UNIVERSITY OF LJUBLJANA
SCHOOL OF ECONOMICS AND BUSINESS

MASTER THESIS

ESG RATINGS AND THEIR IMPACT ON COST OF CAPITAL IN GERMAN AND AMERICAN COMPANIES

Ljubljana, September 2025 PETER KADUNC

AUTHORSHIP STATEMENT

The undersigned Peter Kadunc, a student at the University of Ljubljana, School of Economics and Business, (hereafter: UL SEB), author of this written final work of studies with the title ESG ratings and their impact on cost of capital in German and American companies, prepared under supervision of Full Professor Matjaž Črnigoj (PhD)

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ABSTRACT

This master's thesis addresses a crucial and increasingly important issue in corporate finance: the impact of environmental, social, and governance factors on companies' cost of capital. It focuses on companies in Germany and the United States from 2021 to 2024 to investigate whether better ESG performance leads to lower financing costs and to identify any differences between these two major economies. The study analyzes three key components of the cost of capital: weighted average cost of capital, cost of debt, and cost of equity. The methodological approach was based on quantitative panel regression analysis using fixed effects models, which was statistically confirmed by Hausman's test. This choice allowed for effective control over unobserved, time-invariant firm heterogeneity, thereby ensuring greater reliability of the estimates. Data on financial indicators and ESG ratings were obtained from the LSEG Workspace database.

The main findings reveal a complex relationship between ESG factors and the cost of capital, which often varies between countries and individual cost components. In terms of WACC, a significant U-shaped relationship with debt was consistently observed in both countries, highlighting the existence of an optimal capital structure. However, the direct impact of overall ESG performance on WACC was statistically significant and negative only in Germany, indicating that better ESG performance lowers WACC in this market, while in the US this direct link was not statistically significant.

The conclusions of this master's thesis emphasize that traditional financial factors are still key in determining the cost of capital. For companies, this means that they must adapt their ESG strategies to specific market conditions in order to achieve tangible financial benefits. For legislators, the findings point to the need for further standardization and transparency in ESG reporting, which would enable a more consistent assessment of sustainability-related risks and opportunities in capital markets.

KEY WORDS: ESG ratings, corporate sustainability, weighted average cost of capital, cross-country comparison, regression analysis

SUSTAINABLE DEVELOPMENT GOALS

POVZETEK

Ta magistrska naloga obravnava ključno in vse bolj pomembno vprašanje v korporativnih financah: vpliv okoljskih, družbenih in upravljavskih dejavnikov na stroške kapitala podjetij. Osredotoča se na podjetja v Nemčiji in Združenih državah Amerike v obdobju od leta 2021 do 2024, da bi raziskala, ali boljša ESG uspešnost vodi v nižje stroške financiranja, in ugotovila morebitne razlike med tema dvema velikima gospodarstvoma. Študija analizira tri ključne komponente stroškov kapitala: tehtane povprečne stroške kapitala, stroške dolga in stroške lastniškega kapitala. Metodološki pristop je temeljil na kvantitativni panelni regresijski analizi z uporabo modelov fiksnih učinkov, kar je bilo statistično potrjeno z Hausmanovim testom. Ta izbira je omogočila učinkovit nadzor nad neopaženo, časovno nespremenljivo heterogenostjo podjetij, s čimer se je zagotovila večja zanesljivost ocen. Podatki o finančnih kazalnikih in ESG ocenah so bili pridobljeni iz zbirke LSEG Workspace.

Glavne ugotovitve razkrivajo kompleksen odnos med ESG dejavniki in stroški kapitala, ki se pogosto razlikuje med državama in posameznimi komponentami stroškov. Pri WACC je bila v obeh državah dosledno opažena pomembna U-oblika razmerja z zadolženostjo, kar poudarja obstoj optimalne kapitalske strukture. Vendar pa je bil neposreden vpliv celotne ESG uspešnosti na WACC statistično pomemben in negativen le v Nemčiji, kar kaže, da boljša ESG uspešnost znižuje WACC na tem trgu, medtem ko v ZDA ta neposredna povezava ni bila statistično značilna.

Zaključki te magistrske naloge poudarjajo, da so tradicionalni finančni dejavniki še vedno ključni pri določanju stroškov kapitala. Za podjetja to pomeni, da morajo svoje ESG strategije prilagoditi specifičnim tržnim razmeram, da bi dosegle oprijemljive finančne koristi. Za zakonodajalce pa ugotovitve kažejo na potrebo po nadaljnji standardizaciji in preglednosti ESG poročanja, kar bi omogočilo bolj dosledno vrednotenje tveganj in priložnosti, povezanih s trajnostjo, na kapitalskih trgih.

KLJUČNE BESEDE: ESG ocene, korporativna trajnost, tehtani povprečni stroški kapitala, meddržavna primerjava, regresijska analiza

CILJI TRAJNOSTNEGA RAZVOJA

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LIST OF ABBREVIATIONS

CAPM – (sl. Model določanja zahtevane donosnosti lastniškega kapitala); Capital Asset Pricing Model
D – (sl. Dolg); Debt
DDM – (sl. Model diskonta dividend); Dividend Discount Model
E – (sl. Lastniški kapital); Equity
ESG – (sl. Okoljski, družbeni in upravljavski standardi); Environmental, Social and Governance
GRI – (sl. Pobuda za globalno poročanje); Global Reporting Initiative
IQR – (sl. Kvartalni razmik); Interquartile Range
IRR – (sl. Interna stopnja donosa); Internal Rate of Return
ISSB – (sl. Mednarodni odbor za trajnostne standarde); International Sustainability Standards Board
LSEG – (sl. Skupina Londonske borze); London Stock Exchange Group
M&M proposition – (sl. Predpostavka Modigliani–Miller); Modigliani–Miller proposition
MSCI – (sl. Morgan Stanley Capital International); Morgan Stanley Capital International
NGO – (sl. Nevladna organizacija); Non-governmental Organization
OAS – (sl.); Option-Adjusted Spread
OLS – (sl. Regresija po metodi najmanjših kvadratov); Ordinary Least Squares method
Rd – (sl. Nominalana obrestna mera dolga); nominal or stated interest rate on debt
Rf – (sl. Obrestna mera brez tveganja/netvegana obrestna mera); risk free rate
Rm – (sl. Pričakovan tržni donos); expected market return
ROA – (sl. Donos na sredstva podjetja); Return on Assets
ROE – (sl. Donos na lastniški kapital); Return on Equity
ROIC – (sl. Donosnost investiranega kapitala); Return on Invested Capital
RRR – (sl. Zahtevana stopnja donosa); required rate of return
S&P – (sl. Standard&Poor); Standard&Poor
SASB – (sl. Odbor za standard trajnostnega računovodstva); Sustainability Accounting Standards Board
SEC – (sl. Komisja za trg vrednostnih papirjev in borzo); Securities and Exchange Commission
WACC – (sl. Tehtani povprečni stroški kapitala); Weighted Average Cost of Capital

1 INTRODUCTION

1.1 Motivation for the thesis

In today's rapidly evolving business landscape, sustainability considerations have emerged as key elements that influence corporate strategies and investor decision-making. Environmental, Social, and Governance (hereinafter: ESG) ratings serve as a critical measure of how well companies address these considerations, providing stakeholders with valuable insights beyond traditional financial metrics. Understanding the link between ESG scores and Weighted Average Cost of Capital (hereinafter: WACC), is increasingly essential for both academics and practitioners.

Focusing on German and American companies allows for an in-depth comparison of how cultural, regulatory, and market differences shape the relationship between ESG ratings and WACC. Germany's robust sustainability-focused policies and the United States' competitive, market-driven environment present unique contexts that may yield important insights into the financial benefits or drawback of strong ESG performance. Exploring these nuances can illuminate the ways in which corporate governance practices, environmental policies, and social engagement translate into cost-of-capital advantages or challenges.

By investigating whether companies with higher ESG ratings enjoy more favorable borrowing conditions, lower equity costs, or improved overall investor confidence, this thesis aims to deepen our understanding of how sustainability-based strategies intersect with corporate finance. Ultimately, these findings can inform investors, policymakers, and companies seeking to balance profit-oriented goals with social and environmental responsibilities.

1.2 Research question

Drawing on the latest empirical findings and scholarly papers, I will explore the relationship between ESG and WACC of companies in Germany and USA. To reach this main goal, thesis will focus on the following research questions:
Are there significant differences between the German and American markets in how ESG impacts WACC?
Which aspects of ESG have the most influence on WACC, and do these effects vary between Germany and USA?
How do factors like market conditions, regulations, and societal attitudes towards sustainability shape the relationship between ESG performance and WACC in these two countries?

By addressing these questions, the thesis will provide a clearer understanding of how ESG factors influence the financial side of running a business and offer insights into how sustainable practices are integrated into financial decision-making across different markets.

1.3 Aim of the thesis and contribution to the field of knowledge

The primary goal of this thesis is to investigate the relationship between a company's ESG ratings and its WACC in two significant economies: Germany and the US. By examining how stronger ESG performance may correlate with lower capital costs, this study seeks to provide evidence on whether companies that prioritize sustainability can benefit from reduced financing expenses, potentially leading to competitive advantages and increased attractiveness for investors. Furthermore, focusing on both Germany and the United States allows for a comparison between different regulatory, cultural, and market environments, shedding light on whether ESG-related benefits or challenges manifest similarly across these two contexts.

Beyond exploring the overall link between ESG performance and WACC, the research will delve into how each pillar of ESG uniquely influences capital costs. In doing so, this study addresses a gap in existing literature by examining the interplay of individual ESG components with cost of capital in distinct economic and regulatory settings. The findings hold practical relevance for businesses aiming to optimize their sustainability strategies and financial resources, investors evaluating potential long-term stability and returns, and policymakers seeking to encourage corporate practices that align with broader social and environmental goals. Ultimately, the thesis aspires to advance scholarly understanding of ESG's role in corporate finance while offering actionable insights for a wide range of stakeholders.

1.4 Research methodology

Thesis begins with a comprehensive review of the existing literature, synthesizing previous studies on ESG performance, cost of capital, and the differences in ESG rating systems. This review is followed by theoretical framework that highlights the role of ESG considerations in influencing a firm's financing costs. Building on these foundations, the core methodology employs a quantitative approach using cross-sectional or panel data to examine the relationship between ESG ratings and WACC.

Relevant ESG scores are gathered from established rating agencies, while financial data (e.g., leverage, firm size, profitability) are sourced from secondary databases such as annual reports and market data providers. Statistical models, in my case regression analysis, is then conducted to test whether ESG ratings affect WACC, controlling for firm- and industry-specific variables. Finally, comparisons between German and American companies allow for an assessment of how varying regulatory, cultural, and market conditions might influence

this relationship. Through this blended framework of literature review, theory, and quantitative analysis, the thesis aims to provide practical implications for corporate finance, investment decision-making, and public policy.

1.5 Key findings

The results suggest that potential drivers of capital costs (e.g., leverage) have strong and often nonlinear effects (a U-shaped relationship with the weighted average cost of capital), but that the impact of ESG on capital costs is not so direct. While strong ESG integration significantly improves the overall weighted average cost of capital in the German market (where higher lagged ESG scores are significantly associated with lower weighted average cost of capital), this direct, overall relationship - the ESG premium - proves to be statistically insignificant in the U.S. sample. This difference may suggest that in the U.S., the way in which ESG benefits the overall cost of capital is different or less direct.

Looking more closely at individual cost elements, the cost of debt analysis reveals more nuanced effects of specific ESG pillars. While ESG is relatively unimportant overall, social performance consistently contributes significantly to lower Cost of Debt in both the US and Germany. This suggests that lenders value good social practices with potentially lower operational or reputational risk. However, the study also reveals surprising associations: governance is associated with increased Cost of Debt in the US, and environmental performance is associated with increased Cost of Debt in Germany. This suggests that investors and lenders have complex views on these specific ESG dimensions that are rooted in context and, within lenders, likely company size. In contrast, ESG factors have little linear direct impact on the cost of equity in either country.

1.6 Limitations of the thesis

One of the primary limitations of this thesis lies in the availability and consistency of the ESG data. Since various rating agencies use different methodologies to assess companies, there may be inconsistencies or gaps in the data. Some firms might not disclose sufficient ESG-related information, which can affect the depth and breadth of the empirical analyses. These issues can limit the reliability of any comparisons made, especially when trying to draw precise conclusions about the influence of ESG ratings on a company's WACC.

Another constraint stems from the study's temporal and geographic scope, which focuses on Germany and the United States within a specific timeframe. While this focus offers valuable insights into two significant markets, it may restrict the broader applicability of the results. Other countries could have different regulatory frameworks, cultural attitudes, and levels of market maturity, all of which could affect the ESG–WACC relationship in ways not captured by a study limited to Germany and the United States. Consequently, although the findings

may be relevant for many developed economies, they may not fully generalize to emerging markets or other developed markets with different institutional contexts.

Moreover, because this research primarily relies on quantitative methods, there is a risk of confounding correlation with causality. The study attempts to isolate the impact of ESG ratings on WACC by controlling for variables such as firm size, industry, and leverage, but there may still be unobserved factors such as particular managerial decisions, corporate governance structures, or macroeconomic conditions that influence both ESG performance and capital costs. In addition, omitted variable bias remains a potential concern, given that not all drivers of corporate sustainability or financing costs can be measured and included in the analyses.

Estimating the cost of capital, especially the WACC, poses many difficulties. One of them concerns the dependability and consistency of data in the computations. ESG-related studies, for example, may use consistent variable definitions but the data used to rate investments may vary from one rating agency to the next based on their methodologies, or may be affected by missing data if a firm does not disclose all required variables thus preventing any further evaluation of capital costs. A third concern is the confusion of correlation and causation. Although it is possible to control for various indicators like firm size, industry, etc., there are unobserved variables like particular managerial decisions, corporate governance, and macroeconomic conditions that will likely influence the ESG performance and the cost of capital.

1.7 Outline of the thesis

Following the introduction, the thesis offers an Overview of ESG Rating Systems, explaining how these ratings are derived, what criteria they typically include, and the varying methodologies used by different rating agencies. This section discusses some of the challenges associated with comparing ESG scores across firms and even across rating providers, given discrepancies in data quality and weighting approaches. This leads into a detailed explanation of the Concept of WACC, establishing how companies' costs of equity and debt combine into an overall metric of financing expenses. By clarifying the theoretical underpinnings of WACC and illustrating why investors pay close attention to it, the reader gains insight into why ESG performance might have a meaningful influence on a company's capital costs.

Next, the thesis explores the Relationship Between ESG and Financial Performance, delving into both classical finance theory and more contemporary literature that ties strong governance and responsible environmental management to reduced risk and improved capital access. This discussion acknowledges that while numerous studies suggest a positive link between sustainability and firm value, the specific impact on WACC remains underexamined particularly in cross-country comparisons. The subsequent Methodology

section details how the research design addresses this gap. It describes data collection procedures such as gathering ESG ratings from recognized providers and compiling financial indicators like firm size, profitability, and leverage and explains the statistical tests and regression models used to estimate the effect of ESG on WACC.

The Analysis and Discussion section then presents the empirical findings, comparing results for German and American firms and interpreting any observed distinctions. Finally, the Conclusion synthesizes the main insights from the analysis and reiterates how the thesis contributes to scholarly debate on ESG and corporate finance. The conclusion also addresses how a more nuanced understanding of ESG's impact on financing costs can benefit not only individual firms and investors but also the broader push toward more sustainable global economic systems.

2 OVERVIEW OF ESG RATING SYSTEMS

2.1 Definition and Scope of ESG Ratings

ESG is a set of metrics measuring a company's dedication to sustainable practices. The framework evaluates how companies respond to environmental issues such as climate change, resource depletion, and waste management; to social issues such as labor practices, diversity, and community relations; and to governance issues such as transparency, ethics, and accountability (MSCI, 2024). ESG ratings are not only about the profitability or returns to shareholders of a company; they exercise a broader view - the potential environmental damages, the gamut of social responsibilities to be fulfilled, and the many forms of governance that create a long-term picture of sustainability and propriety, that the firm epitomizes (Friede, et.al., 2015). By framing these dimensions into a single metric, ESG ratings give us a chance to gauge corporate resilience, risk management, and sustainability as a whole.

The rise in prominence of ESG ratings stems from the ability of global markets to recognize the need for sustainability at a corporate level for long-term success (Clark et.al., 2015). This has led to the rise of ESG-driven investment, colloquially referred to as 'sustainable', 'responsible' or 'impact' investments (Khan et al., 2016). The foundation to this set of beliefs is that superior environmental management, positive social responsibility and good governance will enhance the chance of a corporation managing material risks and taking much more advantage of new opportunities (Crifo & Forget, 2015). The reasoning is very plain: companies that do not keep up with environmental regulations, neglect the welfare of the surrounding communities, and/or exercise a non-transparent form of governance will stand a much higher chance of being in court, having their reputations ruined, or suffering disruptions of one type or another in their operations (Khan et al., 2016). In answer to these risks, a host of rating agencies have created ESG scorecard systems using their own methodology to assess and compare companies by means of this increasingly critical set of

non-financial factors. ESG ratings encapsulate three distinct but interrelated pillars: Environmental, Social, and Governance. While each pillar can be analyzed independently, the combined assessment provides a comprehensive picture of how well a company integrates sustainable and ethical practices into its business model (Lo & Sheu, 2007).

The environmental component of ESG investigates the various areas of ecological performance centered on the impact of various sources of pollution within the framework of environmental regulations already in place. It assesses carbon emissions, energy efficiency, waste management, pollution control, and commitment to the development of eco-friendly products and services (Clark et al., 2015). A company with superior environmental performance may try for more aggressive targets in reducing acquitted greenhouse gas emissions, invest in renewable energy, or establish circular economy concepts in order to mitigate the depletion of available resources (Friede et al., 2015). The poor practice usually adopted by such players includes careless steering of the sought-after control over pollution, along with the disregard for compliance with climate regulation, all of which engender lower ESG ratings. Usually, this means that there is increased potential for reputational damage and also likely legal liabilities. The social pillar of the review goes into detail with respect to how the Company relates with and organizes its connections with people: hence employees, customers, suppliers, and the wider community (Eccles et al., 2012). The metrics under this category often include labor practices, diversity and inclusion initiatives, human rights policies, and community engagement programs (Clark et al., 2015). Those with high scores on social expenditure may win accolades due to safe work conditions, fair pay, and good community relations. Accordingly, these companies are seen as benefitting from higher employee and customer contentments and less vulnerability to disruptions in their supply chain (Khan et al., 2016). Others, meanwhile, that sidestep their social responsibilities expose themselves to the risks of strike action by labor unions, boycotts by consumers, or reputational impact to their brand, commonplace events that are all injurious to long-term financial wellbeing.

Governance encompasses the internal systems, rules, and processes that dictate how decisions are made, implemented, and monitored within a corporation (Crifo & Forget, 2015). High governance standards typically imply transparent reporting, a balanced and accountable board of directors, ethical executive compensation practices, and a clear code of conduct for executives and employees (Lo & Sheu, 2007). Sound governance protects against corruption, fraud, and mismanagement, all of which can undermine shareholder trust and erode corporate value (Clark et al., 2015). Consequently, robust governance structures are considered a vital safeguard against both financial and reputational risks, further underscoring the significance of this pillar in ESG assessments.

When combined, the three pillars, environmental, social, and governance, offer a multilayered snapshot of an organization's overall approach to sustainable and ethical business (Friede et al., 2015). ESG rating agencies typically aggregate company-level data,

sometimes gathered from public reports, regulatory filings, and direct company disclosures, to generate a composite score (Khan et al., 2016). This process often involves weighing the three pillars differently based on industry relevance and materiality considerations. For instance, in energy-intensive industries, environmental factors might receive greater emphasis, while in consumer-facing sectors, social factors could be more influential in determining a company's overall ESG rating (Crifo & Forget, 2015). Providers of ESG scores and their approaches will be explained in the next subchapter.

