public institutional authority prevails over corporate concentration so as to ensure democratic accountability (Lindman, Mäkinen & Kasanen 2023). A clear example is the General Data Protection Regulation (GDPR), which is a manifestation of the EU’s dedication to promoting privacy, data autonomy, and constraining digital overreach. Where U.S. regulators have historically taken a more hands-off stance, the EU itself has cast the bloc as a global leader in digital rights and ethical regulation.

Despite sustained lobbying efforts, particularly by dominant firms such as Google and Facebook, the largest tech lobbyists in the EU since 2012, the European institutions remain largely committed to the public interest. This includes protecting freedoms connected to privacy, speech, and information integrity also under economic pressure

for the platform economy (Lindman et al., 2023). These regulatory efforts further reinforce the role of governance as a public safeguard, reflecting the EU's broader orientation toward a “high-liberal” model of ESG, where firms are embedded within well-defined civic and legal frameworks.

**Figure 3.U.S. Tech Giants Lobbying in Europe (as of October 2017) Adapted from Statista**




Leading European technology firms have responded to this shift by integrating ESG objectives directly into their governance structures. For example, SAP includes sustainability-related key performance indicators (KPIs) in its executive remuneration framework and operates a dedicated board-level sustainability committee to oversee ESG strategy (SAP, 2024). ASML, one of Europe’s most valuable semiconductors firms, maintains a two-tier board structure, with ESG risks and sustainability performance monitored through its Supervisory Board and several committees, including audit, technology, and remuneration (ASML, 2024). Infineon Technologies ensures external validation of its governance system through independent audits, while maintaining a robust internal control framework aligned with the German Commercial Code (Infineon Technologies, 2024).

These governance tactics illustrate how long-term financial resilience is bolstered by ESG integration in oversight. Incorporating ESG concerns at the board level, tying executive pay to sustainability performance and quarterly auditing governance activity, these companies mitigate reputational and regulatory risks. Moreover, these actions enable the access to ESG-consistent investment and increase solvency determinants, such as financial figures (e.g., the Altman Z-Score).

## 3.2 Theoretical Foundations of ESG and Financial Stability

To understand the mechanisms through which Environmental, Social, and Governance (ESG) performance may influence financial stability, it is important to ground the analysis in the main theoretical perspectives. The present research is rooted in Stakeholder Theory, Shareholder Theory, and also in Agency Theory and focuses on the interrelations between ESG practices, risk management, governance structures, and corporate value creation. These theories propose different views on the nature and implications of ESG adoption, especially in the changing and innovative technology industry.

### 3.2.1 Stakeholder Theory

Stakeholder Theory, introduced by Freeman (1984), posits that a firm's success is created by the way in which the firm manages its relationships with different stakeholders, such as employees, customers, suppliers, regulators, and the surrounding society. In the context of ESG, this means that companies that adopt sustainable, ethical, and stakeholder-friendly approaches to their business are far more likely to be better placed to deliver long-term value to owners and other stakeholders.

Empirical studies support this view, indicating that better ESG performance will generate more positive corporate reputation, lower capital costs, and strengthen investor confidence (Ioannou & Serafeim, 2012). These results directly lead to the development of financial safety by reducing exposure to regulatory sanctions, environmental liabilities, and reputational damage (Eliwa et al., 2021). Firms that actively manage their stakeholders with clear reporting and ethical business behavior

are also less susceptible to external shocks, including market slumps or policy change (Gangi et al., 2020).

Although some critics argue that ESG programs can encourage costly resource expenditures away from core activities (Barnett & Salomon, 2012), but stakeholder-focused firms generally enjoy enhanced productivity and efficiency and lower turnover, and higher quality, among other things. Employee engagement, customer loyalty, and brand equity are all drivers of long-term financial performance. This study investigates whether these expectations are met in the European technology industry by analyzing the association between an index of stakeholders' engagement, ESG ratings, and financial soundness.

### 3.2.2 Shareholder Theory

While Stakeholder Theory emphasizes broader stakeholder engagement, Shareholder Theory focuses more narrowly on investor value. Shareholder Theory, a concept originally proposed by Friedman (1970), states that the sole purpose of a corporation is the enhancement of shareholder wealth. ESG issues were historically something of an optional extra -something dealt with only to the extent that they had an obvious financial impact. Investments in sustainability or social projects are considered potentially unnecessary costs that erode short-term profit (Barnett & Salomon, 2012).

However, modern interpretations of Shareholder Theory have evolved to recognize that ESG integration can contribute positively to long-term shareholder value. Firms involved in ESG practice are considered lower risk investments as they control the risks of reputation, regulation, and operation in a more effective manner (Ferrell et al., 2016). Companies with high ESG ratings enjoy lower costs of capital, higher investor confidence and burden, as well as high financial resilience (Eliwa et al., 2021).

In the EU technology space, where companies are even more heavily regulated than their US counterparts and where they are more focused on innovation and intangible asset-based risks, ESG aligned governance and transparency are a necessity in order to maintain shareholder confidence. Literature showed that well-governed companies, and companies governed by ESG-linked executive compensation, are more likely to

provide stable financial performance and endurance for institutional investment in the long term (Boubaker et al., 2020).

Critics of ESG investing argue that it can become burdensome for firms to carry extra costs, especially in industries that are capital-intensive, yet evidence suggests that these costs are counterweighed by long-run financial benefits in the form of lower volatility and better market valuation (Demers et al., 2021). This thesis seeks to investigate whether, in line with contemporary Shareholder Theory, ESG is a factor that enhances financial soundness within the EU's technology sector.

### 3.2.3 Agency Theory

Developed by Jensen and Meckling (1976), the Agency Theory helps to understand agency conflicts between corporate managers (agents) and shareholders (principals). Perhaps in this context, agency problems occur when executives work toward their own interests rather than maximizing shareholder wealth. Such disputes typically lead to higher monitoring costs, wastefulness, and exposure to financial risks.

ESG integration offers a means of mitigating agency conflicts. Improved governance mechanisms such as an independent board, clear ESG reporting, and ESG-related executive remuneration—allow concerns that motivate and guide managerial decisions to be more aligned with long-term shareholder value (Ferrell et al., 2016). For technology companies headquartered in the EU that have technology and data regulations, innovation is clearly a key topic, and ESG governance decreases risk management and improves financial stability.

However, ESG initiatives can also present a new agency problem. Executives may use ESG strategies to justify excessive spending or boost corporate image without meaningful outcomes, a phenomenon known as greenwashing (Boubaker et al., 2020). Poorly structured ESG policies can thus give rise to inefficiencies if they are not well-calibrated with a corporation's strategy and checked by an active board and shareholders.

Further, Agency Theory plays a central role of executive compensation. By tying bonuses and stock options to ESG performance measures, executives will be pressed to consider profits along with sustainability (Eliwa et al., 2021). Similarly, greater shareholder activism and board oversight will continue to ensure ESG investments live up to their intended financial and ethical standards.

In the EU technology market, where the EU Taxonomy and Corporate Sustainability Reporting Directive (CSRD) regime governs firms, good ESG governance provides a mechanism to mitigate agency costs. ESG governance is defined as systems, policies, and practices that integrate ESG, especially the environmental, social, and corporate governance, into the oversight of a company and into decision making. These include boardroom responsibility for ESG performance, honest reporting, stakeholder outreach and investment incentives that are aligned with long-term sustainable goals. There is a proud body of work that firms with strong structures of governance, robust audit policy, and monitoring of stakeholders are inclined to have stronger financial stability and transparency (Ioannou & Serafeim, 2012).

Ultimately, while there are benefits associated with it, short-term financial pressure and regulatory uncertainty can still prevent executives from wholeheartedly jumping into a long-term ESG strategy. This thesis examines whether companies that successfully implement ESG in their governance framework, in line with the Agency Theory, are likely to have stronger financial stability and lessened risk exposure.

### 3.3 Hypothesis

In the EU's technology sector, faced with heightened regulatory complexity and innovation dynamics and exposure to reputational risks, ESG adoption may not only indicate ethical behavior but also a financial strategy for resiliency. High ESG performance could improve solvency, limit financial distress, and attract sustainability investors.

These hypotheses are related to the authors' analysis of whether good ESG ratings lead to improved financial stability and which specific financial measures (solvency, operational efficiency, stock volatility) are most sensitive to ESG performance.

In recent years, factoring Environmental, Social, and Governance (ESG) considerations into corporate decision-making has gained substantial ground both in the practice and mindset of firms, investors, and regulators, who understand the importance they play in promoting financial stability. Multiple studies indicate that firms with a higher ESG score show better financial health, improved risk management, and lower financial vulnerability (Friede, Busch, & Bassen, 2015). Firms with high ESG endeavors are observed to incur lower capital costs, build investor confidence, and mitigate the likelihood of financial distress, therefore resulting in their better financial health. But there is still the question of just how much the performance of companies on the ESG front impacts the stability of corporations from a financial standpoint, especially in the European tech market. The first aim of the study is to analyze whether higher ES scores lead to better financial stability. The second aim is to investigate whether the various ESG pillars affect certain financial aspects: solvency, operational profitability and stock return volatility.

