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Exploring the Impact of ESG Ratings in Banking: A Study of European Banks

Bachelor's thesis

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Declaration of Authorship

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Gabriela Bosnakova

Abstract

This thesis examines the impact of Environmental, Social, Governance (ESG) factors on the financial performance of European banks, focusing on the Weighted average cost of capital and abnormal (WACC) returns during regulatory changes and the COVID-19 pandemic. Using data from 2014 to 2022, the study employs fixed effects models and event study methodologies to analyze the relationship between ESG scores and financial metrics. The findings reveal a complex nonlinear relationship between ESG scores and WACC, suggesting an optimal ESG threshold that minimizes WACC. The study also finds weak correlations between ESG scores and ROE, indicating limited direct effects on financial outcomes. The results of periods of regulatory change and the COVID-19 crisis show inconsistent patterns in abnormal returns without clear evidence that higher ESG scores provide financial resilience. These insights challenge the assumption that higher ESG scores consistently correlate with better financial performance, highlighting the need for more research in different conditions and longer periods of time.

Keywords	Profitability, ESG, Sustainability, Bank
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Abstrakt

Tato práce zkoumá dopad faktorů ESG na finanční výkonnost evropských bank se zaměřením na WACC a abnormální výnosy během regulatorních změn a pandemie COVID-19. Využívá data z let 2014 až 2022. Studie používá modely s pevnými efekty a metodologii studie událostí k analýze vztahu mezi ESG skóre a finančními ukazateli. Zjištění odhalují komplexní, nelineární vztah mezi ESG skóre a WACC, naznačující optimální úroveň ESG skóru minimalizující WACC. Studie také nalézá slabé korelace mezi ESG skóre a ROE, což ukazuje na limitované přímé efekty na finanční výsledky. Výsledky období regulačních změn a krize COVID-19 ukazují nekonzistentní výsledky v abnormálních výnosech, bez jasných důkazů, že vyšší ESG skóre poskytují finanční odolnost. Tyto poznatky zpochybňují předpoklad, že vyšší ESG skóre konzistentně korelují s lepším finančním výkonem, což zdůrazňuje potřebu dalšího výzkumu za různých okolností a v delších časových obdobích.

Klíčová slova	Profitabilita, ESG, Udržitelnost, Bankovnictví
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Acronyms

WACC Weighted average cost of capital

ESG Environmental, Social, Governance

ROE Returns on Equity

CSRD Corporate sustainability reporting directive

ESRS European Sustainability Reporting Standards

WE Western Europe

SE Southern Europe

NE Northern Europe

CEE Central, Eastern Europe

CAR Cumulative abnormal return

Chapter 1

Introduction

In an era where sustainability factors are increasingly influencing business operations and investment decisions, this thesis seeks to examine the impact of Environmental, Social, Governance (ESG) factors on the financial performance of banks supported by Kim & Li (2021). Specifically, the research focuses on analyzing how these factors affect the Weighted average cost of capital (WACC) and abnormal returns, particularly during periods marked by significant regulatory changes and the global upheaval caused by the COVID-19 pandemic.

This study explores the complex interaction between ESG factors and key financial metrics within the banking sector, with a particular focus on banks operating on the European continent. This geographical focus is driven by the similarity in the banking sector's structure across the region, allowing for a more consistent analysis of ESG impacts.

Using a robust data set sourced from the Refinitiv Eikon, which includes panel data from 2014 to 2022 for 52 banks, this research uses detailed ESG practice data to investigate the hypothesized relationships. Additional macroeconomic data obtained from the Eurostat and stock price data from the Wall Street Journal complement the primary data sources, ensuring a comprehensive approach to our analysis.

The research methodology encompasses two main analytical approaches: standard panel data methods with a fixed effect model and non-linear relationship to handle the nuances of the data supported by El Khoury *et al.* (2023), and an event study methodology to assess the impact of specific events on bank performance. These methodologies are tailored to explore the influence of the overall ESG score and individual ESG pillars on financial outcomes such as WACC and Returns on Equity (ROE).

Hypothesis 1 suggests that banks with high ESG scores benefit from a lower cost of capital due to perceived lower risks and positive environmental impacts. This implies that higher ESG scores can enhance a bank's financial stability by attracting risk-averse investors and reducing borrowing costs.

Hypothesis 2 asserts a positive correlation between ESG scores and ROE in the EU banking sector, indicating that sustainable practices and transparent reporting are crucial for financial success and can improve market perceptions and performance.