Beyond assigning numeric or letter-based scores, ESG ratings can also include qualitative assessments, highlighting both best practices and areas of concern for each company (Eccles et al., 2012). These qualitative insights help stakeholders identify specific risks and opportunities, rather than relying solely on an aggregate score. For example, two companies might receive similar overall ratings but differ significantly in the environmental pillar, underscoring divergent approaches to climate change and energy efficiency (Lo & Sheu, 2007).

The growing use of ESG ratings among institutional and retail investors has led to increased scrutiny of company disclosures, encouraging more transparent and standardized reporting of sustainability initiatives (Clark et al., 2015). This "virtuous cycle" of higher disclosure standards and improved ratings, in turn, can bolster investor confidence, reduce capital costs, and enhance a firm's attractiveness to socially conscious consumers (Friede et al., 2015).

2.2 ESG Providers and their Approaches

Over the last decade, ESG ratings have taken center stage in establishing how well companies are responding to sustainability challenges and stakeholder concerns (Eccles et al., 2012). While quite a number of rating agencies exist such as MSCI, Bloomberg, two of the biggest and most used are the S&P Capital IQ Pro and the London Stock Exchange Group (hereinafter: LSEG). While their aims may be similar in assessing firms' non-financial performance, the two agencies vary in terms of their methodology, weightings across ESG factors, and data sources, generating often huge variations in their final scores. Using the ESG Scores, whereby scoring ranges from 0-100, with 100 being the maximum score, the company receives points on the question level (there are 120 questions on average asked concerning one single company), depending on the assessment of the underlying data points (up to 1,000 questions asked per company) through the lens of several pre-defined scoring frameworks assessing the following themes: availability, quality, relevance, and performance of any given company concerning the topics of ESG. These Question-level Scores aggregate up to what could be deemed the criteria-level reflecting the most material ESG themes depending on the sub-industry (up to 30 per firm). In combination with their appropriate groupings, the Criteria-level Scores correspondingly integrate into their corresponding Steering E, S, and G "Dimension Scores," which all funnel down into a single headline ESG Score for every firm; thus, as sustainability risks, opportunities, and impact

management are mainly industry-specific, they are explicitly measuring the overall sustainability performance of a company set in the context relative to other players within that industry (S&P Global, 2024). Offering a systematic, data-driven framework for assessing the ESG profile of any given company, S&P Capital IQ Pro generally works through analysis. Their methodology typically combines both quantitative and qualitative information, gleaned from company filings, regulatory documents, and reputable third-party sources (S&P Global, 2023). Within this framework, environmental factors can include metrics such as carbon emissions intensity, water usage, and energy efficiency, while social considerations might examine labor policies, community engagement, or product safety. Governance factors often encompass board structure, executive compensation, and shareholder rights. Depending on the industry, S&P Capital IQ Pro assigns different weights to each pillar. For example, in a high-polluting sector like chemicals, environmental factors may comprise 40–50% of the total ESG score, whereas for a consumer-facing industry, social issues could carry a higher weight. Below is a hypothetical distribution to illustrate how S&P Capital IQ Pro might weight these factors: 40% E / 30% S / 30% G

To form a final score, S&P Capital IQ Pro aggregates individual metrics within each ESG category, then normalizes the results to allow comparisons across companies and sectors (Clark et.al., 2015). A firm with strong environmental policies but weaker governance structures could see its overall score reduced, underscoring the agency's holistic perspective that subpar performance in one pillar can offset strengths in another. Companies are often grouped into percentile rankings or assigned numerical scores (e.g., on a 0–100 scale), enabling investors and stakeholders to quickly gauge how a firm compares to its peers.

LSEG which took over Refinitiv (Thomas Reuters), by contrast, applies a methodology that blends quantitative metrics with stakeholder-focused, qualitative insights (LSEG, 2023). Similar to S&P Capital IQ Pro, LSEG collects data from public disclosures, specialized databases, and direct corporate engagement; however, the London Stock Exchange Group places particular emphasis on emerging ESG themes, such as supply chain accountability or digital ethics, whenever these issues are deemed material for the sector in question (Friede et.al., 2015). A consumer electronics manufacturer, for instance, may be assessed heavily on resource sourcing and labor standards, while a financial institution could be scrutinized more on data privacy and responsible lending practices. As with S&P Capital IQ Pro, LSEG's weighting scheme varies by sector, but a typical breakdown might allot 35% to environmental indicators, 35% to social factors, and 30% to governance considerations.

One defining characteristic in S&P Capital IQ and LSEG's differences, however, is the reliance of the latter on a broader stakeholder perspective (Clark et al., 2015). To the extent that multi-stakeholder inputs inform its views, it has room to make holistic assessments of issues such as human rights and social justice that may not fall heavily on hard data. However, even with these overlaps, the two platforms could have fundamentally different outcomes concerning the ESG rating of the same company. One part of this divergence arises

from how each agency defines and applies the concept of "materiality." S&P Capital IQ may attend more to quantifiable risks (such as step carbon in dissent with industry averages), while the LSEG could devote equal or greater attention to emergent social factors (like workforce diversity and community relations). Lastly, the ingenuity behind how data is gathered, whether in a question that emerges from media analysis of a corporation or of corporate disclosures validation, means that all of this may be the cause behind another just even such reality. This means that a company may do very well in light of S&P Capital IQ Pro's guidelines due to the robustness of its environmental reporting and risk mitigation theories but fare worse in LSEG because its stakeholder feedback in relation to governance transparency did give way to some concerns (Eccles et al., 2012).

In summary, both S&P Capital IQ Pro and LSEG play significant roles in shaping how companies disclose ESG information and how investors integrate sustainability into their decision-making processes (Friede et al., 2015). While both agencies aim to measure the same core pillars, environment, social, and governance, their methodologies diverge in data sources, weighting, and the interpretation of material issues. Recognizing these methodological nuances is essential for companies, investors, and policymakers seeking a balanced view of a firm's sustainability profile. By comparing ratings from multiple providers, stakeholders gain a more textured understanding of ESG performance, enabling more informed choices in capital allocation, strategic planning, and policy development.

2.3 Greenwashing and Challenges of ESG Evaluation

Greenwashing has become a growing concern in ESG assessment, largely due to the increasing scrutiny of corporate sustainability claims and the growing role of ESG ratings in investment decisions. As companies seek to present themselves in a positive light, some may exaggerate or selectively showcase their environmental and social achievements, creating a misleading impression of their actual performance (Khan et.al., 2016). This practice can lead investors, consumers, and policymakers to base decisions on incomplete or inaccurate information, ultimately undermining the credibility of ESG evaluation. Furthermore, inconsistencies in measurement and reporting standards across different regions, particularly between Germany and the United States, make it even more challenging to compare firms' ESG performance and identify potential greenwashing practices. Dempere, Alamash, and Mattos (2024) highlight that such inconsistencies and selective disclosures not only distort the perceived sustainability of firms but also erode stakeholder trust and the integrity of sustainable finance, underscoring the need for stricter regulatory oversight and standardized ESG reporting frameworks.

One of the main issues contributing to greenwashing is the lack of uniform ESG disclosure standards. While international initiatives such as the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB) aim to bring more consistency to reporting practices, their adoption and enforcement vary significantly between countries. In

Germany, companies often have a longstanding tradition of stakeholder engagement and corporate responsibility, leading to more comprehensive sustainability reports. However, these reports frequently follow national guidelines that may differ from the disclosure frameworks commonly used in the United States, where ESG reporting requirements are still evolving and vary depending on the regulatory body (Khan et al., 2016). Without a globally unified benchmark, companies can strategically report favorable data while downplaying less impressive aspects of their environmental or social impact, making it harder for investors and stakeholders to assess performance objectively.

Across the European Union, in recent regulatory changes have significantly strengthened ESG disclosure obligations. In particular, the Corporate Sustainability Reporting Directive entered into force in January 2023, with implementation phases beginning in the 2024 financial year, which provides the regulatory framework for corporate reporting on sustainability. The CSRD supersedes and expands the Non-Financial Reporting Directive, extending mandatory sustainability reporting for nearly 50,000 EU companies and certain non-EU companies with significant operations in the EU. Depending on a company's subject matter and revenue metrics, certain companies and sectors have more stringent reporting standards. The CSRD identifies the European Sustainability Reporting Standards, which are a set of reporting standards on generally applicable and sector-specific environmental, social, and governance disclosures, and also environmental, social, and governance best practice disclosures. The sustainability disclosure standards are in line with the EU Green Deal and Sustainable Finance Disclosure Regulation to ensure comparability, reliability, and auditability of sustainability disclosures across EU member states, which intends to limit greenwashing and reassure investors and stakeholders (European Commission, 2024).

Another challenge lies in the subjectivity and inconsistency of ESG ratings. Different rating agencies use distinct methodologies, weighting systems, and data sources, leading to significant discrepancies in how companies are evaluated (Friede et.al., 2015). For example, a German automotive firm might receive a high ESG score from one rating provider due to strong environmental initiatives, while another agency in the U.S. may assign a lower rating if it prioritizes social factors such as labor practices or community relations. This variation allows firms to highlight the most favorable ratings while downplaying less favorable assessments, ultimately creating a skewed public perception of their ESG standing. As a result, making direct comparisons between companies operating under different regulatory frameworks, such as in Germany and the United States, becomes increasingly difficult.

Another critical factor contributing to greenwashing is limited transparency in ESG data collection and reporting. Many companies rely on self-reported metrics, such as carbon emissions, energy efficiency, and workforce diversity, which may not always undergo rigorous external verification. While some organizations conduct independent audits, the scope and depth of these assessments can vary widely. Smaller firms often lack the resources for extensive sustainability audits, while larger corporations may have the ability to craft

narrative-driven ESG reports that frame their performance in the most favorable light. Even when third-party audits are conducted, differences in regulatory requirements, such as Germany's strict data privacy laws, can limit what information is disclosed to rating agencies. The result is a fragmented and inconsistent ESG reporting landscape, where stakeholders struggle to differentiate between genuine sustainability efforts and exaggerated claims (Eccles et.al., 2012).

The contrast between German and American firms further illustrates how regulatory and cultural factors shape ESG evaluations. German companies often operate under greater public and political pressure to demonstrate environmental responsibility, reflecting the country's strong civil society engagement and historical emphasis on sustainable business practices. In contrast, U.S. companies tend to operate in a market-driven environment where financial performance and competitiveness are key priorities. While many American corporations are expanding their ESG commitments in response to investor demand and potential regulatory changes, adoption rates and disclosure practices still vary significantly. For example, a German manufacturing firm might focus on eco-efficiency and climate initiatives in response to strict national policies, whereas a comparable U.S. firm might prioritize shareholder returns, only making ESG adjustments when faced with clear market incentives. These differences in ESG priorities make cross-border comparisons more complex, especially when local regulations, public expectations, and corporate strategies influence sustainability reporting. ESG investing continues to grow in Europe, where environmental concerns are deeply embedded in policymaking and corporate strategy, while in the United States ESG adoption remains more market-driven and reactive, often following investor pressure rather than stemming from an established culture of corporate responsibility. This is further highlighted by reports that European climate regulations, unlike the more fragmented approach in the U.S., are becoming a top priority for global firms aiming to stay competitive in the EU market(Financial Times, 2023).

Beyond its impact on investor perceptions, greenwashing also poses serious reputational and financial risks for corporations in both Germany and the United States. As ESG considerations become more embedded in investment decisions, companies that inflate their sustainability credentials risk severe backlash when inconsistencies are exposed. Investors may lose confidence, consumers may boycott brands, and regulators may impose fines and sanctions. In markets like the United States, where litigation is more prevalent, companies could also face class-action lawsuits over misleading ESG claims. Similarly, German firms found to be misrepresenting their sustainability efforts may be subject to strict penalties under environmental protection laws. These risks highlight the need for greater oversight, transparency, and accountability in ESG reporting and ratings (Khan et al., 2015).

Addressing the challenges of greenwashing and improving ESG evaluations require both regulatory intervention and enhanced standardization in sustainability metrics. Efforts to align global reporting frameworks, such as the work of the International Sustainability

Standards Board (ISSB), could help create greater consistency in ESG data across different markets. By establishing clear and enforceable disclosure rules, such initiatives could help minimize greenwashing opportunities and ensure that ESG performance is measured more accurately. However, significant gaps remain, particularly in how Germany and the United States approach ESG regulation and enforcement. Germany has taken a more proactive regulatory stance, while ESG reporting in the U.S. remains fragmented, with different agencies and institutions setting varied requirements. These differences, coupled with biases in ESG rating methodologies and limited transparency in self-reported data, continue to create challenges in assessing corporate sustainability performance and distinguishing genuine ESG leaders from those making superficial or misleading claims.

By acknowledging these issues and working toward more consistent ESG evaluations, stakeholders, including investors, regulators, and businesses, can help foster a more trustworthy and transparent ESG landscape. Companies, in particular, must take steps to strengthen internal ESG controls, embrace independent audits, and adhere to emerging global standards to ensure that their sustainability claims reflect actual performance. At the same time, regulators and financial institutions must push for stronger enforcement measures and more harmonized reporting frameworks to combat greenwashing and maintain the integrity of ESG assessments. Only through greater transparency, accountability, and cross-border cooperation can ESG ratings serve their intended purpose: providing investors and stakeholders with a clear, reliable, and comparable picture of corporate sustainability efforts.

3 CONCEPT OF WACC

3.1 Definition of WACC

The Weighted Average Cost of Capital (WACC) is a fundamental concept in corporate finance, that represents the overall cost of capital for a firm, derived from the required rates of return expected by both shareholders (equity holders) and creditors (debt holders) who supply the company with financing. It is, in essence, the average rate at which a company is expected to pay the funds it raises. According to Brealey, Myers, and Allen (2020), WACC serves as a benchmark for evaluating a company’s investment projects and is pivotal for determining how efficiently a firm uses its capital resources. While various models can add more complexity, such as including preferred stock or other hybrid securities, WACC is most commonly expressed in terms of two primary sources of financing: equity and debt. WACC is a common way to determine the required rate of return (RRR) because it expresses, in a single number, the return that bondholders and shareholders demand in return for providing the company with capital. A company's WACC is likely to be higher if its stock is relatively volatile or if its debt is considered risky because investors will want greater returns to compensate them for the level of risk (Investopedia, 2024).

The cost of equity represents the return demanded by shareholders for investing in the company's stock. In practical terms, it is the rate of return that shareholders expect based on the perceived risk of holding the firm's shares instead of other potential investments (Berk & DeMarzo, 2021). A widely used model to estimate this required return is the Capital Asset Pricing Model (CAPM), which posits:

$$Cost\ of\ Equity = R_f + \beta * (R_m - R_f) \quad (1)$$

Where:
R_f- risk free rate (gov bond yields)
β - firms beta (systematic risk)
R_m- expected market return
$(R_m - R_f)$- market risk premium

Shareholders demand higher returns as a firm's systematic risk (β) increases, reflecting the greater volatility of the firm's stock price compared to the overall market (Ross et.al., 2021). This cost of equity also captures implicit factors such as dividend expectations and potential capital gains. In practice, managers often adjust for additional firm-specific risks or use alternative models, like the Dividend Discount Model (DDM), particularly if the company maintains a consistent dividend policy. DDM could be used for companies with a stable dividend policy as a proxy to determine the cost of equity, where the cost of equity can be determined by combining the dividend yield and expected dividends growth, the latter of which could be estimated by historical data, analyst forecasts or by a sustainable growth rate based on return on equity and retention ratios. In addition to these normative measures, practitioners could make adjustments for firm-specific risk including small-cap premiums, country risk premiums to reflect international operations, or project-specific risk not fully represented by beta. Ultimately, while models developed like CAPM provide an established theoretical basis, the practical application of estimating cost of equity is reliant on proxies and context based adjustments to develop rates representing expected rates of return for shareholders.

The cost of debt is the effective rate a company pays on its borrowed funds. While it may initially seem straightforward, often approximated by the yield to maturity on corporate bonds or the interest rates on loans, there are subtleties that can impact this measure. In practice, the most direct measure of the cost of debt for publicly traded bonds is the yield observed in the secondary market, while for bank loans it is based on contractual interest rates. Because interest expenses are tax-deductible in most jurisdictions, analysts usually calculate the after-tax cost of debt by multiplying the pre-tax cost by one minus the firm's marginal corporate tax rate. Proxies are often necessary when market data is unavailable, such as using yields on similarly rated corporate bonds from the same industry and credit rating category, or estimating rates based on sovereign yields plus a credit spread derived from the firm's perceived risk profile. Credit ratings from agencies such as Moody's, S&P, or Fitch provide a widely accepted benchmark for estimating the appropriate credit spread.

Specifically, the interest a firm pays on its debt is typically tax-deductible (Brealey et al., 2020). As a result, the effective cost of debt is often adjusted downward to account for the tax shield.
Formally:

*After-Tax Cost of Debt= Rd * (1-T)* (2)
Where:
Rd- nominal or stated interest rate on debt
T- marginal corporate tax rate

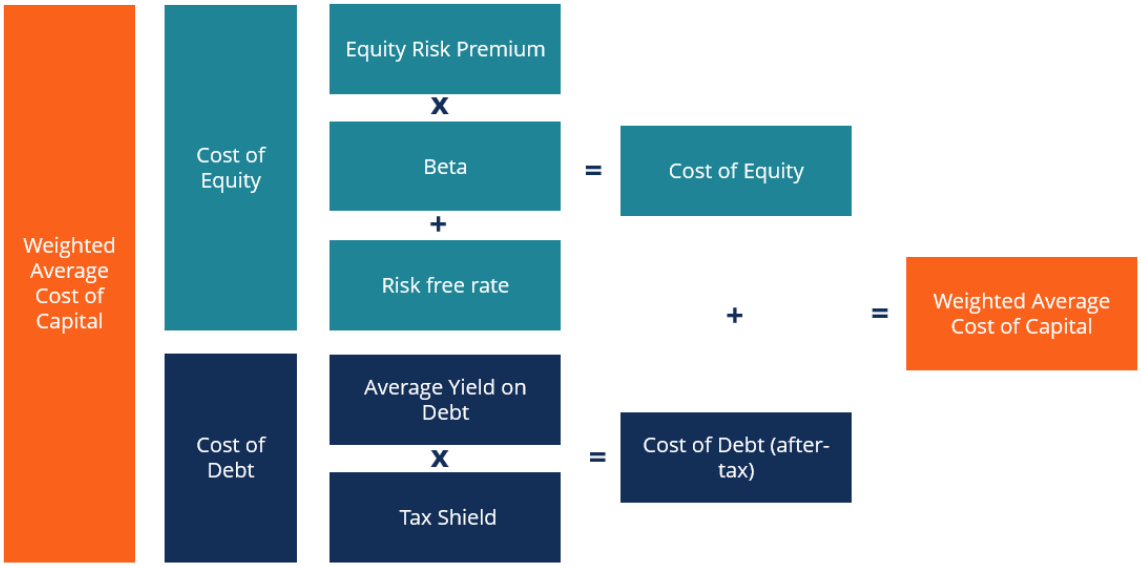
For instance, if a company borrows funds at a 6% interest rate and has a corporate tax rate of 25%, its effective after-tax cost of debt becomes 6%× (1−0.25) =4.5%. This tax shield makes debt financing relatively cheaper than it might appear on the surface and is one of the primary motivations for firms to utilize leverage in their capital structure (Damodaran, 2012).

Once the individual costs of equity and debt have been determined, the firm combines these components to form the Weighted Average Cost of Capital. The most common WACC formula (Ross et al., 2021) is:

*WACC= E/(E+D) * re + D/(E+D)* rd* (1-T)* (3)
Where:
re-cost of equity
rd-cost od debt
T-marginal corporate tax rate

The ratios E/(E+D) and D/(E+D) represent the proportion of financing that comes from equity and debt, respectively. These proportions (or "weights") multiply the respective costs, yielding an aggregate figure that denotes the company's overall financing expense. The idea behind WACC is that every dollar a firm raises, has a particular cost attached to it, and these costs should be averaged according to how significant each source is to the firm's total capital structure (Berk & DeMarzo, 2021). In Figure 1 below we can see visual example of calculatin WACC.