Stronger ESG integrators should also fare better in downturns, since they are better prepared to manage external shocks, regulatory risks, and investor concerns. During the 2008-2009 global financial crisis, companies with strong corporate social responsibility (CSR) programmes and transparent governance models saw a smaller drop in stock price and quicker recovery after the crisis, compared to companies with weaker ESG commitments (Eccles, Ioannou, & Serafeim, 2014). Similarly, in the COVID-19 pandemic, companies with high ESG scores are also observed to be outperforming the market by showing more adaptability, resilience in their supply chain, and long-term strategies towards sustainability (Demers, Guille, & Voulgaris, 2021). For example, Microsoft and SAP, dominant technology companies in Europe, utilized their ESG-focused strategy to stay financially stable throughout the pandemic, thus maintaining investor trust and decreasing stock volatility (Bloomberg 2021).

Conversely, businesses that did not embrace ESG concepts struggled financially and suffered reputational loss. Volkswagen's scandal of emitting test cheating in 2015 is an example of financial risk of bad ESG governance. After Volkswagen was exposed to have faked emission data, it suffered billions of dollars in penalties to regulate its behavior, lawsuits, and investors' pull-out, and suffered a great financial loss and decreasing stock prices (Lee, Cin, & Lee, 2016). The scandal highlighted the

significance of governance transparency and environmental compliance to financial health.

These examples demonstrate that the ESG performance score could be a long-term driver for financial soundness, which could reduce the risk of bankruptcy and increase investor confidence. Given this context, the first hypothesis is formulated as follows:

**H1: Firms with higher ESG ratings exhibit greater financial stability**

While ESG ratings are generally associated with improved financial stability, their impact on specific financial performance metrics, such as solvency, operational efficiency, and stock volatility, remains uncertain. Research suggests that ESG-aligned companies maintain lower leverage ratios, leading to greater solvency and reduced financial distress risk (Albuquerque, Koskinen, & Zhang, 2019). Moreover, firms investing in environmental sustainability and corporate social responsibility tend to experience higher operational efficiency and long-term cost savings (Edmans, 2011).

A prime example of ESG-driven operational efficiency is Schneider Electric, a European technology firm specializing in energy management. Through sustainable energy initiatives and circular economy practices, Schneider Electric significantly reduced its operational costs over five years while simultaneously enhancing its market competitiveness and investor appeal. (Georgia Collins, 2023). Similarly, Tesla's commitment to sustainable supply chains and electric vehicle (EV) innovation has strengthened its financial performance, brand reputation, and market share. According to Tesla's 2023 Impact Report, the company’s sustainability-driven initiatives helped customers avoid more than 20 million metric tons of $CO_2$ emissions, demonstrating that environmental sustainability can be a key driver of corporate growth (2023-tesla-impact-report-highlights, 2023).

Conversely, firms that fail to prioritize ESG considerations often face heightened financial risk and increased investor skepticism. A notable example is Facebook (now Meta), which faced significant scrutiny in 2021 over data privacy issues and governance failures. These challenges resulted in regulatory fines, legal actions, and heightened stock price volatility. In 2019, Meta was fined $5 billion by the U.S.

Federal Trade Commission (FTC) for deceiving users about their data privacy controls. (FTC imposes $5 billion penalty and sweeping new privacy restrictions on Facebook, 2019). Furthermore, in 2023, the company received a €1.2 billion ($1.3 billion) fine from EU regulators for violating data protection laws. (Ziady, 2023). These incidents illustrate the critical role of strong governance structures in maintaining financial stability and investor confidence.

Despite these examples, existing literature presents mixed findings on the financial impact of individual ESG pillars. Some studies suggest that corporate governance has the most impact on the financial performance, as companies holding clear leadership, ethical decisions, and the protection of minority interests in their policy are more profitable and suffer less financially. Velte's (2017) research showed that governance performance has a meaningful impact on corporate financial performance, and, in some cases, it is more important than environmental and social performance factors. In the same vein, Bhandari, Ranta, and Salo's work also provides evidence that firms with strong governance receive sustainable competitive edges in the long run (Bhandari et al., 2022).

Other research highlights the dominance of environmental factors, particularly in industries where sustainability regulations and carbon footprint management play a crucial role in financial decision-making. A study by Xie et al analysed firms' financial performance concerning environmental strategies and found that companies prioritizing carbon reduction and resource efficiency often achieve greater profitability (Xie et al., 2019). Additionally, Businesses in heavily regulated industries, such as energy and technology, benefit financially from strong environmental compliance and proactive sustainability policies (Huang et al., 2022).

Although corporate governance is generally the most significant ESG factor affecting the soundness of financial markets, Kaplan and Randolph (2014) find that the weight of the environmental and social dimensions can depend on industry context, level of regulation and market infrastructure. With these mixed results in mind, we empirically investigate the extent to which ESG ratings affect financial performance measures, specifically for firms in the European technology industry.

**H2: Governance has a stronger impact on financial stability than Environmental or Social factors in tech firms**

The hypotheses will be tested through panel data regression analysis using financial and ESG data from publicly listed European technology firms.

# 4 DATA AND METHODOLOGY

## 4.1 Research Design

This study adopts a simple yet rigorous quantitative research design to analyse the question whether companies' ESG ratings contribute to financial stability in technology companies in the European Union (EU). "The aim is to find out whether good ESG performers are more resilient in terms of exposure to business cycles and stock liquidity." This relationship is examined under the OLS regression, which is one of the most basic and applied statistical methods in financial and sustainable research.

Quantitative approach is dictated by the requirements for objectivity, replicability, and empirical verification. Quantitative methods as a tool to capture and analyze big, numerical data provide the potential to reveal statistically significant relations among supports and obstacles. Especially when analyzing a multi-dimensional construct such as ESG performance, which is likely to have a nuanced impact on financial performance.

The longitudinal approach has been taken while using panel data, which contains several observations of the same firm across time. This makes it possible for the investigation to account for the between-firm variance (cross-sectional variation) as well as the within-firm variance over time (time-series variation), thus providing a more in-depth picture of how ESG activities affect financial stability over time.

## 4.2 Data Collection

The empirical data for this study are obtained from the Refinitiv Workspace database, which supplies extensive financial as well as environmental, social, and governance (ESG) details on listed firms. This research deals with EU (European Union) firms belonging to the technology sector, in terms of the Global Industry Classification Standard (GICS). The sample is limited to companies that have ESG scores and reliable financial data from 2018 to 2024 to make the data consistent over time.

The initial dataset consisted of a broader universe of European publicly listed companies, covering the period from 2014 to 2024. However, due to limitations in ESG data availability, particularly before 2018, the final sample includes only those firms with complete ESG and financial information for the period 2018 to 2024, resulting in 162 firm-year observations. This refined timeframe ensures data consistency and validity across all variables included in the empirical analysis.

Technology companies were categorized according to the Global Industry Classification Standard (GICS), ensuring a consistent industry framework for analysis across firms. Only those classified within the Information Technology sector, such as software, hardware, semiconductors, and IT services, were included in this study. This categorization enabled both standardized and sector-specific analyses.

Firms with missing values in critical variables, including ESG scores, Altman Z"-Score components, or control variables were excluded from the analysis. Observations were only retained if complete data were available for both financial and ESG indicators.

The firm selection process targeted publicly listed technology companies across the EU. Countries with no available ESG data for the technology sector were excluded. A total of 15 EU countries are represented in the final sample. While the original aim was to include all EU member states, some countries, such as those in Eastern or smaller Southern European markets, were excluded due to a lack of publicly available ESG disclosures for technology firms during the observation period.

In total, 162 firm-year observations were retained in the final dataset, technology companies across the 2018–2024 period. Germany and Sweden make up the largest share of the sample, representing 27% and 28% of observations, respectively, reflecting their strong representation of listed technology firms within the EU. The detailed country-level distribution of firms is presented in Table 4.1 below.

**Table 1.Country-wise Distribution of Technology Firms in the Sample (2018–2024)**

| Country | Number of Technology Firms | Percentage of Firms |
|---|---|---|
| Austria | 4 | 2% |
| Belgium | 5 | 3% |
| Bulgaria | 1 | 1% |
| Denmark | 3 | 2% |
| Finland | 14 | 9% |
| France | 16 | 10% |
| Germany | 43 | 27% |
| Greece | 2 | 1% |
| Ireland | 3 | 2% |
| Italy | 11 | 7% |
| Luxembourg | 3 | 2% |
| Netherlands | 8 | 5% |
| Poland | 1 | 1% |
| Spain | 2 | 1% |
| Sweden | 46 | 28% |
| **Grand Total** | **162** | **100%** |

## 4.3 Regression Model

This study employs a panel data regression analysis to investigate the relationship between ESG performance and financial stability among publicly listed technology firms in the European Union (EU). The Altman Z"-Score serves as the dependent variable, representing each firm's level of financial stability and its risk of financial distress. The panel dataset covers the period from 2018 to 2024, encompassing 162 firm-year observations across 15 EU member states. Panel regression techniques are

employed to account for both cross-sectional differences between firms and temporal variation over time, thereby enhancing the robustness and explanatory power of the model.