Hypothesis 3 considers the potential for significant abnormal returns on EU bank stocks in response to new ESG-related regulations like the Corporate sustainability reporting directive (CSRD) or changes to the European Sustainability Reporting Standards (ESRS). This hypothesis explores how proactive ESG disclosures might yield benefits under new regulatory frameworks.

Hypothesis 4 examines the impact of ESG scores on bank resilience and stock returns during the COVID-19 pandemic, proposing that banks with higher ESG scores did not experience abnormal returns due to their resilience. This explores the protective role of ESG in shielding banks from external shocks, underscoring its value in fostering long-term stability.

The structure of the thesis is organized as follows: Chapter 2 provides the theoretical background, offering a comprehensive overview of the topic. Chapter 3 presents a detailed literature review, examining the drivers of bank performance and delving into the specifics of abnormal returns in banking. Chapter 4 outlines the methodologies employed, discussing the rationale behind their selection and verifying the underlying assumptions to ensure valid statistical inferences. Chapter 5 provides an in-depth commentary on our data sources, describing each step involved in compiling the final dataset, and introduces the variable selection along with descriptive statistics. Chapter 6 presents the results of our research, including a concise discussion on each of the hypotheses tested. Chapter 7 wraps up the thesis with a brief summary of the findings and discusses the implications, highlighting avenues for potential future research.

Chapter 2

Theoretical backround

This chapter deals with the theoretical background of our research. First, we will discuss key terms and the context of ESG and introduce how ESG influences performance in banking. Later on, we will have a closer look at abnormal returns. Firstly, efficient market theory, COVID-19, CSRD and ESRS.

Green and sustainable finance is rapidly becoming an integral part of mainstream financial practices, driven by commitments to 'net zero' policies, regulatory frameworks, and evolving market dynamics. Financial institutions are actively realigning their strategies, activities, and operations with the objectives outlined in the Paris Agreement and other sustainability targets.

The latest comprehensive climate science assessment from the International Panel on Climate Change (IPCC) in August 2021 forecasts a likely temperature increase that exceeds 1.5 ° C above preindustrial levels by 2040 and further exceeds 2 ° C later in the century Masson-Delmotte *et al.* (2021). To address this, substantial reductions in greenhouse gas emissions are imperative, positioning the finance sector, along with finance professionals, at the forefront of addressing climate change and other environmental and social challenges.

Finance holds a unique position to lead the transition to a low-carbon and more sustainable world. The finance sector, including financial and banking professionals, has the potential to take advantage of a substantial commercial opportunity by demonstrating a commitment to positive social impact Thompson (2021).

Following the 2008 financial crisis, there was a pronounced focus on enhancing the sustainability of financial institutions. More recently, attention has shifted toward understanding how finance can actively contribute to the sustainability of economies and societies, encompassing the preservation and

enrichment of the natural environment. 'Sustainable finance' involves making the activities and operations of financial institutions more sustainable and financing initiatives aligned with the UN Sustainable Development Goals Biermann *et al.* (2017).

These two facets are interconnected, as the ability to finance sustainable objectives is closely tied to the adoption of sustainable principles and practices within an organization. Sustainable finance is defined as the inclusion of economic, environmental, and social factors in an organization's strategy, management, activities, and operations, coupled with the financing of sustainable economic, environmental, and social objectives.

The term ESG in the context of sustainable finance refers to the way organizations consider and manage environmental factors (E), social (S) and governance (G) in their operations, activities, and investment decisions. Although ESG focuses on these three specific factors, a broader sustainability approach considers the general economic, environmental, and social impacts of the activities and decisions of an organization Thompson (2021).

It is crucial to distinguish between ESG and sustainable, as the latter encompasses a broader spectrum of measured impacts to gauge progress toward a more sustainable, low-carbon world. Since the 2015 Paris Agreement Agreement (2015), there has been a greater focus on environmental sustainability, involving substantial efforts to finance technologies that mitigate climate change and support climate-resilient development.