Figure 1: Visual calculation of WACC



Source: Corporate Finance Institute (2024).

WACC serves a purpose beyond merely being a weighted average of financing costs; it plays a crucial role in strategic decision-making. When a company considers embarking on a new project or expansion, it typically discounts the anticipated cash flows using the WACC to assess the project's financial feasibility. A project is generally deemed worthwhile if its internal rate of return (IRR) exceeds the WACC, as this indicates that the investment is likely to yield returns that surpass the overall cost of capital (Brealey et al., 2020). Additionally, WACC is frequently utilized as a benchmark for evaluating the performance of the firm. By comparing the firm's return on invested capital (ROIC) with the WACC, stakeholders can determine whether the company is creating or eroding value. A consistent ROIC that exceeds WACC suggests that the firm is generating excess returns for shareholders, while a ROIC that falls below WACC may signal underperformance or inefficient capital utilization (Damodaran, 2012).

Furthermore, companies carefully analyze WACC when establishing their optimal capital structure, which is the equilibrium between debt and equity that minimizes the overall cost of capital. The tax-deductibility of interest can make the inclusion of debt advantageous in reducing WACC; however, excessive reliance on debt can lead to financial risk and potential distress costs, which, if significant, may increase WACC. Consequently, financial managers strive to determine a debt-to-equity ratio that achieves an appropriate balance, considering both the tax benefits of debt and the financial security provided by equity (Ross et al., 2021). This optimal structure will be explored in greater detail in the subsequent section.

By dissecting WACC into its key components, cost of equity and cost of debt, it becomes clear that each category of capital brings with it unique risks, expectations, and potential benefits for the firm. Shareholders bearing higher risk, demand returns that reflect market volatility, while debt holders receive interest payments that are fixed but less lucrative. When these costs are combined in proportion to their usage in the firm's capital structure, the resulting WACC illuminates the baseline return a company must achieve on its investments to satisfy all of its capital providers.

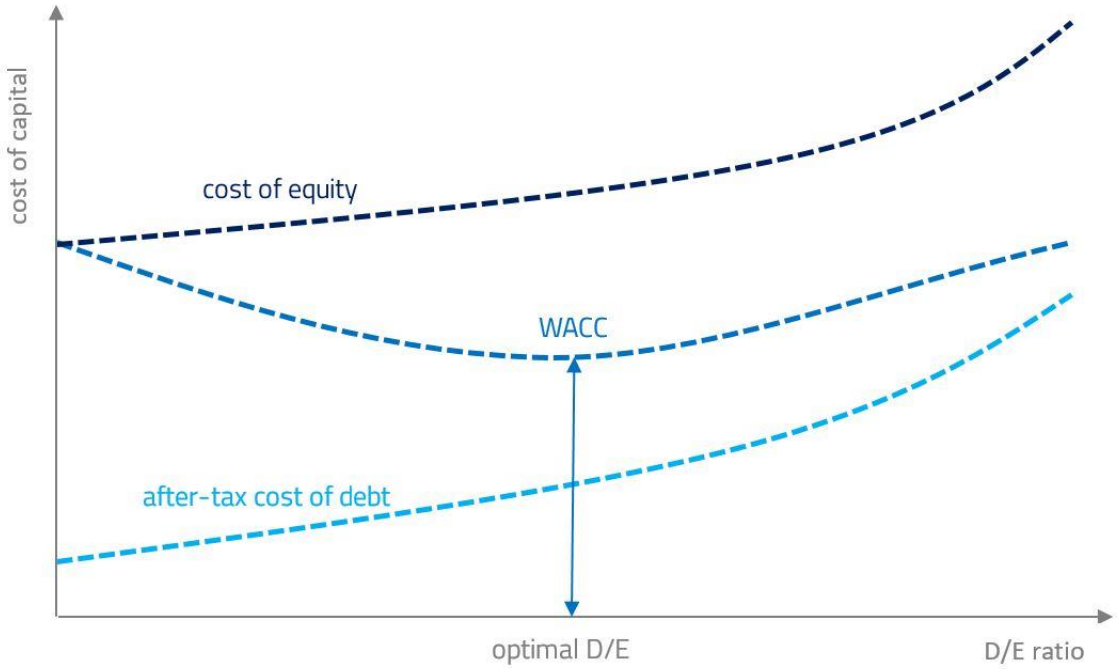
This overarching measure is essential not only in project valuation and performance assessment but also in strategic considerations regarding corporate financing. As global financial markets continue to evolve, understanding the mechanisms behind WACC remains a cornerstone of sound corporate finance practices, ensuring that firms allocate resources efficiently and maintain a balance between growth opportunities and risk management.

3.2 Optimal Capital Structure

In the previous subchapter I briefly mentioned capital structure so here I am going, with visual graph, representing the meaning of optimal capital structure. Determining the appropriate mix of debt and equity, often referred to as the capital structure, remains a central issue in corporate finance. The pursuit of an optimal capital structure is driven by the goal of minimizing the company's overall cost of capital (Brealey et.al., 2020). In theory, if a firm's cost of capital is minimized, its valuation should be maximized, as investors assign higher worth to companies that manage risk efficiently and generate stable returns.

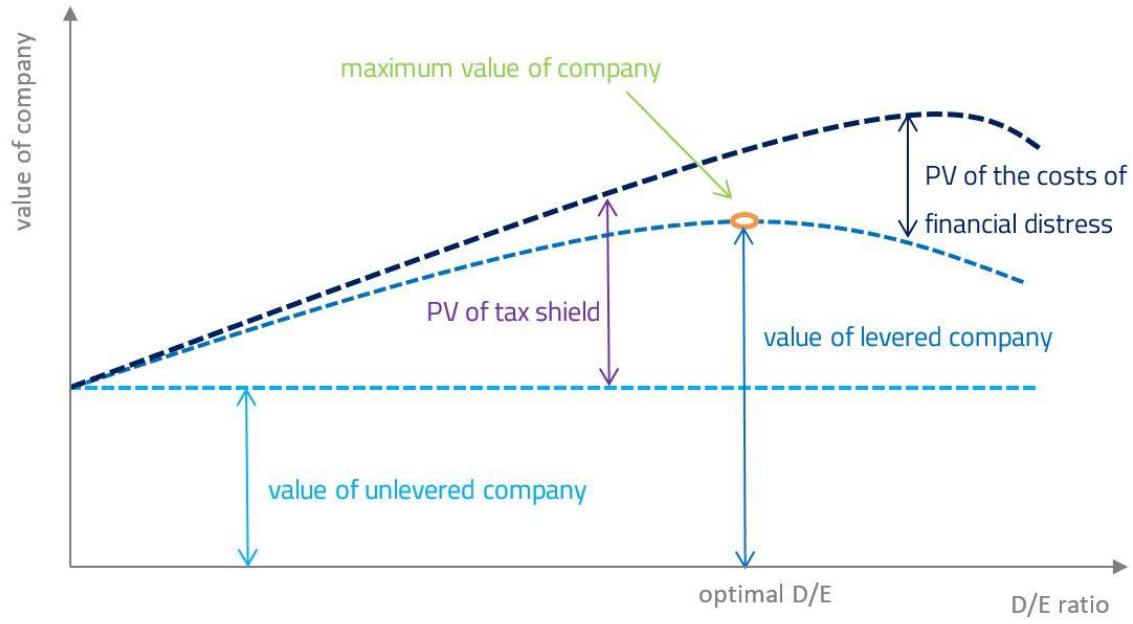
A key intellectual foundation for understanding capital structure choices is provided by the Modigliani–Miller (M&M) propositions. In their original form (Proposition I), Modigliani and Miller (1958) argue that in a world without taxes or transaction costs, a firm's value is independent of how it finances itself, whether fully with debt, fully with equity, or any combination in between. However, once taxes are introduced (Proposition II with taxes), the theory suggests that employing debt can confer a tax advantage because interest payments are usually tax-deductible. This tax shield effectively reduces the after-tax cost of debt, thereby lowering the firm's WACC and increasing firm value (Ross et.al., 2021). Shown in Figure 2 below is a visual representation of WACC and its two components cost of equity and after tax cost of debt.

Figure 2: Visual representation of WACC



Source: Soleadea(2024).

Figure 3: Static trade-off theory



Source: Soleadea (2024).

Shown in Figure 3 above is a depiction of static trade-off theory. Despite the clear theoretical appeal of taking on debt to reap tax benefits, practical considerations complicate the equation. Real-world capital markets involve transaction costs, the potential for financial distress, and the risk of bankruptcy. As leverage (i.e., debt usage) increases, the likelihood of being unable to meet interest obligations under adverse conditions also grows, potentially leading to higher costs of financial distress. These may take the form of legal fees, liquidation expenses, or reputational damage if the company struggles to service its debt (Berk & DeMarzo, 2021). The "trade-off theory" therefore posits that companies balance the tax advantages of debt against the rising risk premiums demanded by lenders and the possibility of default.

Moreover, high leverage can adversely affect operational flexibility, as firms must allocate significant cash flow to debt servicing rather than reinvestment or shareholder returns. Creditors may impose covenants or restrictive conditions that limit strategic choices and hamper growth opportunities (Brealey et al., 2020). As a result, while moderate debt use can reduce the WACC, excessive borrowing can quickly negate these benefits by increasing the cost of both equity and debt due to perceived risk.

In practice, firms often gauge their capital structures by comparing industry norms, maintaining a buffer of liquidity, and considering the preferences of both shareholders and bondholders. Other perspectives, such as the pecking order theory, highlight how information asymmetries may lead firms to prefer internally generated funds first, then debt, and finally external equity. Overall, the optimal capital structure is context-specific, evolving as market conditions, firm strategy, and regulatory environments shift. By carefully balancing the tax shield of debt against the escalating risks of leverage, companies aim to achieve a mix of financing that both minimizes their WACC and maximizes shareholder value.

3.3 Factors Influencing WACC

Since this thesis focuses on how ESG influences WACC, it's important to remember that WACC is shaped by many different factors beyond ESG. WACC is influenced by a complex interplay of macroeconomic factors and company-specific decisions. Market conditions like interest rates, economic uncertainty, and tax policy all affect a firm's cost of capital, just as internal choices regarding capital structure and dividend strategy do. Companies that manage these variables strategically can optimize financing costs and ultimately enhance value for shareholders and stakeholders alike.

One of the most significant external factors is interest rates, which directly impact how much a firm must pay to borrow. When market interest rates rise, lenders require higher returns, increasing the cost of debt (Berk & DeMarzo, 2021). Conversely, in a low-interest

environment, companies can secure cheaper financing, which helps bring down their overall WACC. Another key external influence is market risk, often reflected in a company's beta or broader economic conditions that affect investor sentiment. During periods of high uncertainty or market volatility, investors tend to demand higher equity returns to offset the increased risk (Ross et.al., 2021). This pushes up the cost of equity and, in turn, WACC.

Economic uncertainty is another macroeconomic variable that has a substantial impact on WACC. During recessions, geopolitical tension, and market volatility, investors will demand higher risk premiums on both debt and equity. The increased perceived risk widens credit spreads on corporate bonds and increases the equity market risk premium, all of which increase capital costs. In times of economic uncertainty and market volatility, even the most creditworthy corporations face comparatively higher costs of financing, which is due to not just their corporate performance but also the general level of risk in the market. When there is economic stability and optimism, WACC is lower since risk premiums are narrowed, and firms engage in more aggressive and speculative investment and expansion.

Tax policies also play a crucial role. In many countries, interest expenses on debt are tax-deductible, which reduces the after-tax cost of debt. This tax shield effect can lower WACC, but its impact depends on corporate tax rates and a firm's ability to utilize tax benefits (Brealey et.al., 2020). Any policy changes affecting these deductions can significantly shift a company's cost of capital.

In addition to macroeconomic variables, there are company-specific variables that have a stronger impact on WACC. One of the most significant variables is capital structure, or the mix of debt and equity used to finance a company's operations. Firms with high leverage may experience increased costs for both debt and equity, as creditors and investors see them as financially riskier (Berk & DeMarzo, 2021). But excessive leverage exposes companies to financial risk, which will increase the cost of both debt and equity since creditors will more than likely demand higher yields, and owners will require a higher return due to increased risk of default. As a result, the relationship between leverage and WACC is non-linear: reasonable levels of debt may reduce the weighted average capital model, past a certain point, the risk premium eclipses the tax benefit.

Besides leverage, dividend policy is another internal factor, that indirectly impacts WACC. A company that has provided stable and predictable dividends is, understandably, lower risk, thus providing shareholders with a lower cost of equity. Conversely, companies that provide irregular dividends, like sporadically issuing dividends or paying unsustainably high dividends, are likely viewed as financially constrained, driving up required returns. Retained earnings, which is an internal form of equity capital, affects WACC because it reduces the need to depend on external capital markets to fund itself, however its still an opportunity cost to equity financing based on expected returns by shareholders.

In recent years, ESG performance has emerged as an increasingly important factor influencing WACC, acting as both a risk mitigator and a value driver. Strong ESG practices can lower a firm's perceived risk profile, reducing the required return for both debt and equity investors. Credit rating agencies and lenders may reward companies with credible sustainability strategies through tighter credit spreads, while equity investors may apply lower risk premiums to firms demonstrating resilience to environmental and social risks. Conversely, weak ESG performance or evidence of greenwashing can increase financing costs by eroding investor trust, heightening regulatory scrutiny, and raising the likelihood of reputational damage. In the next chapter, we will explore risk management theory, stakeholder expectations, and key empirical studies that examine the impact of ESG on WACC.

4 RELATIONSHIP BETWEEN ESG AND WACC

A company's cost of financing is impacted by ESG rankings in two big ways, which I will explain in the next two subchapters. ESG ratings, on the one hand, show risk, or more precisely, how well a business's activities are shielded from hazards related to the environment, society, and governance (risk management theory). On the other hand, ESG assessments of companies influence market stakeholders whose behavior has a strong impact on the future performance of the company (stakeholders' expectations).

Incorporating ESG practices into corporate strategy is becoming an essential factor in shaping a company's WACC. ESG influences both the firm's risk profile and the expectations of key stakeholders, ultimately affecting the cost of borrowing and equity financing. From a risk management perspective, strong ESG performance signals that a company is proactively identifying and mitigate potential risks, such as regulatory penalties, environmental liabilities, or reputational damage. By demonstrating responsible business practices, firms reduce uncertainty for investors and creditors, which can lead to lower borrowing costs and more stable equity pricing (Friede et.al., 2015).

Beyond risk reduction, ESG also shapes a company's relationship with key stakeholders, including customers, employees, regulators, and the broader community. As sustainability and corporate responsibility become more important, firms that align with these values are more likely to attract socially conscious investors and maintain a strong reputation in the market (Eccles et.al., 2012). This, in turn, can help lower reputational risks, improve brand loyalty, and provide access to cheaper capital. On the other hand, companies that fail to meet stakeholder expectations, whether in areas like carbon emissions, labor conditions, or governance transparency, may see their risk profile increase. A poor ESG track record can lead to a higher equity risk premium and increased borrowing costs, making it more expensive to raise capital. In this way, ESG acts as both a defensive strategy, protecting the firm from financial and reputational harm, and a strategic advantage, appealing to investors who prioritize long-term stability and responsibility. When effectively integrated into

corporate decision-making, ESG can help drive down WACC by reducing perceived risk of the company.

4.1 Risk Management Theory

Risk management theory offers organizations a structured framework to identify, analyze, and respond to the various threats that can undermine their operations, competitiveness, and financial stability. At its core, this theory recognizes that every business, regardless of size or sector, faces uncertainty in achieving its objectives. Risks may arise from multiple sources, economic downturns, operational missteps, competitive pressures, regulatory changes, or even reputational damage (Brealey et.al., 2020). By systematically addressing these uncertainties, companies can safeguard their assets and, ultimately, sustain long-term growth.

One fundamental concept in risk management theory is risk identification, where organizations catalog possible events or conditions that might prevent them from meeting their strategic goals. In finance, for example, interest rate fluctuations, currency volatility, or counterparty defaults can pose significant threats. Similarly, in operations, supply chain disruptions or technological failures may hinder day-to-day efficiency. Recognizing these risks early allows firms to anticipate potential setbacks, rather than simply reacting once problems materialize (Berk & DeMarzo, 2021).

ESG rankings become an integrated part of a wider risk management framework. Such integration into corporate governance allows the firm to identify and minimize the risks that might otherwise impair their legally mandated posture, public reputation, or sustainable future. That equates not only to mitigating potential losses but also to positively aligning their strategic goals with the expectations of the stakeholder community. In the end, this drives nevertheless their perceived risk lower, allowing the reduction of the WACC. When investors perceive that the risk profile of the firm is well managed because of the high ESG scores, they will do with lower return compensation because their exposure is less; hence, the WACC of their company is lower. Yet, empirical research tells a more complex story of how ESG risks might surface in financial outcomes. Löffler (2023), for example, found that companies with poor ESG ratings should expect significantly higher tail and variance risks, indicating greater exposure to potential extreme negative events. Investors tend to demand higher returns to overcome these risks, raising the firm's cost of capital as a consequence. Conversely, good ESG performers are subject to fewer sudden or systemic shocks, thus securing financing at more favorable terms. This dynamic illustrates how perceptions of environmental or social vulnerabilities directly shape investor sentiment.

Giakoumelou et al. (2022) further consolidates the protective role of ESG by showing how a robust performance on ESG can buffer against the loss of investor confidence during times of crisis. Their research reveals that, in times of increased market uncertainty and

asymmetrical information, ESG scores were of even greater significance, as observed during both the 2008 financial crisis and the COVID-19 pandemic. In the case of the earlier crisis, social and governance criteria predominated investors' focus, while environmental issues took the lead in the more recent crisis. These findings depict a shift in investors' focus on various dimensions within the ESG spectrum, depending on the flavor of the crisis, with a general consensus that, indeed, good ESG performance acts as a shield against downside risk and helps maintain some level of investor confidence. The evidence as discussed does bolster the contention that good risk management practices that are adequately leveraged by a proper acquiescence to ESG issues could go a long way toward assuring a lower cost of capital for the company. Firms that choose to ignore ESG considerations, or do not learn to do so adequately, may find risk premiums emerging for them and capital markets quite jittery. On the other hand, when ESG concerns become part of the decisions on risk management as well as macro strategic planning, they would probably prove to be more resilient and less prone to shocks of an unexpected nature, while, at the same time, any such firms have a higher likelihood of enjoying competitive advantage as a consequence of lower-cost funding attracted their way. In turn, as the audit value of ESG metrics climbs among regulators, investors, and society in general, it's the companies that convert ESG into an opportunity proper with proactive actions that are more likely to preserve, for their stakeholders and shareholders alike, their very image as well as their very balance sheets in the long run.

4.2 Stakeholder Expectations

Stakeholder expectation theory suggests that a company's long-term success depends on how well it manages relationships with various groups that have a vested interest in its operations. These stakeholders include not just shareholders but also employees, customers, suppliers, local communities, and regulatory authorities (Freeman, 1984). Traditionally, corporate finance focused on maximizing shareholder returns, but in today's business landscape, firms are increasingly evaluated based on how they meet broader stakeholder expectations. A company's ability to secure critical resources and maintain its market standing is now closely tied to its responsiveness to these expectations, particularly in areas like environmental, social, and governance (ESG) performance (Eccles et.al., 2012).