The primary objective is to test Hypothesis 1, which posits that firms with higher ESG ratings demonstrate superior financial stability. To this end, the following baseline panel regression model is

$$\boldsymbol{Z_i''} = \boldsymbol{\alpha} + \boldsymbol{\beta_1 ESG_i} + \boldsymbol{\beta_2 ROA_i} + \boldsymbol{\beta_3 Leverage_i} + \boldsymbol{\beta_4 Size_i} + \boldsymbol{\beta_5 R\&D_i} + \boldsymbol{\beta_6 GDP_{PCi}} + \boldsymbol{\epsilon_i}$$

Where $Z_i$" is Altman Z"-Score for firm i, measuring financial stability, $ESG_i$, is ESG composite score (0–100), $R\&D_i$ is the ratio of R&D expenditure to total assets, $Size_i$ is the natural logarithm of total assets, representing firm size, $ROA_i$ is return on assets, a profitability measure, $LEVERAGE_i$, is the ratio of total debt to total assets, $GDP_{PCi}$ is country-level GDP per capita, $\epsilon_i$ is the error term.

To test Hypothesis 2, which examines whether Governance has a stronger influence on financial stability compared to Environmental or Social scores, the model is extended by disaggregating the ESG score into its three pillars:

$$\boldsymbol{Z_i''} = \boldsymbol{\alpha} + \boldsymbol{\beta_1 E_i} + \boldsymbol{\beta_2 S_i} + \boldsymbol{\beta_3 G_i} + \boldsymbol{\beta_4 ROA_i} + \boldsymbol{\beta_5 Leverage_i} + \boldsymbol{\beta_6 Size_i} + \boldsymbol{\beta_7 R\&D_i} + \boldsymbol{\beta_8 GDP_{PCi}} + \boldsymbol{\epsilon_i}$$

Where $E_i$, $S_i$, $G_i$ represent the environmental, social, and governance pillar scores for firm *i*. All other variables are as previously defined.

## 4.4 Variable and Measurement

### 4.4.1 Dependent Variable: Altman Z''-Score

To assess the financial stability of firms in the European technology sector, this study employs the Altman Z''-Score, a well-established metric designed to predict financial

distress in non-manufacturing firms. Compared to the original Z-Score, the Z''-Score excludes inventory-related components, making it particularly suitable for technology companies that rely heavily on intangible assets such as software, intellectual property, and R&D investments (Altman et al., 2017).

The Altman Z''Score is calculated as below.

$$\boldsymbol{Z''Score = 6,56A + 3,26B + 6,72C + 1,05D}$$

For a detailed explanation of each component, please refer to Section 5.1.1.

Altman Z"-Score is based on both practical utility and empirical history. Previous studies have demonstrated the importance of this measure for capital-light and innovation-intensive industries (e.g., Belousova et al., 2022; Chen, Han, & Yuan, 2022), in which traditional solvency ratios can fail to reflect true financial risk. The composition of the Z″-Score (WC/TA, RE/TA, EBIT/TA, and Equity/TL) results in the ability to consider a firm's financial situation from multiple dimensions and perspectives of insolvency risk.

In this study, the Altman Z"-Score is used as the dependent variable, serving as a reliable indicator of financial stability and corporate solvency. It enables an assessment of whether firms with higher ESG performance demonstrate stronger financial health. The Z"-Score for each firm is calculated using standardized financial data sourced from the Refinitiv database and reported in euros to ensure consistency across the sample.

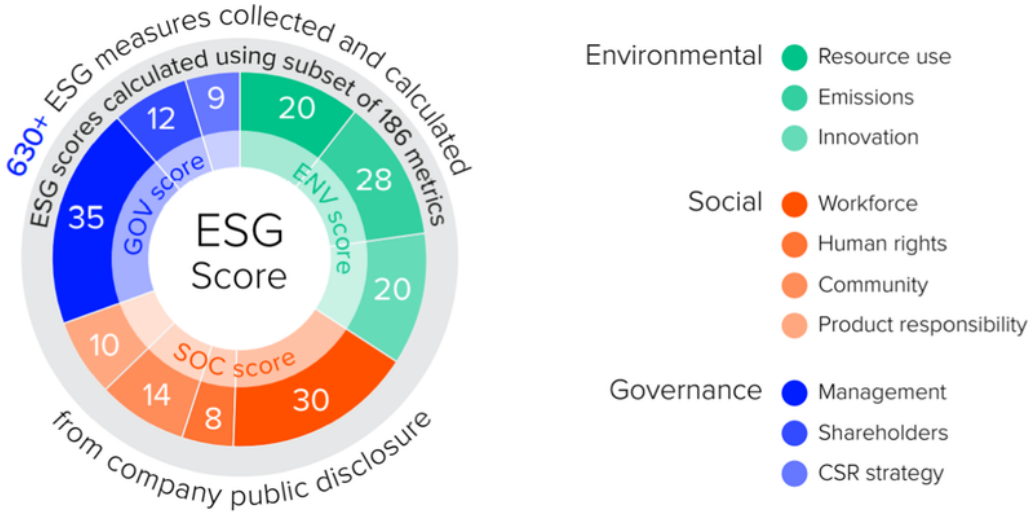
Given the cross-sectional nature of the dataset, the analysis relies on the most recent available ESG and financial data for each firm. While the study does not incorporate time-lagged variables due to data limitations, it is theoretically grounded in the literature which suggests that the financial effects of ESG performance may take time to materialize. Prior research (Bhandari, Ranta, & Salo, 2022; Eccles, Ioannou, & Serafeim, 2014) has emphasized that ESG initiatives contribute to long-term financial resilience by reducing risk exposure, building stakeholder trust, and improving operational efficiency.

Although the model captures ESG and financial data concurrently, it is designed to assess the associative relationship between sustainability performance and financial stability. The inclusion of comprehensive financial control variables like profitability, leverage, and firm size enhances the model's explanatory power and reduces potential confounding bias. As such, the Z"-Score, combined with ESG indicators, provides a theoretically sound framework for evaluating the financial stability of technology firms in the European Union

### 4.4.2 Independent Variable: ESG Score

The primary independent variable in this study is the Environmental, Social, and Governance (ESG) score, which is used as a comprehensive indicator of a firm's sustainability performance. ESG performance in this study is measured using composite ESG scores obtained from Refinitiv. These scores are derived from a total of 630+ underlying ESG measures, calculated using a subset of 186 key performance indicators across three main dimensions: Environmental, Social, and Governance.

**Figure 4.Refinitiv ESG score Adapted from Refinitiv (2022)**




(a) Rating methodology: ESG Scores are aggregation of 186 metrics, selected from more than 630 data points.

(b) ESG categories: the 186 metrics are divided in 10 categories.

In Figure 4 above. Each sub-score includes thematic categories, for example, environmental metrics assess resource use, emissions, and innovation, while governance includes management structure, shareholder rights, and CSR strategy.

The final ESG score is normalized on a 0–100 scale, where higher values indicate stronger ESG performance and greater transparency. To ensure comparability, Refinitiv classifies these scores into four performance quartiles

**Figure 5.ESG score quantiles, Adapted from Refinitiv (2022)**

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

This study includes both composite and disaggregated ESG scores to test the two research hypotheses. First, the overall ESG score is used to examine Hypothesis 1, which proposes a positive relationship between ESG performance and financial stability. The composite ESG score captures a firm's aggregated performance across all sustainability dimensions and has been widely used in empirical research as a forward-looking indicator of corporate resilience (Cui, Jo, & Na, 2018).

To test Hypothesis 2, which posits that governance plays a more significant role in financial stability than environmental or social factors, the model also incorporates the individual ESG pillar scores in which the environmental Score reflects a firm's environmental impact and risk management practices, including emissions control, energy efficiency, and sustainable resource use, social Score measures social responsibility indicators such as employee treatment, diversity, human rights, and community engagement and governance Score assesses board structure, shareholder rights, audit quality, and transparency of management.

These sub-scores enable an analysis of which dimensions of ESG are most closely associated with improved financial stability. Prior studies suggest that governance-related practices, in particular, may have the strongest influence on reducing financial risk and enhancing long-term firm value (Bhandari, Ranta, & Salo, 2022).

The incorporation of ESG performance into the model is grounded in the view that sustainability practices are not merely ethical or reputational but also financially material. The analysis aims to determine whether ESG commitments translate into measurable improvements in financial stability, particularly in the innovation-intensive and risk-sensitive context of the European technology sector.

### 4.4.3 Control Variables

To show the effect of ESG performance on financial stability and ensure the robustness of the regression models, several control variables are included. These variables demonstrate firm-specific and macroeconomic characteristics that may independently influence the Altman Z''-Score.

Firm size is measured as the natural logarithm of total assets, which is a widely accepted method for normalizing highly skewed financial data. Larger firms are generally perceived to be more financially stable due to diversified revenue streams, improved access to credit, greater bargaining power, and stronger institutional visibility.

$$\boldsymbol{FIRM\ SIZE\ =\ ln\ (Total\ Assets)}$$

This approach is utilized by Cui, Jo, and Na (2018), who show that larger firms do not only perform better in financial terms but also have lower levels of information asymmetry and make more consistent ESG disclosures, all of which are driving financial stability.