As ESG considerations take on a more central role in business strategy, firms that actively incorporate sustainability, ethical labor practices, and transparent governance into their operations tend to foster greater trust among stakeholders. This alignment not only strengthens a company's reputation but can also reduce the risk of regulatory penalties, legal disputes, and reputational damage. From an investor's standpoint, a strong ESG record is often viewed as a sign of lower financial and operational risk, making the company more attractive to lenders and equity holders (Friede et.al., 2015). As a result, businesses that proactively manage ESG-related risks may benefit from lower financing costs, since investors and creditors perceive them as more stable and resilient over the long term. This

confidence can contribute to a reduction in the firm's WACC by lowering the risk premiums required by both debt and equity providers.

On the other hand, failing to address stakeholder concerns related to ESG can lead to increased financing costs. Companies that disregard social or environmental responsibilities may face public backlash, regulatory fines, and reputational harm, all of which can make them appear riskier to investors. When financial markets perceive a company as exposed to heightened uncertainty, investors often demand higher expected returns, leading to an increase in WACC (Khan et.al., 2016). Additionally, some investor groups, such as socially responsible investment funds, may exclude companies with poor ESG track records from their portfolios altogether, further limiting access to capital.

At its core, stakeholder expectation theory highlights that financial performance alone does not determine a company's cost of capital. Instead, firms are increasingly evaluated based on their ability to meet societal and ethical standards. Businesses that align with stakeholder expectations on ESG issues often gain access to more favorable financing terms, whereas those that fall short may see their risk premiums rise. In this way, ESG performance serves both as a strategic advantage and a risk management tool, reinforcing the connection between corporate responsibility, investor confidence, and the firm's ability to optimize its WACC.

4.3 Overview of Previous Empirical Research

Evaluating the complex link between ESG factors and the cost of capital is dependent on a range of rigorous methodologies, which may vary depending on the primary research questions, data availability, and analytical focus. Although the primary objective of many studies is to investigate whether desirable ESG performance is associated with lower costs of capital, the methodology the researchers undertake to examine this connection can vary dramatically. A review of the methodologies used in recent published research shows conventional shared practices, reflective of the field of empirical finance, as well as quite heterogeneous decisions with respect to samples, data, and analytical focus. Knowing the methodological nuances of these studies provides the necessary context for interpreting differences among their findings and is also valuable as a starting point for designing rigorous empirical research in this space.

The study written by Atan, et.al. (2021) significantly addresses the implications for ESG factors and dimensions of firm performance (the cost of capital being one dimension), and in this case specifically in the context of Malaysian firms. Their research design is quantitative, acknowledging the use of panel data methodology over the course of a defined period with a population of 54 public limited companies listed on Bursa Malaysia carefully selected using available ESG and financial data from the Bloomberg database. The period for their data collection spanned 4 years from 2010 to 2013. The author's main independent

variable is the ESG score, pro-rated based on discrete levels of environmental, social, and governance information that a company publishes, from a minimum of 0.1 to a maximum of 100, supplied by Bloomberg, in terms of when it was reported. To evaluate lagged effects, which are when researchers consider time delays, where non-financial factors classify research studies that evaluate financial outcomes as lagged effects, the authors include the Bloomberg ESG score from the previous period in their primary regression models.

The dependent variables part of the Atan et al. study utilizes three specific measures of firm performance: profitability, captured using ROE; firm value, captured using Tobin's Q; and cost of capital, quantified on the basis of WACC. All financial measures including ROE, Tobin's Q, and WACC come directly from Bloomberg and all financial measures were calculated using Bloomberg's internal calculations. In addition to the ESG variable, the study included two control variables measured as standard practice or common and extended literature link non-financial factors to firm performance: Financial Leverage and Firm Size. Leverage is defined and calculated by firm's total liabilities as a ratio against is total equity capital. This is the normal conventional way of thinking about and financially quantifying a firm's leverage or debt and in terms of debt-to-equity ratios. Firm Size is measured using the natural log of firm's total assets, the most common type of proxy for systematically controlling for scale among firms. The authors provide a theoretical rationale for including these controls, suggesting that manager behavior regarding ESG disclosure might be influenced by leverage due to creditor scrutiny, and that firm size has been positively linked to corporate social responsibility disclosure in prior research.

To estimate the relationships between the variables, Atan et al. utilize static panel regression techniques. They apply three distinct estimation methods: pooled OLS, fixed effects (FE), and random effects (RE) models. The pooled OLS approach is acknowledged for its simplicity but is noted as restrictive due to its implicit assumption that intercepts and slopes are constant across all sampled companies. The fixed effects model offers a more nuanced approach by allowing for company-specific intercepts, thereby effectively controlling for any time-invariant unobserved characteristics unique to each firm. The random effects model, while requiring fewer degrees of freedom and thus potentially more efficient, assumes that the random variations across companies are uncorrelated with the included explanatory variables and that the firm-specific effects are time-invariant and independent of the regressors. The study employs the Hausman test to statistically determine the most appropriate and efficient estimator among the three available panel methods. The data used for dependent and control variables span from 2011 to 2013, while the lagged ESG variables are drawn from the 2010-2012 period. All variables, except for the binary or count variables if any, are transformed into their natural logarithmic form before inclusion in the regression analysis. The model comparison statistics of the Hausman test always suggests that the fixed effects estimator is statistically the most efficient to examine all the hypotheses in their research study, so the authors use the fixed effects models in their study and interpret the results predominantly based on the fixed effects models results (Hausman, 1978). The

reasoning behind the selected models shows the authors view firm-specific unobservable heterogeneity is essential to control in this sample.

In the fixed effects model assessing the influence of the lagged overall ESG score on WACC (Model 3.1), Atan et al. report a positive and significant coefficient of 0.120 ($p<0.05$). Higher lagged overall ESG scores appear to be positively associated (in terms of worse ESG) with WACC for the Malaysian sample of companies, suggesting that in the sample of Malaysian companies during their full sample period (2010–2014), as WACC increases, it will have a lower average lagged overall ESG score. The control variables in model 3.1 show that Leverage has a positive and significant (0.087, $p<0.01$) for their preferred fixed effects model. While it is pointed out that Leverage was the only factor that is consistent with financial theory (higher leverage), they also see Size show a negative coefficient (-0.065, its p-value >0.10; it is not significant). When they analyze the aggregated ESG score by its pillars of ESG (E, S, G), they do find a positive and significant coefficient for the lagged E score on the cost of capital (0.056, $p<0.05$) and positive but insignificant coefficient for the lagged S score (0.008, $p>0.10$), and then a positive and significant coefficient for the lagged G score (0.056, $p<0.05$) (Table 4, Model 3.2). Overall, their consistently positive association of lagged ESG scores and WACC, at the aggregate and in their preferred fixed effects model, is a significant finding when most theories posit that higher ESG scores would lower the cost of capital. This observation, it might suggest instead that that there might be particular market characteristics and properties, or possibilities associated with the period in which Indonesia was observed for its ESG integration in Malaysia, that might reflect at this time in a reversed association to the expected relationship.

In stark contrast to a longitudinal panel study, Ernst and Woithe (2024) investigate the effect of ESG ratings on the cost of capital based on data from a cross-sectional dataset of S&P 500 index firms on one specific point of time: November 24, 2022. The sample for their study included 498 firms considered part of the S&P 500 on November 24, 2022, with relevant data available for that date. The authors sourced financial data from Bloomberg, while the ESG ratings and score data were based on MSCI, a leader in ESG research and analytics. The study analyzes the association between ESG performance and three measures of the cost of financing: cost of equity (re), cost of debt (rd) and WACC. The independent variables are MSCI ESG ratings (which range from AAA, best, to CCC, worst, on a seven-point alphabetical scale), as well as continuous MSCI ESG scores (range from 0 to 10).

The methodology used by Ernst and Woithe follows a fairly simple three-step process. The first step is descriptive, classifying the firms we sampled into three large classifications derived from MSCI ESG ratings: Leader (AAA and AA ratings); Average (A, BBB and BB ratings); Laggard (B and CCC ratings). In each of these categories when descriptive statistics for the cost of capital measures are fixed across firms, they compute a rich array of descriptive statistics (for example minimum, first quartile, median, third quartile, maximum, mean) for the central tendency, and second and third moments (for example standard

deviation, coefficient of variation, skewness and excess kurtosis). This process is descriptive but does reveal in a preliminary way some differences in the characteristics and distribution of the cost of capital measures at different ESG performance ratings.

The second step moves to assessing the potential for a linear relationship between the continuous ESG score and all three measures of cost of capital. This is done using the correlation between the two variables using Pearson's correlation coefficient (Rxy), which is the common measure of linear association. The magnitude of the computed correlation coefficient is interpreted using Cohen's (1988) guide, where coefficient absolute values of 0.1, 0.3, and 0.5 are commonly described as small, medium, and large effect sizes, respectively. The third step, with conditions on a small linear correlation, consists of doing a linear regression. A significant and rigorous element of this step is to confirm the underlying conditions for valid linear regression inference. Specific criteria include time series independence of the data, normally distributed residuals, and homoscedasticity (i.e.an assumption of residuals with constant variance). The authors accepted that it is common for financial data to not meet the assumptions of normality and linearity, and so they describe taking steps to apply data transformations (specifically logarithm, square root, and reciprocal transformations) to the variables if their diagnostics showed violations, to try get the requirements necessary for a valid regression applied. The cost of equity (re) in the study is estimated using the CAPM, where the firm's beta factor (β) is the firm-specific ingredient to consider as the risk-free rate (rf) and the market risk premium (mrp)(which again isn't guaranteed to be constant for all S&P 500 companies on the comparison date) are held constant ($re=rf+\beta \cdot mrp$). Therefore, to determine the relationship between ESG and the cost of equity it was necessary to regress the firm's beta factor on the ESG score. While control variables are discussed as relevant factors in the paper, they are not explicitly included in the core regression models presented within the methodological section. They find that companies with better ESG ratings (Leaders) tend to have lower median cost of equity and cost of debt compared to Laggards. Specifically, the median cost of equity for Leaders is 8.62%, compared to 9.12% for Laggards. The median cost of debt for Leaders is 5.46%, compared to 6.14% for Laggards. However, for WACC, the median values are very close across categories (Leader: 7.47%, Average: 7.46%, Laggard: 7.51%), with Laggards showing a slightly higher median WACC. The mean WACC for Laggards (7.81%) is notably higher than for Leaders (7.47%) or Average firms (7.54%). Moving to correlation analysis, they report a slightly negative linear correlation between the ESG score and the beta factor (-0.075), and between the ESG score and the cost of debt (-0.072). Crucially, they find no significant linear correlation between the WACC and the ESG score (-0.004). In their linear regression analysis, after transforming the beta factor using the root transformation to meet normality assumptions, they regress the root beta factor on the ESG score. They find a negative and statistically significant coefficient of -0.008 for the ESG score on the root beta factor ($p<0.05$). Translating this back to the original scale of beta, they conclude that companies with better ESG scores benefit from a lower cost of equity because their systematic risk (beta) is lower. In their linear regression analysis, after transforming the beta

factor using the root transformation to meet normality assumptions, they regress the root beta factor on the ESG score. They find a negative and statistically significant coefficient of -0.008 for the ESG score on the root beta factor ($p<0.05$). Translating this back to the original scale of beta, they conclude that companies with better ESG scores benefit from a lower cost of equity because their systematic risk (beta) is lower. Their analysis indicates that while ESG correlates negatively with Re (via beta) and Rd, this relationship does not translate into a significantly different WACC across ESG performance levels in their cross-sectional S&P 500 sample on this specific date.

The MSCI research insight written by Malich and Husi (2024) offers a broad, in-depth analysis of the relationship between MSCI ESG Ratings and the cost of capital, leveraging a large-scale global dataset. Their sample is extensive, covering 4,319 unique corporate issuers indexed by MSCI in either equity or corporate bond markets, with monthly data points available over a significant time span from August 2015 through May 2024. The primary measure of ESG performance employed in this study is the MSCI ESG Rating, specifically focusing on the underlying industry-adjusted ESG score (IAS). This score, ranging from 0 to 10, is a key input into the final alphabetical rating (AAA-CCC) and is designed to capture a company's resilience to financially material sustainability-related risks relative to its industry peers.

The dependent variables in the MSCI study encompass the overall WACC, its two main components, the cost of equity and the cost of debt and market-based proxies that directly reflect investor and lender risk perception: stock beta (β) for equity risk and credit spreads (Option-Adjusted Spread or OAS) for debt risk. The methodology for calculating these costs is detailed, albeit often relying on standard industry approaches. WACC is calculated as a weighted average of the cost of equity, cost of debt, and cost of preferred equity, using market-value-based weights. The cost of equity is primarily calculated using a CAPM model. The cost of debt is estimated using a fundamental data approach, calculated as the company's gross interest expense scaled by its total debt, adjusted for the corporate tax shield as shown in the third chapter. The study highlights that beta is the only company-specific component in their Re calculation formula, making it a direct measure of systematic equity risk, while credit spread (OAS) serves as a market-observable proxy for issuer-specific credit risk relevant to bondholders.

The core analytical methodology involves a systematic comparison of financing costs across different levels of ESG performance. Issuers are segmented into five equal-weighted quintiles based on their industry-adjusted ESG scores: top, high, mid, low, and bottom. The mean and median cost of capital measures (WACC, K(e), K(d), β, OAS) are then compared across these quintiles. To control for macroeconomic factors and other potential confounders and to isolate the effect attributable to the ESG rating, these comparisons are conducted within carefully defined peer groups. These peer groups are established based on a company's home market, sector affiliation (using the GICS classification system), credit

quality (categorized as investment grade or high yield), and funding currency. The statistical significance of the observed differences in the distribution of cost of capital measures, particularly between the top and bottom ESG quintiles, is formally tested using the Mann-Whitney U test. This non-parametric test is chosen specifically because the cost-of-capital data distributions are found to be non-normal. Beyond these cross-sectional comparisons across quintiles, the MSCI methodology explores the potential forward-looking nature of ESG ratings by analyzing changes in cost of capital z-scores (standardized measures) following significant rating changes (upgrades or downgrades of two or more notches) over various time horizons. They also investigate the correlations between the individual E, S, and G pillar scores (and the overall IAS) and the cost of capital components, including a detailed analysis within different sectors to identify if certain sustainability dimensions are more influential drivers of financing costs in specific industries. The data cleaning process utilized involves identifying and removing outliers for cost of capital, cost of equity, cost of debt, beta, and credit spread data based on the interquartile range (IQR) method, where observations falling outside the range of the first quartile minus 1.5 times the IQR or the third quartile plus 1.5 times the IQR are excluded. This is a common method for outlier detection and removal in financial data.

Their study across ESG quintiles show similar patterns. Top ESG quintile firms tend to exhibit lower median costs of capital and risk proxies. For Cost of Equity, the median for the top quintile tend to be lower than the bottom quintile for multiple peer groups, confirmed using the Mann-Whitney U test that found statistically significant differences (e.g., Median K(e) ~8% vs ~9% in broad sample). For stock Beta (β), the median for the top quintile is also lower than the bottom quintile, which is indicative of a lower systematic risk (e.g., Median β ~0.9 vs ~1.1, a general rule rather than absolute). For Cost of Debt, the median remains lower for top ESG quintile firms versus bottom ESG firms; similarly, statistically significant (e.g., Median K(d) ~4.5% vs ~5.5%). Credit spreads (OAS), the market proxy for credit risk, are also lower for top ESG firms (e.g., Median OAS ~1.5% vs ~2.5%). For WACC, although no longer a uniformly linear pattern across all frontiers with five quintiles (e.g., can be concave downward), the median WACC generally trended lower for the top ESG quintile than the bottom quintile. Statistically significant differences are more likely to be found across many peer groups; although, often times (yet in magnitude, smaller than K(e) or K(d)), even for WACC quintiles.

Aside from those comparisons, the correlation analysis reports a generally negative linear relationship between the continuous IAS score and the cost of capital components. For example, they report negative correlations between IAS and β, OAS, K(e), and K(d), typically in magnitudes between -0.10 and -0.20, and often statistically significant, which is consistent with higher ESG scores associated with lower risk/financing costs. The analysis of rating changes also provides supporting evidence for a negative link, showing that firms that received ESG rating upgrades had statistically significant declines in their cost of capital z-scores in subsequent time periods, while those that received downgrades had statistically

significant increases in capital costs. The study looks at the three pillars of E, S, and G, reporting that all are generally negatively correlated with financing costs, however the strength and significance varies by sector, thus suggesting that certain pillars (like Environmental for energy companies or Governance for financial firms) may carry more materiality in terms of capital costs depending on the industry.

The study of Piechocka-Kałużna et.al.(2021) examined only US firms and used a mix of descriptive statistics, correlation analysis and regression analysis to examine the direction and strength of the relationship between both the ESG score and the three individual ESG elements and the cost of capital. The authors collected data from Thomson Reuters Eikon for a sample of US firms for the five-year period of 2016 to 2020. The independent variables the authors analyzed were the ESG Score and the single scores for the three separate components of the ESG Score (E, S, and G) taken from Thomson Reuters Eikon. The Eikon ESG score is based on a comprehensive assessable of the above reference firm's reporting of their data in each subcategory classification of E, S, and G. The Eikon ESG score is presented in a 12 point alphabetical scale from D- to A+.

The dependent variables examined are the WACC, the Cost of Equity, and the Cost of Debt. These cost of capital figures are also obtained directly from the Thomson Reuters Eikon database. While Eikon's data covers the last 10 fiscal years, the specific analytical period for their correlation and regression analyses is limited to the 2016-2020 timeframe. The methodology begins with the computation and presentation of descriptive statistics for the studied variables over the 2016-2020 period. This includes calculating basic measures like the mean, maximum, minimum, and a measure of volatility or dispersion, such as the coefficient of variation, to characterize the structure and trends of the data.

The core of their analysis involves conducting correlation and regression tests. They first calculate Pearson's linear correlation coefficients to assess the bivariate relationships between the dependent variables (WACC, Cost of Equity, Cost of Debt) and the independent variables (ESG Score, E, S, G Pillar Scores). A key methodological nuance introduced by the authors is the explicit examination of these correlation and regression relationships not only for variables within the same fiscal year but also by incorporating a time lag. This approach is motivated by the plausible assumption that the impact of corporate ESG disclosures and performance in a given year might not be immediately reflected in the cost of capital but could become apparent and influence investors' and lenders' perceptions, thereby affecting financing costs, in the subsequent fiscal year or potentially later. After completing the correlation analysis, they estimate multivariate regression functions. In these models, WACC, Cost of Debt, and Cost of Equity are their dependent variables, while the ESG Score and the individual E, S, G pillar scores, are their independent variables. They formally test for statistical significance on both the calculated correlation coefficients, and the estimates (coefficients) of the regression functions at the .05 level of significance. The results of these regressions are detailed for each separate year within the 2016 -2020 period,

identifying which independent variables (total ESG score or individual pillar scores) had a statistically significant effect on WACC or Cost of Equity in that year. They also specify that for Cost of Debt, in the initial correlation analysis, the ESG independent variables all had insignificant relationships, which was also represented in the regression analysis as the estimates for the ESG variables in the Cost of Debt regressions were all statistically insignificant as well. They also noted that explicit control variables such as firm size, financial leverage, or profitability, are not identified as being contained in the regression models in his study's methodology and results sections.

Throughout their correlation analysis for the years 2016-2020, there were a number of important negative, albeit often not statistically significant, correlations between the various ESG measures (total score and pillars) and all three of the cost of capital variables; for all three variables on the same year and with a one-year lag. For instance, the correlation between the total ESG score and WACC for a one-year lag was -0.036 ($p>0.05$); for Cost of Equity, the coefficient of the lagged correlation = -0.034 ($p>0.05$); for the Cost of Debt, the lagged correlation =-0.028 ($p>0.05$). Next, they conducted a multivariate regression analysis to examine the effect of E, S and G pillar scores, on both the cost of capital measures for each year individually and with a lag. Overall, the multivariate regression results were mixed and inconsistent across both years and pillars. As an illustration, regarding the multivariate regression of WACC on lagged E, S and G pillar scores, depending on the year, there were positive coefficients associated with the lagged E, lagged S and lagged G pillar scores for WACC, especially in some years while in other years there were no significant and negative coefficients with the lagged pillar score. For instance, with respect to WACC, when the lagged E coefficient = 0.055, ($p<05$), in 2019, it was positive and statistically significant. Although there were coefficients for the lagged E, lagged S and lagged G in the regressions on WACC for the various years, only the lagged E pillar gave a positive significant coefficient. The Social pillar and Governance pillar also showed variability in terms of signs and significance across the various years for both their regressions on WACC and Cost of Equity. For the Cost of Debt regressions, the coefficients for the ESG pillar scores are consistently reported as statistically insignificant across all years and with lags, aligning with their correlation findings. Their overall conclusion from the regression analysis is that ESG (and its components) affects the cost of capital (WACC and Cost of Equity), but the direction and strength of the relationship vary depending on the specific ESG pillar and the year of analysis, and the effect on the cost of debt is generally negligible and statistically insignificant in their US sample.

Research into the connection between ESG factors and a firm's cost of capital employs many quantitative techniques to answer if superior ESG performance is associated with lower capital costs. The review of recent studies reveals similarities in using panel data and regression analysis, as well as methods unique to individual studies, due to the different samples or data chosen, sources of data and questions the individual studies answer.

Together, the studies provide more evidence in this area, but can sometimes appear to be variable, which highlights the difficulty in understanding this relationship.

The effect of ESG on financing options is ultimately based on risk management, the stakeholder influence, and several other significant operational and strategic pathways that enhance a firm's financial profile and attractiveness to capital providers. From a risk management perspective, ESG performance is seen by investors and lenders as part of the assessment around a firm's ability to identify, manage, and ultimately mitigate various non-financial risks. Companies with strong environmental practices have lower risk around regulatory fines, environmental disasters, and on supply chain disruptions created by climate change. Companies with strong social performance reduce risk of a labor strike or unrest, collaborate for increased employee productivity or positive brand reputation, all of which reduce operational and reputational risk. Good governance practices add transparency to decision making and accountability to environmental and social outcomes. These practices reduce risks of fraud, mismanagement, poor decisions and a firm that finds itself in litigation. By managing regulation, reputation, and operational risks companies have less inherent volatility and negativity, which low expectations and events (which are negative); this results in better risk profile for capital providers. A lower risk profile creates lower expectations for a return by investors on the equity financing cost and demands by lenders for lower interest rates on debt financing costs, create decreased total cost of capital.

Moreover, the rising prominence of stakeholder expectations is impacting on the manner by which ESG influences financing. In particular, capital providers (e.g., large institutional investors and asset managers) are increasingly embedding ESG considerations into their investment processes, attributable to fiduciary duty, client demand and because they believe ESG performance is material to long-term value creation. This has led to an increase in investor demand for the securities of high-ESG companies. This increase in demand can cause stock prices to increase (lowering the cost of equity), and bond yields to decreases (lowering the cost of debt). Other capital providers, such as banks and other debt lenders, are also underwriting ESG criteria and incorporating these criteria into their assessment of credit risk as well as loan terms (for example, sustainability-linked loans, preferential financing terms etc.). Companies that meet, or exceed, the ESG expectations of their material stakeholders can potentially enhance their internal reputation, broaden access to capital, and potentially more attractive financing options from their lenders. To add to that, strong ESG performance can also lead to a reduction in materials use and waste, which also lead to electric and resource cost-saving efficiencies. These efficiencies improve cash flows and financial viability, leading to better credit risk. Strong ESG performance may also lead to improved innovation and new business opportunities potential if new sustainable products and services, or alternative and cleaner technologies, are developed. This could create new potential streams of revenue as well as reducing business risk of technological obsolescence or a change in consumer preferences leading to improved growth prospects and stability. Furthermore, good social and governance practices can significantly improve the attraction,

retention, and productivity of employees. Having a great workplace that develops a culture of strong values and great leaders fosters increased stability, motivation and skill sets with a workforce that can improve long-term operational performance and reduce turnover and inefficiency costs. Lastly, proactive and effective ESG management produces improved legal and regulatory compliance mitigating exposure to costly fines and litigation, or disruptions in operational continuity that weaken yield and financial stability as well as investor exuberance and confidence. In sum, the influence of ESG on financing, comes from reducing financial and operational risks, conforming to changing market and stakeholder expectations, and providing actual operational and strategic improvements that improve a firm's overall financial condition and can reduce capital costs.

In conclusion, the reviewed studies, despite their varied findings, collectively highlight the complex but increasingly important relationship between ESG and the cost of capital. While some studies, like Atan et al.'s fixed effects analysis, show unexpected positive links, others, particularly the large-scale MSCI study and the Beta findings of Ernst & Woithe, provide evidence supporting the theoretical expectation of a negative relationship, driven by risk reduction and stakeholder influence, as well as operational and strategic benefits like improved efficiency, innovation, employee management, and compliance. The mixed results, especially in studies with fewer controls like Piechocka-Kałużna et al., underscore the necessity of robust methodologies, including panel data with fixed effects and comprehensive control variables (such as size, leverage, and profitability), to isolate the true effect of ESG. In the next chapter I will present my methodology with my research design, data collection and my results.

5 METHODOLOGY

The study adopts a quantitative, explanatory research design to examine the causal and associative links between corporate ESG performance and various components of the cost of capital. Given the panel nature of the dataset, which comprises observations of multiple firms over several time periods, a panel data regression approach is employed. This methodology is particularly suitable for analyzing dynamic relationships, controlling for unobserved heterogeneity, and mitigating potential endogeneity issues that are common in corporate finance research.

In the following two subsections I am going to present the research design that I am going to use in order to answer my research questions given at the beginning of the paper. The main questions are:
How does ESG scores affect WACC in German and American companies?
Which aspects of ESG have the most influence on WACC, and do these effects vary between Germany and USA?

How do factors like market conditions, regulations, and societal attitudes towards sustainability shape the relationship between ESG performance and WACC in these two countries?
How does ESG scores affect Cost of Debt and Cost of Equity separately in German and American companies?

Keeping those questions in mind here is how I decided on my Research design and how I choose the datasets.

5.1 Research Design

The main goal of my thesis is to see how ESG scores affects WACC in companies from USA and Germany. Based on research of the problem and previous papers on this topic I have decided to use lagged ESG scores, meaning using previous years scores and how they affect WACC in selected companies. There are also a plethora of beforementioned factors influencing WACC, so that is why I included some factors as independent variables in those models. Of course I also wanted to see if Cost of Debt and Cost of Equity would show different results as WACC so I decided to make three different models with all three metrics as dependent variables.

With that in mind, and some of the previous analytical work presented in previous chapters, I have decided that my base empirical models would be stated as:

$$\textit{Model 1: } WACC_{it} = \beta_0 + \beta_1 lagESG_{it} + \beta_2 LEVERAGE_{it} + \beta_3 LEVERAGE^2_{it} + \beta_4 ROA_{it} + \beta_5 EBIT\ MARGIN_{it} + \beta_{6+} lnMARKET\ CAP_{it} + \beta_7 lnASSETS_t + \beta_8 YearDummy.2022 + \beta_9 YearDummy.2023 + \beta_{10} YearDummy.2024 + \alpha_i + \varepsilon_{it}$$

$$\textit{Model 2: } Rd_{it} = \beta_0 + \beta_1 lagESG_{it} + \beta_2 LEVERAGE_{it} + \beta_3 ROA_{it} + \beta_4 EBIT\ MARGIN_{it} + \beta_5 lnMARKET\ CAP_{it} + \beta_6 lnASSETS_{it} + \beta_7 YearDummy.2022 + \beta_8 YearDummy.2023 + \beta_9 YearDummy.2024 + \alpha_i + \varepsilon_{it}$$

$$\textit{Model 3: } Re_{it} = \beta_0 + \beta_1 lagESG_{it} + \beta_2 LEVERAGE_{it} + \beta_3 ROA_{it} + \beta_4 EBIT\ MARGIN_{it} + \beta_5 lnMARKET\ CAP_{it} + \beta_6 lnASSETS_{it} + \beta_7 YearDummy.2022 + \beta_8 YearDummy.2023 + \beta_9 YearDummy.2024 + \alpha_i + \varepsilon_{it}$$

The only difference between Model 1 and Model 2 and 3 is that we must include $LEVERAGE^2$ in Model 1, since its inclusion is essential because it captures the theoretical U-shaped relationship between financial leverage and a firm's weighted average cost of capital. Initially, as leverage increases, WACC tends to decline due to the tax deductibility of interest and the relatively lower cost of debt compared to equity. However, beyond a certain point, excessive debt heightens financial risk, prompting both lenders and equity investors to demand higher returns, which in turn increases WACC. The LEVERAGE term captures the initial downward trend, while $LEVERAGE^2$ allows the model to reflect the

eventual upward slope, thus enabling an accurate estimation of this non-linear, U-shaped curve. In contrast, the cost of debt (Rd) and cost of equity (Re) typically increase monotonically with leverage due to escalating risk, making a squared term unnecessary in their individual regressions.

Then further on I wanted to see how each pillar of ESG affects WACC in both countries, so I have broken down ESG into three different variables. So, the second part of my regression is stated as:

$$Model\ 4: WACC_{it} = \beta_0 + \beta_1\, lagE_{it} + \beta_2\, lagS_{it} + \beta_3\, lagG_{it} + \beta_4\, LEVERAGE_{it} + \beta_5\, LEVERAGE^2_{it} + \beta_6 ROA_{it} + \beta_7\, EBIT\ MARGIN_{it} + \beta_8\, lnMARKET\ CAP_{it} + \beta_9\, lnASSETS_t + \beta_{10} YearDummy.2022 + \beta_{11} YearDummy.2023 + \beta_{12} YearDummy.2024 + \alpha_i + \varepsilon_{it}$$

$$Model\ 5: Rd_{it} = \beta_0 + \beta_1\, lagE_{it} + \beta_2\, lagS_{it} + \beta_3\, lagG_{it} + \beta_4\, LEVERAGE_{it} + \beta_5 ROA_{it} + \beta_6\, EBIT\ MARGIN_{it} + \beta_7 lnMARKET\ CAP_{it} + \beta_8 lnASSETS_t + \beta_9 YearDummy.2022 + \beta_{10} YearDummy.2023 + \beta_{11} YearDummy.2024 + \alpha_i + \varepsilon_{it}$$

$$Model\ 6: Re_{it} = \beta_0 + \beta_1\, lagE_{it} + \beta_2\, lagS_{it} + \beta_3\, lagG_{it} + \beta_4\, LEVERAGE_{it} + \beta_5 ROA_{it} + \beta_6\, EBIT\ MARGIN_{it} + \beta_7 lnMARKET\ CAP_{it} + \beta_8 lnASSETS_t + \beta_9 YearDummy.2022 + \beta_{10} YearDummy.2023 + \beta_{11} YearDummy.2024 + \alpha_i + \varepsilon_{it}$$

In all of the models used entities (companies) are denoted by i, time is denoted by t, and ε_{it} is an error term, while β_0 is the constant term and α_i being entity-specific fixed effects. Having companies from two different countries gave me an opportunity to use different models for both countries, so in the end I used 12 models for my analysis (two different models stated above for companies in each country).

Next up came the decision of which estimation model to use in the analysis. Based on previous researches such as Atan et. al. (2021) and Stamenkovic (2024), I have concluded that the OLS model will not be viable for my models, and this is due to OLS ignoring individual-specific effect, meaning OLS assumes that all entities are identical, but in reality every single one has unique characteristics that may not be captured by variables. Panel data also has a time component, meaning that observations for the same company over time are often correlated. There is also a issue of endogeneity, which refers to where the effect of an independent variable on a dependent variable cannot be casually interpreted because it includes omitted causes leading to biased estimates. Here is where Fixed or Random Effects models can help mitigate it.

Then I was left with a choice of previously mentioned Fixed and Random Effects model. The Fixed Effects model assumes that individual-specific characteristics (factors that do not change over time) are correlated with the explanatory variables. These characteristics could include intrinsic company policies, management culture, or regulatory environments that

remain relatively stable throughout the observed period. Unlike the Fixed Effects model, the Random Effects model assumes that entity-specific characteristics are uncorrelated with the independent variables. Instead of treating alpha as a fixed parameter to be removed, the RE model considers it a random variable drawn from a normal distribution.

For choosing the right model for my thesis, I have chosen the Hausman Test. The Hausman test is a statistical procedure used by researchers, especially in panel data methods, to determine whether a fixed-effects or random-effects regression model should be used. In the kind of research that observes the same entities repeatedly over some time, we need to account for unobserved characteristics which may be unique to each entity and constant across the various observations. Hausman test, thus, is intended to see if these unobserved entity-specific characteristics correlate with any of the explanatory variables in the regression.

When running a Hausman test, one computes both a fixed-effects and a random-effects model and then compares the resulting sets of estimates for any marked discrepancies. Typically, the null hypothesis in the Hausman framework states that the random-effects estimator is consistent. The alternative hypothesis is that the random-effects estimator is not consistent, favoring fixed effects as the more accurate modelling choice.

Table 1: Results of Hausman test for all data

	WACC		**Rd**		**Re**	
	ESG	E, S, G	ESG	E, S, G	ESG	E, S, G
chi-square	24.80	29.89	37.02	42.30	41.16	43.03
p-value	0.0057	0.0029	0.00006	0.00003	0.00001	0.00002

Source: Own work.

The choice of econometric model in panel data analysis is critical for ensuring the validity and robustness of empirical findings. In this study, the decision to employ a Fixed Effects model was obtained by the Hausman test. As demonstrated in Table 1 above, the Hausman test statistics were consistently high, with chi-square values ranging from 24.80 to 43.03, all yielding p-values significantly below 0.01. These extremely small p-values compelled the rejection of the null hypothesis that the random-effects assumption holds. The statistical implication is clear: unobserved entity-specific characteristics are, in fact, correlated with the explanatory variables in the dataset. Under such conditions, a Random Effects model would introduce bias and inconsistency into the estimates. Consequently, the Fixed Effects model was selected as the primary estimation strategy, as it effectively accounts for these unobserved, time-invariant firm-specific factors, providing a more accurate and unbiased assessment of the relationships under investigation.

Despite the strong statistical justification for the Fixed Effects approach, it is common practice in empirical research to perform robustness checks using alternative model specifications. This serves to assess the sensitivity of the results to different underlying assumptions. Therefore, in addition to the primary Fixed Effects regressions, I also conducted models using Pooled Ordinary Least Squares and Random Effects models. Crucially, these alternative models were run with and without the explicit inclusion of industry/sector dummy variables. The choice for models without dummies was made to directly compare their outcomes with the Fixed Effects models, which, by their nature, implicitly absorb any time-invariant industry-specific effects into the firm-specific fixed effects.

In conclusion, while the robustness checks using Pooled OLS and Random Effects models without explicit industry dummies provide additional perspectives, they largely reinforce the initial decision to rely on the Fixed Effects models. The results for the primary ESG variables, particularly for WACC and Re in Germany, showed considerable sensitivity to the model specification, indicating that the unobserved firm-specific characteristics, which Fixed Effects effectively control for, play a critical role in shaping these relationships. Therefore, to ensure the most robust and unbiased estimates, especially concerning the nuanced impact of ESG on the cost of capital, the Fixed Effects approach remains the most appropriate choice for this analysis, despite the differing results observed in less stringent model specifications. The inconsistencies highlight the complexity of the ESG-WACC relationship and the importance of rigorous methodological choices and chances to further this research.

5.2 Data Collection

To examine the relationship between ESG ratings and the WACC, Rd and Re for German and American companies, I constructed a dataset comprising financial and ESG-related data for publicly listed firms in these countries. Data was sourced from LSEG Workspace, using the application Screener within the LSEG Workspace ensuring consistency and comparability across observations. Financial companies, such as banks and insurance firms, were excluded from the analysis due to their fundamentally different capital structures and regulatory environments. Unlike non-financial firms, financial institutions operate with highly leveraged balance sheets as part of their business model, making their WACC less comparable to other industries. Additionally, they are subject to strict regulatory requirements that influence their capital composition, risk exposure, and financial reporting. These factors create structural differences that could distort the relationship between ESG ratings and WACC, making it difficult to draw meaningful comparisons with non-financial firms. The dataset contains a total of 3,213 observations for a time period of 4 years from 2021-2024, covering key financial indicators, ESG scores, and control variables, that are described in this subsection. The 4-year time period was chosen because of the lagged ESG

scores and their availability. There are 935 American companies and 89 German companies in the model, which was expected due to American companies being larger and more prone to put all the needed variables out to the public. As shown in Table 2 below, there is 263 companies in Industrial sector, which is 25.68% of all companies, then 187 companies in Consumer Cyclicals, 172 in Technology, 83 in Healthcare, 86 Energy companies, 77 consumer Non-Cyclicals, 87 in Basic materials sector, 63 Utilities and 6 in Academic and Educational Services.

Table 2: Companies in the dataset by sector

Companies per sector

	number
Industrials	263
Consumer Cyclicals	187
Technology	172
Basic Materials	87
Energy	86
Healthcare	83
Consumer Non-Cyclicals	77
Utilities	63
Academic & Educational Services	6

Source: Own work.

While discussing sectors I have to mention that because of the use of Fixed Effects Regression, I couldn't include industry dummies in the main models, since restrictions that Fixed Effects pose. Although they have been added to the Random Effects model which is presented in the Appendix. Before going through variables used in the model the data was cleaned with the method of centiles with first and last centile being excluded from the sample.

The Dependent Variable in Model 1 and 4 is WACC, which was introduced in section 3. of this thesis. WACC represents a firm's overall cost of financing, combining both equity and debt based on their respective proportions in the capital structure. It is a key financial metric that reflects the minimum return a company must generate to satisfy investors and creditors. WACC is influenced by factors such as market risk, capital structure, and macroeconomic conditions. The dataset contains 3,213 observations for WACC, with an arithmetic mean of 6.29%, a standard deviation of 2.54 percentage points, and values ranging from 1.47% to 13.33%. This broad range indicates substantial variation in financing costs across firms, likely due to differences in industry, firm size, risk exposure, and capital structure.

In Models 2,3,5 and 6 the Dependent Variables are Rd and Re respectively. Re, which is short for Cost of Equity represents the return that equity investors require on their investment in the company. It reflects the risk of investing in the firm's stock and is often estimated using models like the Capital Asset Pricing Model (CAPM). I have also tried calculating Re for all of the companies, but after comparison and minimal differences with the LSEG collected data decided to use all data from LSEG Workspace. It contains 3213 observations for Re, ranging from 3.43% to 19.62%, with arithmetic mean of 9.67% and standard deviation of 2.61 percentage points.

Rd on the other hand is short for Cost of Debt being second number used in calculating WACC. It is the effective interest rate a company pays on its borrowed funds. It reflects the risk perceived by lenders and is typically lower than the cost of equity. There are also 3213 observations ranging from 0.22% to 7.70%, with standard deviation of 1.25 percentage points and arithmetic mean of 4.16%.

Table 3: Descriptive statistics for variables

Dependent variables

	number	arithmetic mean	standard deviation	min	max
WACC	3213	6.29	2.54	1.47	13.33
Rd	3213	4.16	1.25	0.22	7.70
Re	3213	9.67	2.61	3.43	19.62

Independent variables

	number	arithmetic mean	standard deviation	min	max
LagESG Score	3213	51.04	18.17	8.97	87.79
LagSocial Score	3213	42.35	24.86	0.08	91.81
LagGovernance Score	3213	52.94	20.82	8.01	93.89
LagEnvironmental Score	3213	56.35	20.67	5.17	93.41

"(table continues)"

(continued)

Control variables

	number	arithmetic mean	standard deviation	min	max
Leverage	3213	98.53	120.61	0.01	1166.89
ROA	3213	6.31	5.85	-27.14	30.65
EBITMargin	3213	13.22	10.06	-38.08	58.64
Marketcap	3213	21.76mrd	58.86mrd	0.234mrd	1086.72mrd
Assets	3213	15.19mrd	29.29mrd	0.108mrd	261.63mrd

Source: Own work.