R&D intensity is the proportion of R&D expenditure to total assets to reflect how a firm is committed to investments in research and development relative to company size. In the technology industry, more R&D intensity could generally denote a

forward-looking business approach oriented towards innovation and product creation. Yet this might also entail a greater degree of financial risk in the short run because of uncertain returns and growing expenditures. This control variable is included to help the model separate the impact of ESG strategy from that of the level of innovation expenditure.

$$\boldsymbol{R\&D\ Intensity\ =\ R\&D\ Expenditure/\ Total\ Assets}$$

As emphasized by Belousova et al. (2022), developing R&D activities is important for high-tech sectors, and R&D investments are frequently related to environmental and digital transformation strategies, constituting an essential aspect in ESG-performance systems.

Another proxy of financial performance is the return on assets, a profitability and operations efficiency performance metric. The comparison between two groups indicates that companies with better performance (higher ROA) are more resistant to financial distress and with lower default risk, and that influence will have a positive effect on Altman Z''-Score. Adding ROA helps disentangle the impact of ESG from traditional profitability.

$$\boldsymbol{ROA =\ Net\ Income/\ Total\ Assets}$$

Leverage, on the other hand, is calculated as the ratio between the total liabilities and total assets. It provides a measure of how much of a company's capitalization is comprised of debt. Highly levered businesses are exposed to financial and market risk, interest rate risk, and have more difficulty raising other types of financing in the public and private equity markets. This parameter is directly related to financial risk and is a portion of the Z''Score computation. Adjusting for this factor, we make the model only rely on the specific debt position as a structural factor of the company, excluding its ESG impact. Gao and Han (2020) emphasize the importance of leverage in financial modeling through the analysis of firm perseverance and the influence of corporate governance and managerial actions.

$$\boldsymbol{Leverage\ =\ Total\ Liabilities/\ Total\ Assets}$$

GDP per capita, measured in euros (converted from USD using average annual exchange rates), reflects the economic development of a firm's home country. Higher GDP per capita typically indicates stronger institutions and access to capital, which contribute to greater financial stability. Firms operating in such environments usually enjoy structural financial advantages regardless of their ESG profile.

Given that each firm's data is observed at a single point in time, this study adopts a cross-sectional regression approach. This approach enables us to provide company-level measures of ESG and financial stability without requiring time-series data or fixed effects. In doing so, by considering the most recent year for which data are available for each company, the model provides a snapshot stock of firm-level conditions, thus providing a clear estimate of how sustainability influences financial health at a point in time. This approach is appropriate to the question under investigation because it keeps variation between firms separated without modeling them as time series or fixed effects.

**Table 2. Summary of Variables Used in the Regression Model**

| Variable Name | Measurement | Source |
|---|---|---|
| ***Dependent Variables*** | | |
| Altman Z'' -Score | Z" = 6.56A + 3.26B + 6.72C + 1.05D | Refinitiv LSEG |
| | | |
| ***Independent Variables*** | | |
| ESG Score | Score between 0 and 100 | Refinitiv LSEG |
| Environmental Score | Score between 0 and 100 | Refinitiv LSEG |
| Social Score | Score between 0 and 100 | Refinitiv LSEG |
| Governance Score | Score between 0 and 100 | Refinitiv LSEG |
| | | |
| ***Control variables*** | | |
| R&D Intensity | Continuous ratio | Company reports / Refinitiv LSEG |
| Firm Size | Logarithmic transformation | Refinitiv LSEG |
| Return on Assets (ROA) | Continuous ratio | Refinitiv LSEG |
| Leverage | Continuous ratio | Refinitiv LSEG |
| GDP per Capita (EUR) | Euro (converted from USD) | World Bank / ECB |

# 5 EMPIRICAL ANALYSIS

## 5.1 Descriptive statistics

### 5.1.1 Dependent Variable: Altman Z''-Score

The Altman Z''Score is a widely recognized financial distress prediction model which is used to evaluate corporate solvency and bankruptcy risk. Given its effectiveness in assessing financial stability, this study employs the Altman Z''Score to determine the likelihood of financial distress among firms in the European technology sector (Altman et al., 2017). This model is particularly relevant for technology firms, which often rely more on intangible assets, R&D investments, and innovation-driven growth than traditional asset-heavy industries.

As mentioned in section 4.4.1, the Altman Z''Score is calculated as below.

$$\boldsymbol{Z''Score = 6,56A + 3,26B + 6,72C + 1,05D}$$

**Where,** $\boldsymbol{A = {}^{WC}/_{TA}}$

$\boldsymbol{B = {}^{RE}/_{TA}}$

$\boldsymbol{C = {}^{EBIT}/_{TA}}$

$\boldsymbol{D = {}^{EQUITY}/_{TL}}$

For this sample of companies, financial data has been collected from the Refinitiv database to calculate the Altman Z-score. The selected variables are the following:

A = Working Capital / Total Assets (WC/TA) which indicates liquidity ie how much short-term assets exceed short-term liabilities.

B = Retained Earnings / Total Assets (RE/TA) that reflects the firm's ability to reinvest profits, a proxy for long-term profitability.

C = EBIT / Total Assets which measures operational efficiency ie earnings before interest and taxes relative to assets.

D = Equity / Total Liabilities (EQUITY / TL) represents financial leverage on how much equity finances liabilities (inverse of debt ratio).

For this research, all financial variables necessary for the calculation of the Z''-Score were extracted from the Refinitiv database. The sample includes 162 publicly listed technology firms operating within the European Union, covering a diverse range of firm sizes and financial profiles.

**Table 3. Descriptive Statistics of Z''-Score Components**

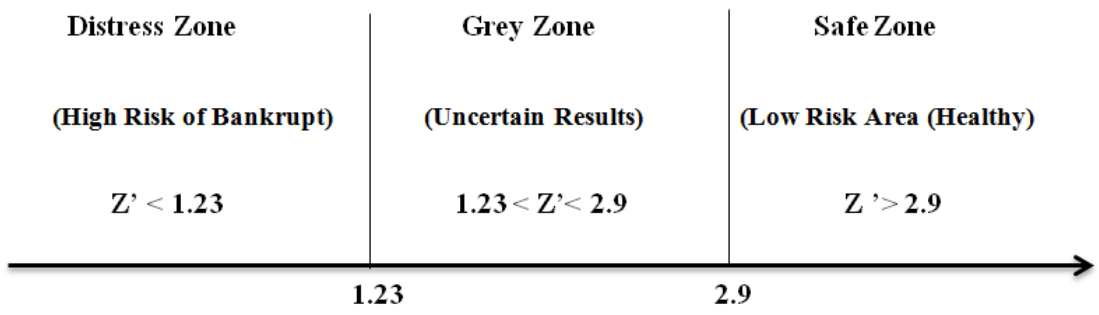
| | *Total Assets* | *Total Liabilities* | *Working Capital* | *Retained Earnings/ Total Assets* | *EBIT/ Total Assets* | *Total Shareholders Equity* |
|---|---|---|---|---|---|---|
| Mean | 5603777.24 | 2684450.49 | 754360.42 | 0.05 | 0.10 | 2805819.38 |
| Medium | 653883.49 | 292019.39 | 107658.50 | 0.04 | 0.09 | 280129.63 |
| Maximum | 74122000.00 | 30112800.00 | 10686000.00 | 0.24 | 0.44 | 44607000.00 |
| Minimum | 4533.38 | 17621.01 | 4533.38 | 0.00 | 0.00 | 23832.13 |
| Std. Dev. | 12986623.11 | 679378.99 | 175157.10 | 0.04 | 0.07 | 699509.93 |
| Skewness | 3.33 | 3.17 | 3.78 | 2.00 | 1.98 | 3.79 |
| Kurtosis | 12.07 | 10.10 | 15.98 | 6.12 | 7.07 | 17.17 |
| Sum | 448302178.92 | 214756039.28 | 58840112.87 | 3.95 | 8.24 | 224465550.65 |
| Count | 162.00 | 162.00 | 162.00 | 162.00 | 162.00 | 162.00 |

Table 5.1 provides a statistical summary of the core components used in the Z''-Score computation. These figures have been converted to units of thousands for readability and consistency.

As shown, the dataset exhibits a considerable degree of variability, particularly in total assets and equity, which is characteristic of the heterogeneous nature of the EU technology sector. High skewness and kurtosis across several variables suggest the presence of significant outliers, with a few very large firms disproportionately influencing the distribution. This reinforces the importance of using robust statistical methods to control for scale effects in the regression models presented in subsequent sections

The Altman Z''-Score classification model categorizes firms into three financial health zones based on their scores. These zones are used to assess a firm's likelihood of bankruptcy.

**Figure 6. Altman Z''-Score Zones (Adapted from Anjum 2012, p 216)**




Firms falling within the safe zone are considered to have strong financial foundations, while those in the grey zone require further monitoring and analysis. Firms in the distress zone are most vulnerable to financial instability and may face challenges related to liquidity, debt servicing, or operational continuity.

**Table 4.Altman Z''-Score Descriptive Statistics**

| | *Z Score* |
|---|---|
| Mean | 3.6141 |
| Standard Error | 0.2144 |
| Median | 3.2418 |
| Mode | #N/A |
| Standard Deviation | 1.9174 |
| Sample Variance | 3.6765 |
| Kurtosis | 1.6116 |
| Skewness | 1.2552 |
| Range | 9.2908 |
| Minimum | 0.9051 |
| Maximum | 10.1959 |
| Sum | 289.1254 |
| Count | 162 |

The descriptive statistics for the Z''-Scores are shown in Table 4 . The mean Z''-Score is 3.61, with a median of 3.24, indicating that a majority of the firms fall within the "safe zone" (Z'' > 2.6), and are thus considered financially stable. However, the range of Z''-Scores is wide, spanning from 0.91 to 10.20, suggesting notable heterogeneity in the financial health of the firms analyzed.