Independent Variables in the model are lagged ESG Scores which have been described in depth in 2. Section of the paper. ESG shows a set of criteria for certifying the sustainability and ethical impact of a company. With this growing trend of environmental, social, and governance factors, investors and stakeholders will hold firms accountable for their long-term viability and risk management and not just their financial performance. These three pillars of ESG shall serve this analysis as key independent variables, which are:

• Environmental (E): Measure a company's impact on the planet in terms of carbon emissions, energy efficiency, waste management, and resource usage.

• Social (S): Evaluates the company about the relationships businesses share with their employees, customers, and communities. These include labor practices, diversity, human rights, and customer satisfaction.

• Governance (G): Focuses on corporate leadership, ethical behavior, board structure, executive compensation, and transparency in the decision-making process.

These pillars act as additional risk-affect factors that could impact a firm's WACC and investor confidence, which the regression in this paper shall devote its time testing.

Lagged ESG Total Score's arithmetic mean is 51.04, with a standard deviation of 18.17, ranging from 8.97 to 87.79. The mean value of lagged Social Score is 42.35, with a standard deviation of 24.86, ranging from 0.08 to 91.81, furthermore the mean value of lagged Governance Score is 52.94, with a standard deviation of 20.82, and a range between 8.01 and 93.89. Lastly for lagged Environmental Score, the mean value is 56.35, with a standard deviation of 20.67, and values spanning from 5.17 to 93.41.

These statistics highlight the variability of ESG performance among companies in the sample, suggesting differing levels of sustainability commitment and governance structures.

Control Variables were chosen after a deep consideration and overview of other papers of esteemed economists.

The leverage ratio, expressed in the dataset as the debt-to-equity (D/E) ratio, reflects how much a company relies on debt compared to its own equity. It's included as a control variable because past research has shown its strong influence on WACC. According to Loffer (2023), firms with higher leverage face a greater risk of default, making them more vulnerable to financial instability. Leverage also plays a key role in determining a company's cost of capital. Generally, a higher D/E ratio leads to an increase in both the cost of debt and the cost of equity, as creditors and investors demand higher returns to offset the added risk. However, there's a balancing effect: the tax shield created by deductible interest payments helps reduce the overall WACC, but only up to a certain point. If leverage continues to rise beyond a manageable level, the benefits of the tax shield diminish, and the company may struggle with financial strain. Firms in the sample have an average leverage level of 98.53, with a high standard deviation of 120.61, and extreme values ranging from 0.01 to 1,166.89.

Return on Assets (ROA) is an important control variable in this analysis because it affects WACC through risk perception, debt capacity and investor confidence. Since profitability plays a key role in shaping both the cost of equity and the cost of debt, it has a direct impact on a company's overall financing costs. More profitable firms tend to generate higher internal funds, which reduces their need for external financing and lowers their borrowing costs. Additionally, they are seen as less risky by investors, who, in turn, require lower returns, ultimately decreasing the firm's WACC.

On the other hand, firms with lower profitability may face challenges in securing favorable financing conditions, leading to higher capital costs. ROA is also closely linked to ESG performance, as firms with strong ESG practices often benefit from greater financial efficiency and lower operational risks so failing to account for ROA in the analysis could result in biased estimates. By including ROA in the model, the analysis ensures that differences in firm profitability do not distort the observed relationship between ESG ratings and WACC, leading to more accurate and reliable results. The mean value is 6.31%, with a standard deviation of 5.85 percentage points, and a range from -27.14% to 30.65%. This suggests a wide disparity in profitability among the firms.

I also included EBIT Margin or Earnings Before Interest and Taxes Margin which is a crucial profitability metric that indicates how much profit a company makes from its core operations for every dollar of revenue, before accounting for interest expenses and taxes. This variable is included as a control in the regression because it directly reflects a firm's operational

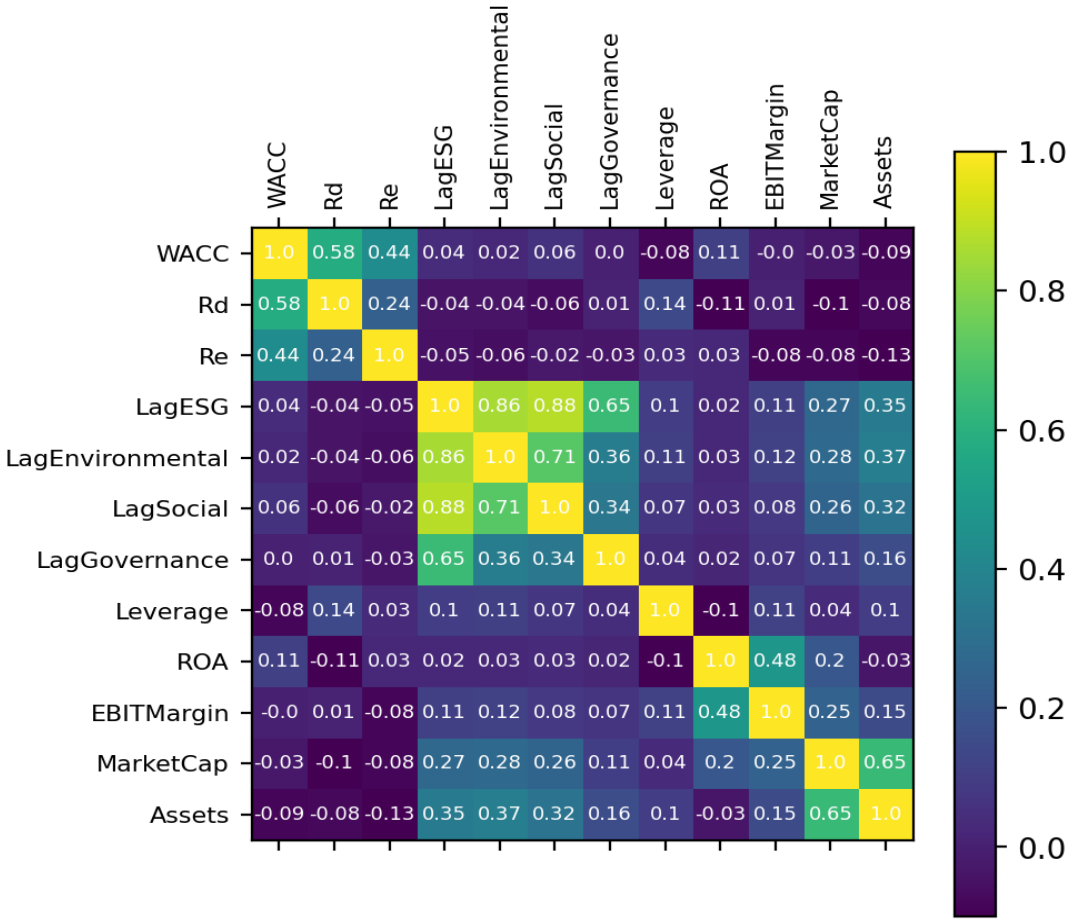
efficiency and pricing power, which are vital indicators of its financial health and stability. A higher EBIT Margin suggests better management of operating costs and strong underlying business performance, implying lower operational risk. This can enhance investor confidence and creditworthiness, thereby influencing the firm's cost of equity and debt, and consequently its WACC. The arithmetic mean for the data is 13.22%, with minimum value of negative 38.08 and maximum of 58.64%.

Market capitalization is another control variable in the study of the relationship between WACC and ESG ratings, representing the market value of a company's share at a total. The size of the firm, as estimated by the market capitalization, is important for a company's accessibility to finance, perceived risks, and costs of capital; hence, this is a fundamental control in investigating WACC variances within firms. One fundamental reason market capitalization was included in this model is that it influences a firm's cost of capital. Larger companies tend to secure financing at relatively lower costs owing to the fact that they are already established in the market with diversified income-generating streams and greater financial stability. Because of the relatively lower costs of funding as compared with the smaller firms, they tend to receive financing on a relatively competitive basis. These smaller firms usually find themselves paying more for capital because, as concerns related to investor risk perceptions and access to external financing play an important role in determining capital costs, firms with less attractive characteristics must pay for that in terms of higher capital costs. Inclusion of market capitalization results in the main virtue of the model ensuring that the effect of ESG ratings on WACC is not confused by differences in financing conditions between large and small firms. Thus, the inclusion of market capitalization in the model provides a cleaner and more accurate opportunity to assess the true effect of ESG factors on a firm's cost of capital, providing further insight into the financial consequences of ESG factors. The mean market cap is approximately €21,8 billion, ranging from €23 million to €1.08 trillion, indicating substantial variation in company size. As market capitalization reflects the market value of the companies, total assets represent the overall size and scale of a company’s resources, encompassing everything the firm owns, such as cash, property, equipment, and inventory. This variable is included as a control in the regression because it captures aspects of firm size and operational capacity that can influence financial performance and risk, beyond what market capitalization alone reflects. Total assets provide a comprehensive measure of a company's physical and financial resource base, which can affect its ability to generate revenue, service debt, and invest in growth opportunities. Larger firms with greater total assets often have more stable cash flows and better collateral, which can reduce the perceived risk by creditors and investors, potentially lowering the cost of debt and equity. This makes total assets an important determinant of the company’s WACC. The arithmetic mean of assets are approximately €15.2 billion, ranging from €108 million to €261.6 billion, indicating substantial variation in Asset value. I used the natural logarithm of market capitalization and asset value in the model to reduce skewness, handle extreme values, and stabilize variance, making the data more normally distributed.

Before I started with my regression analysis I analyzed my datasets with the help of Pearson Correlation Matrix, which gives a structured representation of the linear relationships among multiple continuous variables. This matrix presents an overall picture of how different variables in a dataset interact with each other. The Pearson correlation coefficient as r is the measure of the strength and direction of a linear relationship between two variables. It ranges from -1 to +1. A value of +1 indicates that there is a perfect positive correlation, i.e., an increase in one variable results in an equal increase in the other variable. An opposite correlation results in a perfect negative correlation if one of the variables increases while the other decreases by a proportional amount. When the value of the coefficient is zero, there is no linear relationship between the two variables. In my analysis, based on absolute value of the r coefficient, higher values are shown as more yellow-green color and lower values as blue-purple.

The correlation matrix reveals generally weak linear relationships between the lagged ESG performance measures and the various cost of capital components. For the WACC, the composite lagged ESG score shows a very weak positive correlation of 0.04. Similarly, Lag Environmental correlates with WACC at 0.02, while Lag Social shows a slightly higher positive correlation at 0.06. Lag Governance, in contrast, exhibits no discernible linear correlation with WACC, registering 0.0. When examining Rd, the correlations with ESG variables are consistently negative but very weak: Lag ESG at -0.04, Lag Environmental at -0.04, and Lag Social at -0.06. Lag Governance shows a negligible positive correlation of 0.01 with Rd. For the Re, the linear relationships with ESG are also very weak and negative: Lag ESG at -0.05, Lag Environmental at -0.06, Lag Social at -0.02, and Lag Governance at -0.03.

Figure 4: Pearson Correlation Matrix



Source: Own work.

Turning to the control variables, Leverage shows a weak negative correlation with WACC (-0.08) but a weak positive correlation with Rd (0.14) and a very weak positive correlation with Re (0.03). This indicates that higher leverage is associated with a slightly lower WACC, but a slightly higher cost of debt. Profitability, as measured by ROA, surprisingly exhibits a weak positive correlation of 0.11 with WACC, while showing a weak negative correlation with Rd (-0.11) and a very weak positive correlation with Re (0.03). EBIT Margin has virtually no correlation with WACC (-0.0), a very weak positive correlation with Rd (0.01), and a weak negative correlation with Re (-0.08). Firm size, represented by Market Cap and Assets, generally aligns with expectations; Market Cap has weak negative correlations with WACC (-0.03), Rd (-0.1), and Re (-0.08). Similarly, Assets shows weak negative correlations with WACC (-0.09), Rd (-0.08), and Re (-0.13), suggesting larger firms tend to have slightly lower financing costs.

Within the ESG variables themselves, as expected strong positive inter-correlations are evident between all of the pillars. Lag ESG is highly correlated with Lag Environmental (0.86), Lag Social (0.88), and Lag Governance (0.65). Lag Environmental and Lag Social also show a strong positive correlation (0.71). Among the control variables, ROA and EBIT

Margin exhibit a moderate positive correlation (0.48), reflecting their shared role as profitability indicators. Similarly, MarketCap and Assets are strongly correlated (0.65), as both capture aspects of firm size.

6 ANALYSIS AND DISCUSSION

6.1 Results of Regression Analysis

Table 4 provided below shows the results of Models 1 and 4(WACC as dependent variable) from previous chapter for both Germany and USA that were made during this research.

For the USA sample, Model 1 shows that ESG has a positive but statistically insignificant coefficient of 0.0035, indicating no significant linear relationship with WACC. However, several control variables exhibit strong significant effect. Leverage shows a really small negative and highly significant coefficient of -0.004 ($p < 0.01$), suggesting that higher leverage is associated with a slightly lower WACC. This effect is curvilinear, as Sqared Leverage has a positive and highly significant coefficient of 0.0000031 ($p < 0.01$), confirming the expected U-shaped relationship where WACC initially decreases with leverage but then increases at higher levels. LnMarketcap (logarithm of market capitalization) is also highly significant and positive at 0.2716 ($p < 0.01$), indicating that larger firms by market value tend to have a higher WACC. The year dummy variables, Year.2022, Year.2023, and Year.2024, are all highly significant ($p < 0.01$) with positive coefficients (6.2215, 5.2718, and 5.253 respectively), suggesting common time-specific effects that increased WACC in these years relative to the base year of 2021. Other control variables like ROA, EBIT Margin, LnAssets, and the constant are not statistically significant in this model. The R-squared for this model is 0.9272, indicating a very high proportion of variation in WACC explained by the independent variables within firms.

When the USA sample model is disaggregated by individual ESG pillars (second column under USA), the results for ESG variables remain largely insignificant. Lag Environmental, Lag Social, and Lag Governance all show insignificant coefficients, suggesting that the individual ESG pillars, when included separately, do not have a statistically significant linear impact on WACC in the US sample. The coefficients for Leverage (-0.004, $p < 0.01$) and SqLeverage (0.0000031, $p < 0.01$) remain highly significant and positive, confirming the U-shaped relationship. Similarly, LnMarketcap continues to be highly significant and positive (0.2703, $p < 0.01$). The year dummy variables Year.2022, Year.2023, and Year.2024 also remain highly significant ($p < 0.01$) with positive coefficients (6.2213, 5.2731, and 5.252 respectively). The R-squared for this model is also very high at 0.9273.

Table 4: Results of fixed effects regression for WACC as dependent variable

	USA		*Germany*		*Total Sample*	
Lag ESG	0.0035		-0.0243 **		0.0043	
	(0.0029)		(0.0113)		(0.0036)	
Lag Env.		0.0034		-0.0043		0.0054
		(0.0022)		(0.0089)		(0.0028)
Lag Social		-0.0016		-0.0095		0.0015
		(0.0025)		(0.0099)		(0.0031)
Lag Gov.		0.0011		-0.0125 *		-0.0017
		(0.0016)		(0.0074)		(0.002)
Leverage	-0.004 ***	-0.004 ***	-0.0089 *	-0.0088 *	-0.0036 ***	-0.0036 ***
	(0.0008)	(0.0008)	(0.005)	(0.005)	(0.001)	(0.001)
SqLeverage	0.0000031 ***	0.0000031 ***	0.0000095 *	0.0000092*	0.0000026 ***	0.0000025 **
	(0.0000008)	(0.0000008)	(0.0000055)	(0.0000055)	(0.000001)	(0.000001)
ROA	0.0047	0.0048	0.0317	0.0304	0.0041	0.0044
	(0.0056)	(0.0056)	(0.025)	(0.0251)	(0.007)	(0.007)
EBITMargin	0.0042	0.0041	0.0175	0.0179	-0.0005	-0.0003
	(0.0047)	(0.0047)	(0.0187)	(0.0188)	(0.0059)	(0.0059)
LnMarketcap	0.2716 ***	0.2703 ***	0.4944 **	0.4881 **	0.4677 ***	0.4678 ***
	(0.0599)	(0.06)	(0.1969)	(0.1984)	(0.0734)	(0.0734)
LnAssets	-0.0718	-0.0711	-1.9189 ***	-1.8623 ***	-0.3366 **	-0.3399 **
	(0.1313)	(0.1313)	(0.5916)	(0.6015)	(0.1647)	(0.1647)
const	-2.7257	-2.6607	39.97 ***	38.948 ***	-0.9102	-0.8237
	(2.8843)	(2.8846)	(12.633)	(12.858)	(3.6091)	(3.6076)
Year.2022	6.2215 ***	6.2213 ***	1.0647 ***	1.0852 ***	5.9561 ***	5.9461 ***
	(0.0448)	(0.0451)	(0.1837)	(0.1847)	(0.056)	(0.0562)
Year.2023	5.2718 ***	5.2731 ***	0.6591 ***	0.6829 ***	5.0252 ***	5.0085 ***
	(0.0478)	(0.0485)	(0.1899)	(0.1914)	(0.0595)	(0.0602)
Year.2024	5.253 ***	5.252 ***	-0.2527	-0.2501	4.9312 ***	4.9078 ***
	(0.0534)	(0.0545)	(0.2115)	(0.2138)	(0.0663)	(0.0675)
R-squared	0.9272	0.9273	0.5812	0.5851	0.8718	0.8721
Observations	2963	2963	250	250	3213	3213

Note: Standard errors are stated in parentheses below coefficients.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Source: Own work.

For the Germany sample, a different pattern of significance emerges. In the first model (third column under Germany), ESG shows a negative and statistically significant coefficient of -0.0243 ($p < 0.05$), indicating that in the German context, better lagged ESG performance is associated with a lower WACC. Leverage is significant at -0.0089 ($p < 0.1$), suggesting a negative linear relationship. SqLeverage is positively significant at 0.0000095 ($p < 0.1$), again supporting a U-shaped relationship between leverage and WACC. LnMarketcap is significant and positive at 0.4944 ($p < 0.05$), similar to the US sample. LnAssets is negative and highly significant at -1.9189 ($p < 0.01$), implying that larger firms by assets have a lower WACC. The const term is highly significant and positive at 39.97 ($p < 0.01$). The year dummy variables Year.2022 (1.0647, $p < 0.01$) and Year.2023 (0.6591, $p < 0.01$) are highly significant and positive, while Year.2024 shows an insignificant negative coefficient. The R-squared for this model is 0.5812. When disaggregating the German sample by ESG pillars (fourth column under Germany), Lag Governance shows a negative and statistically significant coefficient of -0.0125 ($p < 0.1$), indicating that better lagged governance performance is associated with a lower WACC. LagEnvironmental and LagSocial are not significant. The coefficients for Leverage (-0.0088, $p < 0.1$) and SqLeverage (0.0000092, $p < 0.1$) remain significant with the expected U-shape. LnMarketcap is still significant and positive (0.4881, $p < 0.05$). LnAssets remains highly significant and negative (-1.8623, $p < 0.01$). Year dummies are highly significant and positive: Year.2022 (1.0852, $p < 0.01$) and Year.2023 (0.6829, $p < 0.01$), while Year.2024 is again insignificant. The R-squared for this model is 0.5851.

For the combined USA and Germany panel, the regression analysis on WACC reveals several statistically significant relationships. The composite lagged ESG score shows a positive but insignificant coefficient, suggesting no overall linear relationship with WACC across the total sample. However, the control variables consistently exhibit strong significance. Leverage has a negative and highly significant coefficient of -0.0036 ($p < 0.01$), indicating that increasing leverage initially reduces WACC. This effect is curvilinear, as SqLeverage is positive and highly significant (0.0000026, $p < 0.01$), confirming the expected U-shaped relationship where WACC eventually rises with excessive debt. LnMarketcap is also highly significant and positive at 0.4677 ($p < 0.01$), suggesting that larger firms by market value tend to have a higher WACC. Conversely, LnAssets shows a negative and significant coefficient of -0.3366 ($p < 0.05$), implying that larger firms by total assets are associated with a lower WACC. The year dummy variables, Year.2022, Year.2023, and Year.2024, are all highly significant ($p < 0.01$) with positive coefficients (5.9561, 5.0252, and 4.9312 respectively), indicating common time-specific effects that increased WACC in these years relative to the base year. The R-squared for this combined model is 0.8718, signifying a high proportion of within-firm variation in WACC explained by the model's variables.

Table 5: Results of fixed effects regression for Rd as dependent variable

	USA		*Germany*		*Total Sample*	
Lag ESG	-0.0009		-0.0053		-0.000005	
	(0.0021)		(0.0098)		(0.0021)	
Lag Env.		0.0003		0.0173 **		0.0012
		(0.0016)		(0.0076)		(0.0016)
Lag Social		-0.0044 **		-0.0155 *		-0.0043 **
		(0.0018)		(0.0084)		(0.0018)
Lag Gov.		0.0025 **		-0.0079		0.0024 **
		(0.0011)		(0.0063)		(0.0011)
Leverage	0.0003	0.0003	0.0034 *	0.004 **	0.0003	0.0003
	(0.0003)	(0.0003)	(0.0018)	(0.0018)	(0.0003)	(0.0003)
ROA	-0.0124 ***	-0.0124 ***	-0.0104	-0.0097	-0.0126 ***	-0.0127 ***
	(0.004)	(0.004)	(0.0214)	(0.0211)	(0.004)	(0.004)
EBITMargin	0.000092	-0.0002	-0.0033	-0.0011	-0.0002	-0.0005
	(0.0034)	(0.0034)	(0.0163)	(0.016)	(0.0034)	(0.0034)
LnMarketcap	-0.3096 ***	-0.3128 ***	-0.6187 ***	-0.6655 ***	-0.3106 ***	-0.3126 ***
	(0.0432)	(0.0432)	(0.1711)	(0.169)	(0.0421)	(0.042)
LnAssets	0.3892 ***	0.3927 ***	0.4742	0.4887	0.3884 ***	0.3892 ***
	(0.0932)	(0.093)	(0.4995)	(0.4975)	(0.0929)	(0.0927)
const	0.8469	0.8706	4.0546	4.8818	0.7221	0.7852
	(2.0726)	(2.0683)	(10.765)	(10.726)	(2.0586)	(2.055)
Year.2022	2.5044 ***	2.5108 ***	2.4658 ***	2.475 ***	2.5052 ***	2.5096 ***
	(0.0325)	(0.0326)	(0.1563)	(0.154)	(0.0322)	(0.0323)
Year.2023	1.9921 ***	2.005 ***	1.8375 ***	1.8579 ***	1.9853 ***	1.9951 ***
	(0.0345)	(0.035)	(0.1606)	(0.1584)	(0.0341)	(0.0345)
Year.2024	2.1299 ***	2.1426 ***	1.4938 ***	1.4429 ***	2.0836 ***	2.0922 ***
	(0.0384)	(0.0392)	(0.1777)	(0.1762)	(0.0379)	(0.0386)
R-squared	0.8031	0.8041	0.7402	0.7270	0.7933	0.7942
Observations	2963	2963	250	250	3213	3213

Note: Standard errors are stated in parentheses below coefficients.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Source: Own work.

Overall, the results highlight interesting country-specific differences. The direct effect of ESG on WACC varies. In the USA, neither composite nor individual ESG pillars show a significant linear impact on WACC, whereas in Germany, both the composite ESG score and the Governance pillar are significantly and negatively associated with WACC.

While the U-shaped relationship for leverage is consistently significant in both samples, and larger firms (by market cap in both, by assets in Germany) have a significant impact on WACC. The year dummies consistently demonstrate significant time-specific effects across both countries, capturing broader market or macroeconomic influences on WACC.

The fixed effects regression results for the Cost of Debt reveal distinct patterns of significance across the USA and Germany samples. In the USA sample, when examining the composite lagged ESG score, its coefficient is insignificant. However, including pillars of ESG, where Lag Social exhibits a negative and statistically significant coefficient of -0.0044 ($p < 0.05$), suggesting that better past social performance is associated with a lower cost of debt in the US. Conversely, Lag Governance shows a positive and statistically significant coefficient of 0.0025 ($p < 0.05$), indicating that higher past governance scores are linked to a higher cost of debt in the US. Among control variables in the USA, ROA consistently displays a negative and highly significant coefficient of -0.0124 ($p < 0.01$) across both models, implying that higher profitability is associated with a lower cost of debt. LnMarketcap also consistently shows a negative and highly significant coefficient, around -0.31 ($p < 0.01$), indicating that larger firms by market valuation tend to have a lower cost of debt. All year dummy variables (Year.2022, Year.2023, Year.2024) are highly significant ($p < 0.01$) with positive coefficients, reflecting common time-specific effects that influenced the cost of debt.

For the Germany sample, the analysis presents a different set of significant findings. When individual ESG pillars are considered, Lag Environmental shows a positive and statistically significant coefficient of 0.0173 ($p < 0.05$), suggesting that better past environmental performance is associated with a higher cost of debt in Germany. In contrast, Lag Social is negatively significant at -0.0155 ($p < 0.1$), indicating that better past social performance is linked to a lower cost of debt, mirroring the finding in the US, but here we have to add that they offset eachother. Among control variables, Leverage is consistently positive and statistically significant (around 0.0034 to 0.004, $p < 0.1$ or $p < 0.05$), indicating that higher financial leverage is associated with a higher cost of debt. LnMarketcap also consistently shows a negative and highly significant coefficient, around -0.62 to -0.66 ($p < 0.01$), implying that larger German firms by market value have a lower cost of debt. Similar to the US, all year dummy variables (Year.2022, Year.2023, Year.2024) are highly significant ($p < 0.01$) with positive coefficients, capturing time-specific influences on Rd. ROA, EBIT Margin, and LnAssets are not statistically significant in the German models. The R-squared values for both US models are around 0.80, while for German models, they are around 0.74, indicating strong explanatory power within firms in both countries.

For the combined USA and Germany panel, the regression analysis on the Cost of Debt reveals several significant relationships. The composite lagged ESG score shows a negligible and insignificant coefficient. However, when disaggregating ESG, LagSocial exhibits a negative and statistically significant coefficient of -0.0043 ($p < 0.05$), indicating that better

past social performance is associated with a lower cost of debt in the combined sample. Conversely, LagGovernance shows a positive and statistically significant coefficient of 0.0024 ($p < 0.05$), suggesting that higher past governance scores are linked to a higher cost of debt. Among the control variables, ROA (Return on Assets) consistently displays a negative and highly significant coefficient of -0.0126 ($p < 0.01$), implying that higher profitability is associated with a lower cost of debt. LnMarketcap also consistently shows a negative and highly significant coefficient of -0.3106 ($p < 0.01$), indicating that larger firms by market valuation tend to have a lower cost of debt. Furthermore, LnAssets is positive and highly significant at 0.3884 ($p < 0.01$), suggesting that larger firms by asset base are associated with a higher cost of debt. All year dummy variables (Year.2022, Year.2023, Year.2024) are highly significant ($p < 0.01$) with positive coefficients (2.5052, 1.9853, and 2.0836 respectively), reflecting common time-specific effects that influenced the cost of debt. The R-squared for this combined model is 0.7933, indicating strong explanatory power within firms.

In the USA sample, both the composite lagged ESG score and its individual pillars are statistically insignificant. However, several control variables show significant effects. ROA consistently exhibits a negative and statistically significant coefficient of -0.0119 ($p < 0.05$) across both models, indicating that higher firm profitability is associated with a lower cost of equity. LnAssets is also consistently positive and statistically significant at approximately 0.29 ($p < 0.05$), suggesting that larger firms by asset base tend to have a higher cost of equity. All year dummy variables (Year.2022, Year.2023, Year.2024) are highly significant ($p < 0.01$) with positive coefficients (e.g., Year.2022 at 0.3271, Year.2023 at 0.9057, Year.2024 at 0.2082), reflecting common time-specific factors that increased the cost of equity in these years relative to the base year. Other controls like Leverage, EBIT Margin, and LnMarketcap do not show statistical significance in the US models.

For the Germany sample, Lag ESG, Lag Environmental, Lag Social, Lag Governance are also largely insignificant. However, LnMarketcap shows a negative and statistically significant coefficient (approximately -0.37, $p < 0.05$ or $p < 0.1$) in both German models, suggesting that larger firms by market valuation tend to have a lower cost of equity. Crucially, the year dummy variables are highly significant: Year.2023 has a strong positive coefficient (around 1.06, $p < 0.01$), and Year.2024 also shows a positive and significant coefficient (around 0.55, $p < 0.01$), indicating time-specific increases in the cost of equity. Year.2022 is not significant in the German models. Other variables like Leverage, ROA, EBIT Margin, and LnAssets do not exhibit statistical significance in the German regressions for Re. The R-squared values are relatively low, around 0.22 for the US models and 0.35 for the German models, indicating that the models explain a smaller proportion of the within-firm variation in the Cost of Equity compared to WACC or Rd.

Table 6: Results of fixed effects regression for Re as dependent variable

	USA		*Germany*		*Total Sample*	
Lag ESG	-0.0001		-0.0096		-0.0012	
	(0.0031)		(0.0107)		(0.003)	
Lag Env.		-0.0008		-0.0021		-0.001
		(0.0024)		(0.0084)		(0.0023)
Lag Social		0.0032		-0.0116		0.0022
		(0.0027)		(0.0093)		(0.0026)
Lag Gov.		-0.002		0.0022		-0.0021
		(0.0017)		(0.007)		(0.0016)
Leverage	-0.0006	-0.0006	0.0022	0.0025	-0.0005	-0.0005
	(0.0004)	(0.0004)	(0.0019)	(0.002)	(0.0004)	(0.0004)
ROA	-0.0119 **	-0.0119 **	0.0349	0.0362	-0.0099	-0.0099
	(0.0059)	(0.0059)	(0.0233)	(0.0234)	(0.0057)	(0.0057)
EBITMargin	-0.0041	-0.0039	-0.0116	-0.0118	-0.0044	-0.0042
	(0.005)	(0.005)	(0.0177)	(0.0178)	(0.0048)	(0.0048)
LnMarketcap	-0.0667	-0.0644	-0.3719 **	-0.3659 *	-0.0952	-0.0942
	(0.0633)	(0.0633)	(0.186)	(0.1876)	(0.0598)	(0.0598)
LnAssets	0.2927 **	0.2904 **	-0.2568	-0.3515	0.2808 **	0.2809 **
	(0.1364)	(0.1364)	(0.5429)	(0.5522)	(0.1319)	(0.1319)
const	4.5035	4.4817	22.131 *	24.215 **	5.3529	5.3141
	(3.0333)	(3.0328)	(11.7)	(11.905)	(2.9246)	(2.9246)
Year.2022	0.3271 ***	0.3232 ***	0.2447	0.2343	0.3196 ***	0.3171 ***
	(0.0476)	(0.0478)	(0.1699)	(0.171)	(0.0458)	(0.046)
Year.2023	0.9057 ***	0.8976 ***	1.0668 ***	1.0654 ***	0.9203 ***	0.9147 ***
	(0.0505)	(0.0513)	(0.1746)	(0.1758)	(0.0484)	(0.0491)
Year.2024	0.2082 ***	0.2011 ***	0.5479 ***	0.5551 ***	0.2374 ***	0.2328 ***
	(0.0562)	(0.0574)	(0.1931)	(0.1955)	(0.0538)	(0.0549)
R-squared	0.2202	0.2213	0.3435	0.3484	0.2240	0.2248
Observations	2963	2963	250	250	3213	3213

Note: Standard errors are stated in parentheses below coefficients.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Source: Own work.

For the combined USA and Germany panel, the regression analysis on the Cost of Equity (Re) reveals fewer statistically significant relationships compared to WACC and Rd. Neither the composite lagged ESG score nor its individual pillars show a statistically significant linear impact on Re. Among the control variables, LnAssets is consistently positive and

statistically significant at 0.2808 ($p < 0.05$), suggesting that larger firms by asset base tend to have a higher cost of equity in the combined sample. Other traditional financial controls like Leverage, ROA, EBIT Margin, and LnMarketcap are not statistically significant in these combined models for Re. However, the year dummy variables, Year.2022, Year.2023, and Year.2024, are all highly significant ($p < 0.01$) with positive coefficients (0.3196, 0.9203, and 0.2374 respectively), indicating common time-specific effects that influenced the cost of equity across both countries. The R-squared for this combined model is 0.2240, suggesting that the model explains a relatively smaller proportion of the within-firm variation in the Cost of Equity compared to WACC and Rd models.

Across the fixed effects regression analyses for WACC, Cost of Debt, and Cost of Equity in both US and German samples, several consistent patterns and notable divergences emerge regarding the influence of ESG and control variables.

For WACC, a significant U-shaped relationship with Leverage is consistently observed in both countries, highlighting an optimal capital structure. Additionally, LnMarketcap generally shows a significant positive impact on WACC, while LnAssets has a significant negative effect in Germany. Crucially for the thesis, the direct effect of ESG varies by country: Lag ESG is significantly negative in Germany, indicating lower WACC with better ESG, but remains insignificant in the USA.

Regarding the Cost of Debt, Leverage consistently and significantly increases Rd in both samples. ROA shows a significant negative effect on Rd in the US, while LnMarketcap consistently lowers Rd in both countries. The individual ESG pillars reveal mixed country-specific impacts: Lag Social significantly reduces Rd in both the US and Germany, but Lag Governance increases Rd in the US, and Lag Environmental increases Rd in Germany.
For the Cost of Equity, ESG variables generally lack significant impact in either country. Instead, profitability (ROA in the US) and firm size (LnAssets in the US, LnMarketcap in Germany) primarily drive Re, although their specific directions can vary.

6.2 Recommendations to Companies and Policymakers

Companies should strategically approach ESG and financial management, recognizing the distinct impacts observed across countries and cost of capital components. For German companies, the significant negative association between overall Lag ESG and WACC (coefficient -0.0243, $p < 0.05$) suggests that robust, integrated ESG strategies can genuinely lower their total cost of capital, making transparent reporting on comprehensive ESG performance a clear financial imperative. In contrast, for US companies, while a direct overall ESG-WACC link is not evident, the significant negative impact of Lag Social on Cost of Debt (Rd) (coefficient -0.0044, $p < 0.05$) highlights that strong social performance can specifically lead to cheaper borrowing. Companies should be discerning with ESG

investments; Lag Social consistently showed a positive impact (lower Rd) in both the US and Germany (-0.0155, $p < 0.1$ in Germany), but Lag Governance was unexpectedly associated with a higher Rd in the US (0.0025, $p < 0.05$), and Lag Environmental was linked to a higher Rd in Germany (0.0173, $p < 0.05$). This suggests that not all ESG aspects are equally rewarded by the market and might even be penalized if not aligned with investor expectations.

Beyond ESG, the consistent and significant U-shaped relationship between Leverage and WACC (negative linear coefficients US and Germany, both significant, and positive squared terms of in US and Germany, all significant) underscores the importance of actively managing debt levels to optimize overall cost of capital. Furthermore, maintaining strong profitability, as evidenced by ROA's significant negative association with Cost of Debt and Cost of Equity in the US, indicates that financially healthier companies can secure cheaper financing.

Policymakers have a crucial role in shaping market conditions that encourage sustainable corporate practices and optimize capital allocation. Given the differing impacts of ESG on WACC and its components across the US and Germany, considering initiatives to standardize ESG reporting and disclosure requirements could enhance transparency and allow markets to more consistently price ESG risks and opportunities. While the significant negative impact of Lag Social on Cost of Debt (Rd) in both countries suggests that social policies are financially rewarded, the unexpected positive relationship between Lag Governance and higher Rd in the US, and Lag Environmental and higher Rd in Germany, warrants closer investigation. Policymakers should explore if current reporting or market perceptions inadvertently signal higher risk in these specific contexts. To promote efficient capital structures, policies should avoid creating undue biases toward excessive debt or equity, enabling firms to reach their most efficient capital mix, given the clear U-shaped relationship between Leverage and WACC.

7 CONCLUSION

This thesis provided a thorough examination of the relationship between a firm's ESG performance and three components of the firm cost of capital, WACC, Cost of Debt, and Cost of Equity, for firms located in Germany and the US. The study conducted a wide-ranging panel data fixed effects study to evaluate how ESG performance related to the costs of financing as it relates to two major economies in the world, acknowledging the difference between the US and Germany and their respective market and regulatory environments.

The findings conclude that while the underlying drivers of the costs of capital - such as financial leverage - generates a strong and often non-linear (U-shaped relationship for WACC) effects, the effects of ESG on the costs of capital are not so straightforward. In particular, while a strong ESG integration produced clear benefits for the overall WACC in

the German market where higher lagged ESG scores were significantly related to a lower WACC, this direct overarching relationship in the US sample - the ESG premium - is not showing to be statistically significant. This difference may suggest that the means through which ESG becomes a source of advantages in overall cost of capital may differ or be less direct in the American experience.

Looking deeper into the individual cost elements, the analysis for the Cost of Debt revealed many more nuanced effects of specific ESG pillars. While overall ESG was unimportant, social performance was consistently significant in lowering Rd in both the US and Germany. This suggests lenders are appreciating the value of strong social practices with possibly less operational or reputational risks. However, what emerged from the study was surprising associations: in the US, Governance was associated with an increase in Rd; in Germany, Environmental performance was associated with an increase in Rd, indicating complexities of investor and lender perceptions related to these specific ESG dimensions, and their complexities derived from context and, possibly within lenders, organization size.
In contrast, for the Cost of Equity, ESG factors had few linear direct effects in either country. Equity investors generally did not utilize ESG factors to form their required returns. In comparison, traditional financial metrics around profitability and firm size had stronger effects on determining equity investors' required rates of return. This suggests for equity markets, the main drivers of Re will remain solely rooted in conventional financial performance and risk characteristics set out in foundations of finance and capital markets. Likewise, in all models and countries, strong and significant Year Dummy fixed effects underscored the fundamental importance of macroeconomic conditions and trends across an entire market in determining the cost of capital, beyond, and irrespective of firm-specific characteristics.

This research also opens several opportunities for further investigation. One avenue is to expand beyond Germany and the United States, either by including more developed markets or by exploring emerging economies. A larger geographical scope paired with a longer timeframe could improve the robustness of the conclusions and allow for stronger causal inferences. There are also options to delve deeper into sector-specific analyses, as some industries are more directly impacted by environmental regulations (e.g., the energy sector), while others might focus more on social or governance aspects. Studying these sector-based differences can help clarify whether certain ESG factors bear more weight in specific industries.

Disaggregating the ESG pillars in greater detail, including sub-components like carbon intensity, labor relations, or executive compensation, could also shed light on precisely which aspects of ESG are most pertinent to investors and lenders when determining the cost of capital.

In conclusion, this thesis provides important empirical evidence to a very active and ongoing debate regarding the financial effects of ESG. It has shown in a variety of contexts, that although traditional financial measures can be important indicators of capital costs, the influence ESG is having on capital costs is extremely contextualized by country and is also often determined by the specific ESG pillar and dimension of costs. The results encourage firms to contextualize ESG changes to their own market environments in order to capture realized financial gains, and encourage policymakers to think about regulations and frameworks that reduce the variability and uncertainty associated with signals prevalent in the ESG landscape, especially as they relate to price more accurately the risks and opportunities associated with sustainability. This research reinforces the fairly nascent and complex relationship between the consideration of ESG in various contexts when making financial decisions, and the opportunities and challenges it provides for firms and the related opportunity for investors alike.