The minimum value of 0.91 places some firms in the "distress zone" (Z'' < 1.1), where the risk of financial distress or bankruptcy is considered high. This means that while overall, most of the firms homogeneous financial profile, for a part of the sample, the threat to solvency is substantial. The moderate variation around the mean is also indicated by the standard deviation of 1.92. Positive skewness (1.26) and moderate kurtosis (1.61) indicate that most of the firms are concentrated around the mean and very few firms have very high Z''-Scores that drag the average up.

This highlights the financial diversity within the EU technology sector, where a mix of highly stable, moderately stable, and financially vulnerable firms coexist. These results reinforce the need to examine what factors, such as ESG performance which explain differences in financial stability across firms.

### 5.1.2 ESG Scores and Control Variables

In this study, Environmental, Social, and Governance scores represent the core independent variables which used to assess the relationship between sustainability performance and financial stability in the European technology sector. The ESG data used are sourced from the Refinitiv Workspace database and reflect a robust, standardized methodology for evaluating corporate sustainability.

Refinitiv's ESG rating system is based on more than 630 underlying data points, from which a total of 186 key performance indicators are derived. These KPIs are categorized into three primary pillars: Environmental, Social, and Governance. Each pillar contains multiple thematic categories. The environmental score includes metrics related to resource use, emissions, and innovation, while the social score encompasses factors such as workforce policies, human rights, community engagement, and product responsibility, and the governance score evaluates the effectiveness of management structures, shareholder rights, and CSR strategy.

Figure 6 (see previous section) shown the structure and components of the ESG score, highlighting the ten underlying categories that contribute to the composite score. All ESG indicators are measured on a 0–100 scale, where higher values denote stronger ESG performance, greater transparency, and lower exposure to sustainability-related risks.

Given the delayed nature of ESG outcomes, all ESG variables were intended to be lagged by one year to reduce endogeneity. However, due to limitations in data availability, the current regression uses the most recent available ESG and financial data for each firm in a cross-sectional analysis. This approach captures a representative snapshot and enables valid hypothesis testing within a static framework.

This study includes both the composite ESG score and the disaggregated pillar scores (E, S, and G). The composite score is used to test Hypothesis 1, which proposes a positive relationship between overall ESG performance and financial stability. The individual pillar scores are employed in the analysis of Hypothesis 2, which

investigates whether the governance component exerts a stronger influence on financial stability than the environmental or social dimensions.

Descriptive statistics for the ESG variables are presented in Table 5

**Table 5. Descriptive Statistics for ESG Scores (Cross-sectional Data)**

| Variable | Mean | Median | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ESG Score | 52.11 | 51.65 | 21.27 | 5.22 | 92.64 |
| Environmental Score | 44.77 | 46.66 | 26.88 | 0.21 | 94.26 |
| Social Score | 54.58 | 55.32 | 24.70 | 6.56 | 96.06 |
| Governance Score | 54.33 | 55.15 | 23.75 | 5.79 | 96.06 |

***All variables are scaled from 0 to 100.***

The average composite ESG score is 52.11, suggesting that, on average, technology firms in the EU are positioned just above the midpoint of the 0–100 scale. This reflects a moderate level of sustainability integration across the sector but also highlights room for improvement, especially as ESG reporting becomes more standardized and legally mandated under regulations such as the Corporate Sustainability Reporting Directive (CSRD).

Among the three ESG pillars, the Environmental score has the lowest mean (44.77) and the highest standard deviation (26.88). This indicates that environmental practices vary widely across firms and that, on average, the sector underperforms in areas such as carbon emissions, energy efficiency, and environmental innovation. The minimum score in this category (0.21) further suggests that some firms have virtually no structured environmental strategy or transparency. This may reflect the ongoing difficulty technology firms face in reducing energy consumption, particularly in relation to data centers and digital infrastructure.

Both the Governance (54.33) and Social (54.58) scores are higher than the Environmental component, and their standard deviations are slightly lower, indicating more consistency in corporate practices related to stakeholder management and board

accountability. These findings are consistent with previous research suggesting that technology firms have traditionally prioritized transparency, shareholder rights, and internal controls, especially due to their reliance on investor confidence and intellectual property protection.

In summary, these results indicate that although ESG adoption is growing within the EU technology sector, progress remains uneven—particularly in environmental domains. The consistent strength in governance suggests it may indeed play a more stabilizing role, which is explored further in the regression analysis for Hypothesis 2. Overall, the descriptive statistics support the empirical investigation into whether stronger ESG performance, especially in governance, contributes to improved financial stability

## 5.2 Regression Analysis Results: Key Determinants of Financial Stability

This section provides a comprehensive overview of the empirical results derived from the Ordinary Least Squares (OLS) regression model, which is specifically designed to test the association between corporate sustainability performance and financial stability within the European technology sector. In this analysis, we utilize the Altman Z"-Score, a widely recognized indicator of bankruptcy risk, as the dependent variable. This score is instrumental in measuring the level of solvency at the firm level, allowing us to assess how well each company can meet its long-term obligations.

In this context, ESG performance emerges as a critical independent variable. We examine ESG performance not only in an aggregate sense but also in relation to its specific components, namely Environmental (E), Social (S), and Governance (G), throughout the text. This nuanced approach enables us to better understand how each facet of ESG performance interacts with financial stability. Additionally, various financial control variables are incorporated into the model. This inclusion is essential for isolating the influence of ESG engagement, as highlighted by previous research conducted by Friede, Busch, & Bassen (2015) and Cui, Jo, & Na (2018).

The cross-sectional nature of the data allows us to leverage the most recent year of available data for each firm, effectively providing a snapshot of both the financial

position and ESG status of each company at that specific point in time. It is crucial to note that while this model estimates the simultaneous relationship between ESG engagement and financial health, it does not imply causation. Instead, it offers insights into the correlation between these two critical areas.

The overall regression model demonstrates strong explanatory power, with an $R^2$ of 0.608 and an adjusted $R^2$ of 0.539. These values indicate that approximately 61% of the variation in financial stability, as measured by the Z"-Score, can be explained by the ESG and financial variables included in the model. The model's F-statistic is 8.80 ($p < 0.001$), confirming its statistical significance at the 1% level. This result suggests that the combination of sustainability performance and financial fundamentals significantly contributes to differences in firm-level financial stability, aligning with the approach advocated by Bhandari, Ranta, and Salo (2022) in examining sustainability within firm-specific risk structures

The analysis tests two core hypotheses:

**H1**: Firms with higher ESG ratings exhibit greater financial stability

**H2**: Governance has a stronger impact on financial stability than Environmental or Social factors in tech firms.

Table 6 presents the regression output from the Ordinary Least Squares (OLS) model used to test the relationship between ESG performance and financial stability. The dependent variable is the Altman Z''-Score, and the independent variables include both composite and disaggregated ESG scores, along with financial and macroeconomic control variables. The table includes coefficient estimates, standard errors, t-statistics, p-values, and confidence intervals.

**Table 6.OLS Regression Output – Determinants of Financial Stability (Altman Z''-Score as Dependent Variable)**

| *Regression Statistics* | |
|---|---|
| Multiple R | 0.7799 |
| R Square | 0.6082 |
| Adjusted R Square | 0.5390 |
| Standard Error | 2.6526 |
| Observations | 162 |

| | *Coefficients* | *Standard Error* | *t Stat* | *P-value* | *Lower 95%* | *Upper 95%* |
|---|---|---|---|---|---|---|
| Intercept | 10.0223 | 5.0107 | 2.0002 | 0.0508 | -0.0371 | 20.0817 |
| ESG Score | 0.0985 | 0.1807 | 0.5450 | 0.5881 | -0.2643 | 0.4613 |
| Social Pillar Score | -0.0659 | 0.0766 | -0.8601 | 0.3938 | -0.2197 | 0.0879 |
| Governance Pillar Score | -0.0473 | 0.0675 | -0.7013 | 0.4863 | -0.1827 | 0.0881 |
| Environmental Pillar Score | -0.0216 | 0.0516 | -0.4191 | 0.6769 | -0.1253 | 0.0820 |
| ROA | 1.3705 | 0.2694 | 5.0861 | 0.0000 | 0.8295 | 1.9114 |
| Size | -0.0342 | 0.2854 | -0.1200 | 0.9050 | -0.6072 | 0.5387 |
| Leverage | -10.5523 | 1.7814 | -5.9235 | 0.0000 | -14.1287 | -6.9759 |
| R & D | -3.4885 | 5.1762 | -0.6739 | 0.5034 | -13.8801 | 6.9031 |
| GDP | 0.000037 | 0.000035 | 1.065421 | 0.291703 | -0.000033 | 0.000107 |

As shown in Table 6, the ESG variables, including the composite score and individual pillar scores, do not show statistically significant coefficients. In contrast, ROA and Leverage are both highly significant at the 1% level, suggesting that profitability and capital structure remain key predictors of financial stability in the EU technology sector.

While the ESG scores indicate positive but insignificant effects, the environmental, social, and governance sub-scores surprisingly return negative coefficients. This might

reflect the short-term cost impact of ESG activities that are not yet offset by long-term gains. The results suggest no empirical support for Hypotheses 1 and 2 in the current cross-sectional framework.

The coefficient for the composite ESG score is positive ($\beta = 0.098$), but statistically insignificant ($p = 0.588$), suggesting that higher ESG ratings do not significantly predict financial stability in the short term. Similarly, the individual pillar scores—Environmental ($\beta = –0.022$, $p = 0.677$), Social ($\beta = –0.066$, $p = 0.394$), and Governance ($\beta = –0.047$, $p = 0.486$)—are also statistically insignificant, with all three showing negative coefficients. These unexpected results may reflect the short-term cost burdens of ESG initiatives or the delayed nature of their financial benefits, which may not yet be captured in Z"-Score measures. Moreover, the lack of significant variation in governance practices among EU tech firms may explain the weak statistical impact of the governance pillar.

This finding is consistent with research emphasizing the delayed nature of ESG returns. For example, Fatemi, Fooladi, and Tehranian (2015) argue that ESG strategies often yield long-term intangible value, such as enhanced brand reputation or stakeholder loyalty, which may not be captured in short-term financial ratios.

Overall, the results offer no empirical support for H1 or H2 in the context of this cross-sectional sample. These findings underscore the importance of considering time dynamics and sectoral nuances when evaluating ESG performance relationships

The control variables provide critical context for interpreting financial stability.

**Return on Assets (ROA)** is highly significant ($\beta = 1.370$, $p < 0.001$), confirming that profitability is a key driver of financial health. This aligns with the Altman model and extensive empirical evidence (Cheng, Ioannou, & Serafeim, 2014).

**Leverage** also shows a strong and negative relationship with Z"-Score ($\beta = –10.552$, $p < 0.001$), indicating that firms with higher debt ratios are more exposed to financial instability. This finding reflects core financial theory regarding capital structure risk.

**Firm Size** (log of total assets), **R&D Intensity**, and **GDP per Capita** do not show statistically significant associations with Z"-Score in this model. While firm size has been linked to financial resilience in other contexts (Garcia & Orsato, 2020), its lack of significance here may stem from sector-specific dynamics or differences in capital intensity.

Likewise, the non-significance of GDP per Capita ($\beta = 0.000037$, $p = 0.292$) implies that country-level economic development, although it may be significant in terms of large-scale macro-level studies, does not reveal the influence of the firm-level financial stability in the EU technology sector. One reason is that EU member states have a relatively high and similar GDP per capita, and the variation across countries in the sample is small. Furthermore, the national perspective of macroeconomic stability might not reflect the firm-specific risk exposures and strategic management divergence that have a direct impact on the financial viability as expressed by the Altman Z" Score.

## 5.3 Regression Analysis Results on the view of Theoretical Frameworks and Prior Research

This thesis aimed to examine whether the ESG performance can have an impact on financial stability, taking into account the Altman Z''-Score as a solvency and financial distress risk alternative proxy. Nevertheless, the regression results give no significant support of Hypothesis 1, that earnings are more stable for companies with high ESG scores, a daily increase of 1%. Similarly, Hypothesis 2 that governance will have a stronger effect rather than environmental and social did not find supporting evidence. The insignificant results for any ESG factor dimensions indicate that ESG may not have an immediate and tangible influence over short-run solvency in the European technology sector.

In terms of Stakeholder Theory (Freeman, 1984), the involvement in ESG should contribute to financial resilience by opportunity a value-generating relationship with stakeholders, the reputational capital, and by the reduction of exposure to ecological and regulatory risks. The source of value creation would be more closely associated with stakeholder awareness and value creation rather than short-term indicators of

financial stability. This seems to be consistent to the previous results reported by Fatemi et al. (2015), who claim that ESG investment creates long-term value, which is not realized in short-term financial ratios.

Agency Theory (Jensen & Meckling, 1976) posits that effective governance mechanisms minimize managerial greed and improve transparency, making the firm sound. It appears that the assumption that the governance pillar has the largest effect is not supported. One possible reason is that large EU tech firms already operate under rigorous regulatory regimes such as the CSRD and EU Taxonomy which result in relatively uniform governance practices across firms. This narrow range of variation may potentially diminish the capacity for governance scores to significantly distinguish financial outcomes when measured as a cross-sectional analysis.

Under Shareholder Theory, ESG investments are often justified only to the extent that they enhance financial performance. The negative, but not significant, coefficients of the ESG pillars might be interpreted as short-term costs to ESG implementation, especially in high-R&D-intensive sectors such as technology, for which short-term insolvency and reduction in risk were not perpetuated. These expenses could come in the form of compliance costs, mandatory sustainability reporting, and reallocation or waste of resources from revenue-generating functions.

The results of this study diverge from several strands of prior research, which have shown a positive connection between ESG performance and financial stability. The studies that are available put more emphasis on profitability, market valuation, or cost of capital, and far less on how the actual relationship between ESG and Financial stability is measured, above all by the Altman Z''Score.

For example, research by Alareeni and Hamdan (2020) and Eccles et al. (2014) suggests that companies with higher ESG scores benefit from improved investor sentiment, operational performance, and reduced risk exposure factors that theoretically contribute to stronger financial health. However, the majority of these studies focus primarily on performance indicators like Return on Assets (ROA), Tobin's Q, or stock returns, rather than on solvency or distress risk.

The results of this thesis, especially regarding the non-significant relationship between ESG scores and the Altman Z''-Score, align more closely with the findings of Demers et al. (2021), who argue that ESG engagement did not protect companies against financial fluctuations during times of crisis. This suggests that ESG commitment may not offer short-term defenses against financial instability, particularly in the technology sector, where solvency is heavily influenced by innovation cycles and the value of intangible assets.

In addition, these results resonate with the conclusions of Fatemi et al. (2015), who argue that ESG generates long-term value primarily through the enhancement of reputation and stakeholder trust, rather than through immediate improvements in financial ratios. This perspective helps explain why ESG factors may lack the capacity to influence solvency in a cross-sectional analysis, which represents only a snapshot of financial performance.

# 6 CONCLUSION AND FUTURE RESEARCH

## 6.1 Summary of Findings

The purpose of this thesis was to examine if the Environmental, Social and Governance (ESG) performance affects the financial stability in the European technology sector. Rooted in stakeholder, shareholder, and agency theories, we were interested in trying to answer whether firms rated higher in ESG are more financially stable (RQ1) and whether the various ESG pillars such as environmental, social, and governance, differentially matter in terms of financial solvency (RQ2). We used the Altman Z"-Score to gauge financial stability as it is a widely adopted tool for assessing corporate risk of insolvency, and ESG performance data were collected from Refinitiv, which combines composite and disaggregated pillar scores into a single metric.

The empirical analysis, based on Ordinary Least Squares (OLS) regressions with a cross-sectional sample of 162 firm-years for 2018-2024, leads us to mixed results. The composite ESG score had a positive coefficient but was not statistically significant ($\beta = 0.098$, $p = 0.588$). This result indicates that, in line with theoretical discourse and extant literature (for example, Friede, Busch, & Bassen, 2015; Eccles, Ioannou, & Serafeim, 2014), ESG ratings at the higher end do not translate into more short-run financial stability. Therefore, RQ1 is not addressed by the findings of this research.

Similarly, the disaggregated approach of the ESG pillars resulted in non-significant outcomes. None of the coefficients of the environmental ($\beta = –0.022$, $p = 0.677$), social ($\beta = –0.066$, $p = 0.394$), and governance ($\beta = –0.047$, $p = 0.486$) scores were positive and significant on conventional levels. These results suggest that all the individual dimensions of ESG had an insignificant influence on the financial soundness of EU technology companies represented by the Altman Z"-Score. Therefore, this is also not in support of RQ2 within the context of this cross-sectional analysis.

These findings contribute to an important nuance in the ESG–finance literature. Although some research suggests that ESG engagement is associated with improved risk management and increased trust of stakeholders (e.g., Bhandari, Ranta, & Salo, 2022), our study does not detect a direct benefit for solvency in the short run. One

reason may be that you have to wait for quite a long time before ESG starts producing returns. According to Fatemi, Fooladi, and Tehranian (2015), the positive results of ESG practices are generally of an intangible nature in the long-term perspective -cost savings, for example- and cannot be easily spotted from solvency ratios.

In contrast, conventional financial indicators showed significant explanatory power in the model. ROA was significantly positively related to Z"-Score ($\beta = 1.370$, $p < 0{\cdot}001$, profitability was identified as a major determinant of financial stability). Debt was negatively and significantly ($\beta = -10.552$, $p < 0.001$) related to leverage, highlighting the danger of increased debt— a finding aligned with traditional corporate finance theory. The other factors, such as firm size, R&D intensity, or GDP per capita, did not show any significant impact.

Overall, the evidence of this thesis suggests that the financial stability of short-term is not materially supported by an increased level of ESG performance composite or pillar-wise within publicly listed technology companies in the European Union. This would indicate that ESG can be a strategic and reputational advantage, but the financial gains from ESG need a longer-term frame. As such, the study highlights the importance of future research to extend the analysis using either a longitudinal model or a dynamic panel methodology in an attempt to capture the long-run effect of ESG performance on the firm-level financial health.