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APPENDICES

Appendix 1

Table 7: Results of random effects regression for WACC

	USA		*Germany*	
LagESG	0.0021		0.0065	
	(0.0017)		(0.0085)	
LagEnvironmental		0.0012		-0.0022
		(0.0015)		(0.0068)
LagSocial		-0.0001		0.0092
		(0.0018)		(0.0077)
LagGovernance		0.0012		-0.0002
		(0.0012)		(0.006)
Leverage	-0.0028 ***	-0.0028 ***	-0.0135 ***	-0.0137 ***
	(0.0005)	(0.0005)	(0.0028)	(0.0028)
SqLeverage	0.0000024***	0.0000024***	0.000015 ***	0.000015 ***
	(0.00000057)	(0.00000057)	(0.0000041)	(0.0000041)
ROA	0.0114 **	0.0113 **	0.04	0.0387
	(0.0045)	(0.0045)	(0.0237)	(0.0239)
EBITMargin	-0.0019	-0.002	-0.0171	-0.0159
	(0.0031)	(0.0031)	(0.0161)	(0.0162)
LnMarketcap	0.2896 ***	0.2897 ***	0.6247 ***	0.6165 ***
	(0.0363)	(0.0364)	(0.1599)	(0.1608)
LnAssets	-0.3491 ***	-0.3488 ***	-0.5688 ***	-0.5544 ***
	(0.0427)	(0.043)	(0.1849)	(0.1847)
const	2.6099 ***	2.6101 ***	5.8245 ***	5.613 **
	(0.6444)	(0.6637)	(2.1898)	(2.1775)
Year.2022	6.2491 ***	6.2491 ***	0.8462 ***	0.8522 ***
	(0.0425)	(0.0426)	(0.1803)	(0.1822)
Year.2023	5.3392 ***	5.3397 ***	0.3488 **	0.3479
	(0.0422)	(0.0424)	(0.1766)	(0.1789)
Year.2024	5.3512 ***	5.3505 ***	-0.6427 ***	-0.6358 ***
	(0.0429)	(0.0431)	(0.1835)	(0.1849)

"(table continues)"

(continued)

	USA		*Germany*	
Sector.Consumer Cyclicals	1.0205 **	1.0099 **	0.8448	0.8749
	(0.404)	(0.4046)	(0.5398)	(0.5386)
Sector.Consumer Non-Cyclicals	-0.3913	-0.4033	-1.3272	-1.3211
	(0.4136)	(0.4143)	(0.755)	(0.7535)
Sector.Energy	1.1843 ***	1.1718 ***	0.4061	0.4645
	(0.4126)	(0.4132)	(0.7565)	(0.759)
Sector.Healthcare	-0.0847	-0.0862	-1.152	-1.1803
	(0.413)	(0.4133)	(0.6644)	(0.6631)
Sector.Industrials	0.4517	0.4387	1.1642 **	1.1545 **
	(0.4015)	(0.4022)	(0.4604)	(0.4597)
Sector.Technology	0.6035	0.6025	1.4988 ***	1.4912 ***
	(0.4057)	(0.406)	(0.5338)	(0.534)
Sector.Utilities	-0.8093	-0.8355 **	-1.2314	-1.194
	(0.4193)	(0.4211)	(0.8894)	(0.8902)
Sector.Basic Materials	0.5294	0.5086	/	/
	(0.4118)	(0.4129)		
R-squared	0.9269	0.9269	0.5292	0.5305
Observations	2963	2963	250	250

Note: Standard errors are stated in parentheses below coefficients.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Source: Own work.

Appendix 2

Table 8: Results of random effects regression for Rd

	USA				*Germany*			
LagESG	-0.0009				0.0003			
	(0.0011)				(0.0047)			
LagEnvironmental			0.0008				0.0007	
			(0.001)				(0.0038)	
LagSocial			-0.003	***			0.0002	
			(0.0012)				(0.0045)	
LagGovernance			0.0012				-0.0016	
			(0.0008)				(0.0036)	
Leverage	0.0009	***	0.0009	***	0.0014	**	0.0015	**
	(0.0001)		(0.0001)		(0.0006)		(0.0006)	
ROA	-0.0169	***	-0.017	***	-0.0112		-0.0118	
	(0.003)		(0.003)		(0.0168)		(0.017)	
EBITMargin	0.0048	**	0.0047	**	-0.0184		-0.0175	
	(0.002)		(0.002)		(0.0099)		(0.0102)	
LnMarketcap	-0.2525	***	-0.2507	***	-0.2732	***	-0.2751	***
	(0.0235)		(0.0235)		(0.0942)		(0.0957)	
LnAssets	0.211	***	0.2151	***	0.2777	***	0.2845	***
	(0.0269)		(0.027)		(0.099)		(0.1007)	
const	3.3173	***	3.2316	***	0.7061		0.6458	
	(0.3939)		(0.407)		(1.0039)		(1.0187)	
Year.2022	2.5059	***	2.5085	***	2.5149	***	2.5236	***
	(0.0307)		(0.0307)		(0.1418)		(0.1418)	
Year.2023	1.9911	***	1.9959	***	1.9359	***	1.9424	***
	(0.0304)		(0.0304)		(0.1365)		(0.1369)	
Year.2024	2.1442	***	2.1476	***	1.6069	***	1.6082	***
	(0.0306)		(0.0307)		(0.1395)		(0.1394)	

"(table continues)"

(continued)

	USA		*Germany*	
Sector.Consumer Cyclicals	0.2776 (0.2447)	0.2434 (0.2453)	0.1201 (0.2368)	0.1231 (0.2418)
Sector.Consumer Non-Cyclicals	-0.151 (0.2505)	-0.1862 (0.2511)	-0.2379 (0.3378)	-0.2422 (0.3453)
Sector.Energy	0.4486 (0.2503)	0.4151 (0.2508)	-0.0114 (0.3343)	-0.023 (0.3451)
Sector.Healthcare	0.0043 (0.2504)	-0.0135 (0.2507)	0.3838 (0.2865)	0.3848 (0.2945)
Sector.Industrials	0.0474 (0.2432)	0.0107 (0.2438)	0.1242 (0.2003)	0.1194 (0.2053)
Sector.Technology	0.2748 (0.2458)	0.2603 (0.2461)	0.4678 (0.2384)	0.4544 (0.2458)
Sector.Utilities	-0.2855 (0.2538)	-0.3524 (0.2552)	-0.3859 (0.3906)	-0.4107 (0.4008)
Sector.Basic Materials	0.3197 (0.2494)	0.272 (0.2503)	/	/
R-squared	0.8019	0.8027	0.7162	0.7177
Observations	2963	2963	250	250

Note: Standard errors are stated in parentheses below coefficients.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Source: Own work.

Appendix 3

Table 9: Results of random effects regression for Re

	USA				*Germany*			
LagESG	-0.0009				-0.0011			
	(0.0026)				(0.0092)			
LagEnvironmental			-0.0021				-0.0034	
			(0.0021)				(0.0073)	
LagSocial			0.0031				-0.003	
			(0.0024)				(0.0082)	
LagGovernance			-0.0016				0.0048	
			(0.0015)				(0.0063)	
Leverage	-0.000072		-0.000066		0.0012		0.0012	
	(0.0003)		(0.0003)		(0.0014)		(0.0014)	
ROA	-0.0093		-0.0093		0.0421		0.0432	
	(0.0055)		(0.0055)		(0.0225)		(0.0227)	
EBITMargin	-0.0031		-0.0029		-0.025		-0.0264	
	(0.0044)		(0.0044)		(0.0164)		(0.0165)	
LnMarketcap	-0.1601	***	-0.1593	***	-0.4038	**	-0.3934	**
	(0.0529)		(0.0529)		(0.1637)		(0.1648)	
LnAssets	0.1705	**	0.1652	**	0.7408	***	0.7366	***
	(0.0698)		(0.0703)		(0.2088)		(0.2085)	
const	8.2082	***	8.2323	***	-0.3222		-0.4123	
	(1.3742)		(1.3914)		(3.0023)		(2.9933)	
Year.2022	0.3239	***	0.3221	***	0.1148		0.0986	
	(0.0466)		(0.0467)		(0.1657)		(0.1676)	
Year.2023	0.9376	***	0.9333	***	0.8953	***	0.8796	***
	(0.047)		(0.0474)		(0.1628)		(0.165)	
Year.2024	0.2569	***	0.2548	***	0.3144		0.3158	
	(0.0492)		(0.0498)		(0.1698)		(0.1714)	

"(table continues)"

(continued)

	USA				*Germany*			
Sector.Consumer Cyclicals	2.7238 (0.9223)	***	2.7651 (0.923)	***	1.8446 (0.7583)	**	1.8577 (0.7571)	**
Sector.Consumer Non-Cyclicals	-0.9228 (0.9444)		-0.8779 (0.9451)		-1.5936 (1.0909)		-1.5775 (1.0883)	
Sector.Energy	2.6367 (0.9404)	***	2.6828 (0.9411)	***	0.4764 (1.0963)		0.4889 (1.0967)	
Sector.Healthcare	-0.0853 (0.9429)		-0.0694 (0.9432)		-1.3018 (0.9505)		-1.2805 (0.9485)	
Sector.Industrials	1.2232 (0.9175)		1.2674 (0.9181)		1.5457 (0.6607)	**	1.5633 (0.6596)	**
Sector.Technology	1.2379 (0.9262)		1.2475 (0.9266)		1.7931 (0.744)	**	1.8031 (0.7431)	**
Sector.Utilities	-2.1695 (0.956)	**	-2.0874 (0.9575)	**	-3.2036 (1.2809)	**	-3.1885 (1.2801)	**
Sector.Basic Materials	1.388 (0.9418)		1.4505 (0.9428)		/		/	
R-squared	0.2179		0.2188		0.3223		0.3225	
Observations	2963		2963		250		250	

Note: Standard errors are stated in parentheses below coefficients.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Source: Own work.

Appendix 4

Table 10: Results of pooled OLS regression for WACC

	USA				*Germany*			
LagESG	0.0015				0.0325	***		
	(0.0013)				(0.0073)			
LagEnvironmental			0.0003				-0.0012	
			(0.0013)				(0.0057)	
LagSocial			0.0006				0.0171	**
			(0.0015)				(0.007)	
LagGovernance			0.001				0.0201	***
			(0.0011)				(0.0058)	
Leverage	-0.0024	***	-0.0024	***	-0.015	***	-0.0151	***
	(0.0004)		(0.0004)		(0.0026)		(0.0026)	
SqLeverage	0.0000022	***	0.0000022	***	0.000018	***	0.000018	***
	(0.00000052)		(0.00000052)		(0.0000047)		(0.0000046)	
ROA	0.0165	***	0.0164	***	0.0652	**	0.069	**
	(0.0044)		(0.0044)		(0.0312)		(0.0312)	
EBITMargin	-0.0051	**	-0.0051	**	-0.0642	***	-0.0648	***
	(0.0026)		(0.0026)		(0.0166)		(0.0169)	
LnMarketcap	0.2584	***	0.2586	***	0.6757	***	0.6369	***
	(0.0298)		(0.03)		(0.1533)		(0.1532)	
LnAssets	-0.3089	***	-0.3096	***	-0.7529	***	-0.7129	***
	(0.0328)		(0.0329)		(0.1585)		(0.1578)	
const	2.4464	***	2.4327	***	7.9397	***	7.5752	***
	(0.4299)		(0.4458)		(1.4646)		(1.4431)	
Year.2022	6.27	***	6.2699	***	0.6127	**	0.5811	**
	(0.0617)		(0.0617)		(0.2957)		(0.2939)	
Year.2023	5.4034	***	5.403	***	0.1802		0.1339	
	(0.06)		(0.0601)		(0.2829)		(0.2812)	
Year.2024	5.4287	***	5.4275	***	-0.7848	***	-0.7822	***
	(0.0593)		(0.0593)		(0.2879)		(0.2862)	

"(table continues)"

(continued)

	USA				*Germany*			
Sector.Consumer Cyclicals	0.9023 (0.2616)	***	0.901 (0.2621)	***	0.5322 (0.3556)		0.5975 (0.3521)	
Sector.Consumer Non-Cyclicals	-0.503 (0.2671)		-0.504 (0.2677)		-1.5838 (0.51)	***	-1.4353 (0.5085)	***
Sector.Energy	1.0828 (0.2682)	***	1.0836 (0.2687)	***	0.3657 (0.4936)		0.552 (0.4956)	
Sector.Healthcare	-0.1572 (0.2675)		-0.1572 (0.2678)		-1.436 (0.4214)	***	-1.3537 (0.421)	***
Sector.Industrials	0.3743 (0.2597)		0.3714 (0.2603)		0.9976 (0.2904)	***	1.0583 (0.2891)	***
Sector.Technology	0.5583 (0.2623)	**	0.5568 (0.2627)	**	1.6726 (0.3535)	***	1.8082 (0.3568)	***
Sector.Utilities	-0.8451 (0.2705)	***	-0.853 (0.2724)	***	-0.8036 (0.5769)		-0.6768 (0.5748)	
Sector.Basic Materials	0.4105 (0.2656)		0.4052 (0.2667)		/		/	
R-squared	0.8232		0.8233		0.5964		0.6062	
Observations	2963		2963		250		250	

Note: Standard errors are stated in parentheses below coefficients.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Source: Own work.

Appendix 5

Table 11: Results of pooled OLS regression for Rd

	USA				*Germany*			
LagESG	-0.0006				0.0022			
	(0.0009)				(0.004)			
LagEnvironmental			0.0008				-0.0009	
			(0.0008)				(0.0032)	
LagSocial			-0.0023	**			0.0026	
			(0.001)				(0.0039)	
LagGovernance			0.0007				0.0002	
			(0.0007)				(0.0032)	
Leverage	0.0011	***	0.0011	***	0.0012	**	0.0012	**
	(0.0001)		(0.0001)		(0.0005)		(0.0005)	
ROA	-0.0192	***	-0.0194	***	-0.0192		-0.0201	
	(0.0029)		(0.0029)		(0.017)		(0.0172)	
EBITMargin	0.0057	***	0.0056	***	-0.0183	**	-0.0172	
	(0.0017)		(0.0017)		(0.0092)		(0.0094)	
LnMarketcap	-0.2463	***	-0.244	***	-0.2081	**	-0.2099	**
	(0.0195)		(0.0196)		(0.0842)		(0.0851)	
LnAssets	0.1961	***	0.1977	***	0.1967	**	0.203	**
	(0.0213)		(0.0213)		(0.086)		(0.0867)	
const	3.6102	***	3.5682	***	1.0531		0.9489	
	(0.2817)		(0.2919)		(0.8071)		(0.8056)	
Year.2022	2.4752	***	2.4773	***	2.4777	***	2.482	***
	(0.0405)		(0.0405)		(0.1631)		(0.1641)	
Year.2023	1.9501	***	1.9542	***	1.9358	***	1.9352	***
	(0.0395)		(0.0395)		(0.1554)		(0.1563)	
Year.2024	2.1153	***	2.1184	***	1.6042	***	1.6048	***
	(0.0389)		(0.039)		(0.1577)		(0.1585)	

"(table continues)"

(continued)

	USA		*Germany*	
Sector.Consumer Cyclicals	0.1727 (0.1717)	0.1472 (0.172)	0.1225 (0.1892)	0.1342 (0.1899)
Sector.Consumer Non-Cyclicals	-0.2466 (0.1754)	-0.2728 (0.1757)	-0.2904 (0.2817)	-0.2887 (0.2842)
Sector.Energy	0.3179 (0.1762)	0.2931 (0.1764)	-0.0408 (0.2725)	-0.0247 (0.2769)
Sector.Healthcare	-0.1291 (0.1758)	-0.1401 (0.1758)	0.3016 (0.2261)	0.2897 (0.2303)
Sector.Industrials	-0.0611 (0.1705)	-0.0881 (0.1708)	0.1388 (0.1583)	0.1354 (0.16)
Sector.Technology	0.1734 (0.1723)	0.1631 (0.1724)	0.4561 ** (0.1926)	0.4443 ** (0.1977)
Sector.Utilities	-0.3566 ** (0.1773)	-0.406 ** (0.1784)	-0.3168 (0.3161)	-0.3183 (0.3188)
Sector.Basic Materials	0.219 (0.1744)	0.1831 (0.175)	/	/
R-squared	0.6462	0.6469	0.5615	0.5618
Observations	2963	2963	250	250

Note: Standard errors are stated in parentheses below coefficients.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Source: Own work.

Appendix 6

Table 12: Results of pooled OLS regression for Re

	USA				*Germany*			
LagESG	-0.0006				0.0231	**		
	(0.0027)				(0.0098)			
LagEnvironmental			-0.0025				-0.0118	
			(0.0026)				(0.0078)	
LagSocial			0.003				0.0136	
			(0.003)				(0.0095)	
LagGovernance			-0.00004301				0.0271	***
			(0.0021)				(0.0078)	
Leverage	0.0011	***	0.0011	***	0.000081		0.0000061	
	(0.0003)		(0.0003)		(0.0012)		(0.0012)	
ROA	0.0118		0.0119		0.1156	***	0.126	***
	(0.0089)		(0.0089)		(0.042)		(0.0416)	
EBITMargin	-0.0011		-0.001		-0.0652	***	-0.0712	***
	(0.0051)		(0.0051)		(0.0227)		(0.0228)	
LnMarketcap	-0.5232	***	-0.5237	***	-0.8467	***	-0.9121	***
	(0.0598)		(0.0602)		(0.2083)		(0.2061)	
LnAssets	0.513	***	0.5112	***	1.058	***	1.122	***
	(0.0653)		(0.0654)		(0.2127)		(0.21)	
const	8.3728	***	8.3199	***	1.4316		0.9354	
	(0.8648)		(0.8968)		(1.9975)		(1.9513)	
Year.2022	0.3451	***	0.3433	***	-0.477		-0.5272	
	(0.1244)		(0.1245)		(0.4036)		(0.3975)	
Year.2023	1.0914	***	1.0861	***	0.3932		0.3213	
	(0.1211)		(0.1212)		(0.3846)		(0.3787)	
Year.2024	0.4227	***	0.4184	***	-0.1857		-0.1671	
	(0.1195)		(0.1197)		(0.3903)		(0.384)	

"(table continues)"

(continued)

	USA				*Germany*			
Sector.Consumer Cyclicals	2.5153 (0.5271)	***	2.5447 (0.5282)	***	1.6455 (0.4683)	***	1.7412 (0.46)	***
Sector.Consumer Non-Cyclicals	-1.0912 (0.5385)	**	-1.0581 (0.5396)		-1.7551 (0.6972)	**	-1.5204 (0.6885)	**
Sector.Energy	2.4053 (0.5408)	***	2.4438 (0.5417)	***	0.57 (0.6744)		0.8599 (0.6709)	
Sector.Healthcare	-0.0625 (0.5395)		-0.0587 (0.54)		-1.363 (0.5595)	**	-1.2264 (0.5579)	**
Sector.Industrials	1.1894 (0.5234)	**	1.2197 (0.5246)	**	1.4758 (0.3919)	***	1.5817 (0.3876)	***
Sector.Technology	1.3901 (0.5289)	***	1.3908 (0.5296)	***	2.344 (0.4768)	***	2.5612 (0.4788)	***
Sector.Utilities	-2.4126 (0.5444)	***	-2.3557 (0.5481)	***	-3.0984 (0.7824)	***	-2.8734 (0.7722)	***
Sector.Basic Materials	1.1792 (0.5353)	**	1.2254 (0.5375)	**	/		/	
R-squared	0.3068		0.3071		0.4412		0.4651	
Observations	2963		2963		250		250	

Note: Standard errors are stated in parentheses below coefficients.
*** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Source: Own work.