## 6.2 Limitations of the Study

While this study contributes valuable insights into the ESG–financial stability nexus in the European technology sector, several limitations must be acknowledged. These restrictions might have an impact on the results and should be taken into account for applying the results or planning further studies.

One of the biggest methodological drawbacks of this research is that it is cross-sectional. By examining the most recent year of data, the analysis provides a static snapshot of the ESG−financial stability relation. But the impacts of ESG tend to accrue over time and in the long term. Previous studies report that the impact of ESG investing, e.g., improved brand equity, customer loyalty, or regulatory and policy risk,

is often a long-term rather than short-term effect (Fatemi, Fooladi, & Tehranian, 2015). Hence, the present method could undervalue the long-term effects of sustainability interventions. To identify such a temporal relationship, a panel data model using lagged variables or dynamic structures would be more appropriate (Demers et al., 2021).

The sample is restricted to publicly traded tech companies in the EU, which yields a rather small sample of 162 firm-year observations covering 15 countries. A number of EU countries, especially in Central and Eastern Europe, were not included because of inadequate ESG reporting, raising the possibility of geographical biases. Although this industry-specific focus increases internal validity, it may limit the ability to generalize the results to other industries or settings that have different ESG-based practices and regulatory regimes.

ESG data is often of uneven quality and sometimes incomplete. While Refinitiv offers standardized ESG scores based on more than 630 measures, numerous firms do not fully disclose at all dimensions at all periods (in particular for the earlier years in the observation period). Moreover, R&D intensity and some financial variables were provided for a subset of firms, hence the data adjustments. Such gaps might have contained noise or introduced bias to the model, which may have affected estimates accuracy.

This investigation uses the Altman Z"-score as the unique indicator of financial soundness. The Z"-Score has become the most widely used metric for financial distress and bankruptcy risk, although it may not represent all aspects of corporate precaution in a comprehensive manner, such as the ability to manage liquidity and operations, and to avoid risk. Future research might consider enriching the Z"-Score by adding other variables like cash flow volatility, interest coverage, or credit ratings in order to arrive at a more multifaceted measure of financial stability.

Despite including multiple control variables, the model may still suffer from endogeneity due to omitted firm-specific factors such as managerial quality, innovation strategy, or corporate culture. These unobserved characteristics could

influence both ESG performance and financial outcomes, potentially biasing the regression estimates.

The lack of significant results for ESG variables might be due to the short-term orientation of the financial markets. Short-term negative consequences on firm value can be imposed for ESG investments that only have a long-term impact, e.g., lower regulatory risk or higher employee productivity (Friede et al., 2015). This is especially important in the tech sector, as often the innovation cycles are so rapid, and the investor expectations favor shorter-term gains rather than going long on sustainability.

**REFERENCES**

Abou-Jaoudé, N. (2023, January 3). *Here's why we must still focus on ESG, despite the backlash*. World Economic Forum. Retrieved from https://www.weforum.org/stories/2023/01/the-importance-of-esg-sustainable-future-davos-2023/

Alareeni, B. A., & Branson, J. (2012). Predicting listed companies' failure in Jordan using Altman models: A case study. *International Journal of Business and Management*, *8*(1). https://doi.org/10.5539/ijbm.v8n1p113

Alareeni, B. A., & Hamdan, A. (2020). ESG impact on performance of US S&P 500-listed firms. Corporate Governance, 20(7), 1409–1428. https://doi.org/10.1108/cg-06-2020-0258

Albuquerque, R., Koskinen, Y., Yang, S., & Zhang, C. (2020). Resiliency of environmental and social stocks: An analysis of the exogenous COVID-19 market crash. The Review of Corporate Finance Studies, 9(3), 593–621. https://doi.org/10.1093/rcfs/cfaa011

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. The Journal of Finance, 23(4), 589. https://doi.org/10.2307/2978933

Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial distress prediction in an international context: A review and empirical analysis of Altman's Z- score model. Journal of International Financial Management and Accounting, 28(2), 131–171. https://doi.org/10.1111/jifm.12053

ASML. (2024). Corporate governance. ASML. Retrieved from https://www.asml.com/en/company/governance

Atif, M., & Ali, S. (2021). Environmental, social and governance disclosure and default risk. Business Strategy and the Environment, 30(8), 3937–3959. https://doi.org/10.1002/bse.2850

Barnett, M. L., & Salomon, R. M. (2018). Does it pay to be really good? Addressing the shape of the relationship between social and financial performance. In Limits to Stakeholder Influence. Edward Elgar Publishing. http://dx.doi.org/10.2307/41679849

Belousova, V., Bondarenko, O., Chichkanov, N., Lebedev, D., & Miles, I. (2022). Coping with greenhouse gas emissions: Insights from digital Business Services. *Energies*, *15*(8), 2745. https://doi.org/10.3390/en15082745

Bhandari, K. R., Ranta, M., & Salo, J. (2022). The resource-based view, stakeholder capitalism, ESG, and sustainable competitive advantage: The firm's embeddedness into ecology, society, and governance. Business Strategy and the Environment, 31(4), 1525–1537. https://doi.org/10.1002/bse.2967

Bhattacharya, C. B., Korschun, D., & Sen, S. (2009). Strengthening stakeholder–company relationships through mutually beneficial corporate social responsibility initiatives. Journal of Business Ethics, 85(S2), 257–272. https://doi.org/10.1007/s10551-008-9730-3

Bloomberg Publishes 2023 Impact Report. (2024). Bloomberg. Retrieved from https://www.bloomberg.com/company/press/bloomberg-publishes-2023-impact-report/

Boubaker, S., Cellier, A., Manita, R., & Saeed, A. (2020). Does corporate social responsibility reduce financial distress risk? Economic Modelling, 91, 835–851. https://doi.org/10.1016/j.econmod.2020.05.012

Chan, C.-Y., Chou, D.-W., & Lo, H.-C. (2017). Do financial constraints matter when firms engage in CSR? The North American Journal of Economics and Finance, 39, 241–259. https://doi.org/10.1016/j.najef.2016.10.009

Chen, G., Han, J., & Yuan, H. (2022). Urban digital economy development, enterprise innovation, and ESG performance in China. Frontiers in Environmental Science, 10. https://doi.org/10.3389/fenvs.2022.955055

Cheng, B., Ioannou, I., & Serafeim, G. (2014). Corporate social responsibility and access to finance: CSR and Access to Finance. Strategic Management Journal, 35(1), 1–23. https://doi.org/10.1002/smj.2131

Choy, L. T., & Faculty of Arts and Social Science, University of Malaya, Malaysia. (2014). The strengths and weaknesses of research methodology: Comparison and complimentary between qualitative and quantitative approaches. IOSR Journal of Humanities and Social Science, 19(4), 99–104. https://doi.org/10.9790/0837-194399104

*Climate footprint across the IKEA value chain – IKEA Global*. (n.d.). IKEA. Retrieved October 30, 2024, from https://www.ikea.com/global/en/our-business/sustainability/value-chain-climate-footprint/

CORPORATE GOVERNANCE PRACTICES. (n.d.). *CORPORATE GOVERNANCE REPORT*. Infineon.com. Retrieved May 17, 2025, from

https://www.infineon.com/dgdl?fileId=db3a30433c1a8752013c3e6a12c800da&folderId=db3a304312dc768d0112e74143f00bce

Cui, J., Jo, H., & Na, H. (2018). Does corporate social responsibility affect information asymmetry? *Journal of Business Ethics*, *148*(3), 549–572. https://doi.org/10.1007/s10551-015-3003-8

Deloitte United States. (2024). ESG integration for sustainable finance. Deloitte United States. Retrieved from https://www2.deloitte.com/us/en/pages/consulting/articles/esg-finance-product-operations.html

Demers, E., Hendrikse, J., Joos, P., & Lev, B. (2021). ESG did not immunize stocks during the COVID-19 crisis, but investments in intangible assets did. Journal of Business Finance & Accounting, 48(3–4), 433–462. https://doi.org/10.1111/jbfa.12Theth523

Eccles, R. G., Ioannou, I., & Serafeim, G. (2014). The impact of corporate sustainability on organizational processes and performance. Management Science, 60(11), 2835–2857. https://doi.org/10.1287/mnsc.2014.1984

Edmans, A. (2011). Does the stock market fully value intangibles? Employee satisfaction and equity prices. Journal of Financial Economics, 101(3), 621–640. https://doi.org/10.1016/j.jfineco.2011.03.021

Eliwa, Y., Aboud, A., & Saleh, A. (2021). ESG practices and the cost of debt: Evidence from EU countries. Critical Perspectives on Accounting, 79(102097), 102097. https://doi.org/10.1016/j.cpa.2019.102097

European Commission. (2023). *EU taxonomy for sustainable activities*. Retrieved from https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en

Fatemi, A., Fooladi, I., & Tehranian, H. (2015). Valuation effects of corporate social responsibility. *Journal of Banking & Finance*, *59*, 182–192. https://doi.org/10.1016/j.jbankfin.2015.04.028

Ferrell, A., Liang, H., & Renneboog, L. (2016). Socially responsible firms. Journal of Financial Economics, 122(3), 585–606. https://doi.org/10.1016/j.jfineco.2015.12.003

Finger, M., & Rosenboim, M. (2022). Going ESG: The economic value of adopting an ESG policy. Sustainability, 14(21), 13917. https://doi.org/10.3390/su142113917

Fombrun, C., & Shanley, M. (1990). What's in a name? Reputation building and corporate strategy. Academy of Management Journal, 33(2), 233–258. https://doi.org/10.2307/256324

Freeman, R. E. E., & McVea, J. (2001). A stakeholder approach to strategic management. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.263511

Freeman, R. E., & Reed, D. L. (1983). Stockholders and stakeholders: A new perspective on corporate governance. California Management Review, 25(3), 88–106. https://doi.org/10.2307/41165018

Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: aggregated evidence from more than 2000 empirical studies. Journal of Sustainable

Finance & Investment, 5(4), 210–233. https://doi.org/10.1080/20430795.2015.1118917

Fujii, H., Iwata, K., Kaneko, S., & Managi, S. (2013). Corporate environmental and economic performance of Japanese manufacturing firms: Empirical study for sustainable development: Corporate environmental and economic performance of Japanese manufacturing firms. Business Strategy and the Environment, 22(3), 187–201. https://doi.org/10.1002/bse.1747

Gangi, F., Meles, A., Monferrà, S., & Mustilli, M. (2020). Does corporate social responsibility help the survivorship of SMEs and large firms? Global Finance Journal, 43(100402), 100402. https://doi.org/10.1016/j.gfj.2018.01.006

Gao, Y., & Han, K.-S. (2022). Managerial overconfidence, CSR and firm value. Asia-Pacific Journal of Accounting & Economics, 29(6), 1600–1618. https://doi.org/10.1080/16081625.2020.1830558

Garcia, A. S., & Orsato, R. J. (2020). Testing the institutional difference hypothesis: A study about environmental, social, governance, and financial performance. *Business Strategy and the Environment*, *29*(8), 3261–3272. https://doi.org/10.1002/bse.2570

Hussin, N. A. K. M., Bukhari, N. A. N. M., Hashim, N. H. A. N., Bahari, S. N. A. S., & Ali, M. M. (2024). The impact of artificial intelligence on the accounting profession: A concept paper. *Business Management and Strategy*, *15*(1), 34. https://doi.org/10.5296/bms.v15i1.21620

Hamori, S., Yue, X.-G., Yang, L., & C. Crabbe, M. J. (2022). Editorial: ESG investment and its societal impacts. Frontiers in Environmental Science, 10. https://doi.org/10.3389/fenvs.2022.1088821

Huang, J., Yan, Y., Kang, J., Peng, W., & Wang, A. (2023). Driving technology factors of carbon emissions: Theoretical framework and its policy implications for China. The Science of the Total Environment, 904(166858), 166858. https://doi.org/10.1016/j.scitotenv.2023.166858

*IEA: Global data center electricity consumption to "increase significantly," but remain a small part of overall usage*. (2024, October 16). Datacenterdynamics.com. Retrieved from https://www.datacenterdynamics.com/en/news/iea-global-data-center-electricity-consumption-to-increase-significantly-but-remain-a-small-part-of-overall-usage/

Ioannou, I., & Serafeim, G. (2012). What Drives Corporate Social Performance? The Role of Nationlevel Institutions. Journal of International Business Studies, 43(9), 834–864. http://dx.doi.org/10.1057/jibs.2012.26

Jay Gelb, Rob McCarthy, Werner Rehm, and Andrey Voronin. (2023, September). *Investors want to hear from companies about the value of sustainability*. Mckinsey.com. Retrieved from http://mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/investors-want-to-hear-from-companies-about-the-value-of-sustainability?utm_medium=DSMN8&utm_source=LinkedIn&utm_user=14419233730506593

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics, 3(4), 305–360. https://doi.org/10.1016/0304-405x(76)90026-x

Khan, M., Serafeim, G., & Yoon, A. (2016). Corporate sustainability: First evidence on materiality. The Accounting Review, 91(6), 1697–1724. https://doi.org/10.2308/accr-51383

Lee, K.-H., Cin, B. C., & Lee, E. Y. (2016). Environmental responsibility and firm performance: The application of an environmental, social and governance model: Environmental responsibility and firm performance. Business Strategy and the Environment, 25(1), 40–53. https://doi.org/10.1002/bse.1855

Lin, K. C., & Dong, X. (2018). Corporate social responsibility engagement of financially distressed firms and their bankruptcy likelihood. Advances in Accounting, 43, 32–45. https://doi.org/10.1016/j.adiac.2018.08.001

Lindman, J., Makinen, J., & Kasanen, E. (2023). Big Techâ ™s power, political corporate social responsibility, and regulation. *Journal of Information Technology*, *38*(2), 144–159. https://doi.org/10.1177/02683962221113596

Makridou, G., Doumpos, M., & Lemonakis, C. (2024). Relationship between ESG and corporate financial performance in the energy sector: empirical evidence from European companies. International Journal of Energy Sector Management, 18(4), 873–895. https://doi.org/10.1108/ijesm-01-2023-0012

*McKinsey & Company. (2022). Investors want to hear from companies about the value of sustainability.* Retrieved from

https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/investors-want-to-hear-from-companies-about-the-value-of-sustainability

Microsoft Corporation. (2023). *Carbon Accounting at Microsoft*. Retrieved from https://query.prod.cms.rt.microsoft.com/cms/api/am/binary/RW13XCo

Okafor, A., Adeleye, B. N., & Adusei, M. (2021). Corporate social responsibility and financial performance: Evidence from U.S tech firms. Journal of Cleaner Production, 292(126078), 126078. https://doi.org/10.1016/j.jclepro.2021.126078

Pham, D. C., Do, T. N. A., Doan, T. N., Nguyen, T. X. H., & Pham, T. K. Y. (2021). The impact of sustainability practices on financial performance: empirical evidence from Sweden. *Cogent Business & Management*, *8*(1), 1912526. https://doi.org/10.1080/23311975.2021.1912526

Rafi, T. (2022, June 9). Why sustainability is crucial for corporate strategy. World Economic Forum. Retrieved from http://weforum.org/stories/2022/06/why-sustainability-is-crucial-for-corporate-strategy/

Rives, K. (2025, January). *Sustainability and ESG investments will keep expanding under Trump, analysts say*. Spglobal.com. Retrieved from https://www.spglobal.com/market-intelligence/en/news-insights/articles/2025/1/sustainability-and-esg-investments-will-keep-expanding-under-trump-analysts-say-87097152

Smith, B. (2020, January 16). *Microsoft will be carbon negative by 2030*. The Official Microsoft Blog. Retrieved from

https://blogs.microsoft.com/blog/2020/01/16/microsoft-will-be-carbon-negative-by-2030/

*Sustainability*. (n.d.). SAP. Retrieved May 17, 2025, from https://www.sap.com/integrated-reports/2024/en/csrd.html

*Sustainability reporting will create long-term business and investor value*. (n.d.). IFAC. Retrieved October 30, 2024, from https://www.ifac.org/knowledge-gateway/discussion/sustainability-reporting-will-create-long-term-business-and-investor-value

Teslam. (2024, May 24). *Tesla and its commitment to a sustainable future*. Tesla Mag; Tesla Mag EN. Retrieved from https://www.tesla-mag.com/en/tesla-and-its-commitment-to-a-sustainable-future/

Velte, P. (2017). Does ESG performance have an impact on financial performance? Evidence from Germany. Journal of Global Responsibility, 8(2), 169–178. https://doi.org/10.1108/jgr-11-2016-0029

Vishwanathan, P., van Oosterhout, H. (J )., Heugens, P. P. M. A. R., Duran, P., & Essen, M. (2020). Strategic CSR: A concept building meta-analysis. The Journal of Management Studies, 57(2), 314–350. https://doi.org/10.1111/joms.12514

Willmott, E. (2022, March 24). *How Microsoft is using an internal carbon fee to reach its carbon negative goal*. Microsoft Industry Blogs. Retrieved from https://www.microsoft.com/en-us/industry/blog/sustainability/2022/03/24/how-microsoft-is-using-an-internal-carbon-fee-to-reach-its-carbon-negative-goal/

## APPENDIX

During the thesis process, I used OpenAI's ChatGPT to enhance various aspects of my writing and refinement. Specifically, I applied ChatGPT to the abstract, introduction, theory, methodology, and conclusion sections of my thesis. The tool assisted in paraphrasing, clarifying academic language, refining grammar, and improving flow and coherence. In the theoretical and discussion sections, it helped synthesize and organize arguments related to stakeholder theory, agency theory, and shareholder theory.

To ensure the quality of the AI-generated content, I cross-referenced theoretical interpretations and empirical explanations with peer-reviewed journal articles, textbooks, and literature. I validated any conceptual discussions with established sources which are properly cited in the thesis.

Furthermore, I took care to ensure the information was sufficiently comprehensive by consulting academic databases like Google Scholar and incorporating diverse perspectives from within the existing ESG .literature.To maintain academic integrity, I independently verified all content relating to concepts, data interpretation, and literature using peer-reviewed journal articles, textbooks, and reliable academic sources. The use of artificial intelligence was limited to language and structural support. No content was generated autonomously without critical assessment and editing.