The commitment to achieve net zero by 2050 Marteau *et al.* (2021) has become a defining element of the global sustainability agenda, with governments, companies and financial institutions worldwide committed to achieve net zero carbon emissions by 2050. This marks a critical milestone in the fight against climate change. Recent prominence has been given to social sustainability issues and a broader array of environmental concerns beyond climate change, responding to movements such as 'Black Lives Matter' and the imperative to 'build back better' following the Covid-19 pandemic. The Net Zero Banking Alliance requires banks to endorse the commitment statement signed by their CEO. This commitment requires aligning operational and attributable greenhouse gas emissions with net zero pathways by 2050. Within 18 months, banks must set targets for 2030 and 2050, initially focusing on priority sectors. Transparent reporting is emphasized, requiring annual disclosure of emissions data and progress reports against a board-reviewed transition strategy. The commitment also highlights a robust approach to the role of offsets in transition

plans, showcasing the alliance's commitment to sustainable banking practices and climate action.United Nations Environment Programme Finance Initiative (2023) Corporate transparency in sustainability matters has gained prominence with the enactment of the CSRD. This directive, in force since January 5, 2023, extends reporting obligations to a broader spectrum of large companies and listed SMEs. The subsequent adoption of the ESRS by the European Commission further reinforces the commitment to comprehensive reporting, which encompasses ESG issues.

2.1 ESG performance in banking

The extant literature uniformly underscores the pivotal role of ESG scores in shaping the profitability landscape of banking institutions. A coherent narrative emerges from the empirical findings, emphasizing the nuanced impact of ESG practices within the banking sector. Specifically, elevated ESG scores are identified as influential determinants in curtailing risk-taking behavior among banks, thus contributing to the establishment of a more resilient and stable financial system. However, it should be noted that this effect of risk mitigation is contingent on the characteristics of the executive board, as explained by D'Amato *et al.* (2022). Simultaneously, a positive and statistically significant association is observed between overall ESG scores and firm profitability, indicative of the financial returns that can be realized through strategic investments in robust ESG performance Di Tommaso & Thornton (2020).

In addition to examining intricate dynamics, the literature underscores that the environmental and social dimensions of the performance of ESG exert a particularly significant influence on the financial performance of banks operating in emerging markets, as evidenced by the findings of Izcan & Bektas (2022). However, the relationship between ESG scores and profitability exhibits a nuanced character, depending on the inherent risk profiles of the banks.

Research by Aydoğmuş *et al.* (2022) suggests that the impact of ESG scores on profitability manifests itself with greater magnitude among banks characterized by medium to high levels of risk. Integral to this discourse is the endorsement of value creation theory as advanced within the literature. This theoretical framework posits a substantive correlation between non-financial indicators that encompass corporate governance quality, risk management, and environmental and social performance, thereby positioning ESG practices as

instrumental elements that improve the overall performance of banking institutions.

Recognizing the initial costs associated with the adoption of ESG policies, the literature emphasizes long-term prospects that transcend mere financial returns. These include, but are not limited to, revenue stability, mitigation of business risks, positive performance effects, and accrual of added value Bătae *et al.* (2020). Taken together, these considerations underscore the strategic imperative of ESG integration, where initial costs are posited as judicious investments that yield sustained advantages and positively impact the bottom line.

In advancing the current body of academic knowledge, this article Bătae *et al.* (2020) seeks to address a conspicuous gap by conducting a nuanced analysis of substantial variations in ESG and financial performance between discrete classifications of European banks. Such classifications span the dichotomy of Developed Europe versus Emerging Europe, Eurozone versus non-Euro countries, and the categorical division of banks into Western, Central and Eastern European (CEE), Northern, and Southern regions. The methodical comparative examination undertaken in this study seeks to contribute valuable information on the intricate dynamics governing ESG practices and financial outcomes, thus improving academic understanding of the diverse landscape within European banking institutions.

2.1.1 Bank profitability

The profitability of European banks is influenced by various factors. The exposure of European banks to US assets made them vulnerable to the global financial crisis, but post-crisis deleveraging and shedding of claims to the US have contributed to greater bank profitability Wierzbowska & Matsubayashi (2022). Peripheral banks in the euro area are more affected by loan loss provisions, whereas the banks of the main countries make better use of customer deposits Veríssimo *et al.* (2021). Non-interest income has a significant positive impact on profitability for the European banking sector, especially during the COVID-19 pandemic Karadžić & Đalović (2021). Internal factors controlled by bank management do not have a significant impact on profitability, while macroeconomic factors such as the GDP growth rate and the inflation rate have a positive effect Kozak & Wierzbowska (2022). The profitability of EU banks is influenced by both the external macroeconomic environment and management

decisions, with the equity-to-asset ratio and GDP having a positive impact, while the loan-to-asset ratio and the provision for loan losses to the total loan ratio have a negative impact Durguti (2020).

2.2 Abnormal returns

Every participant in the stock market strives to maximize their profit while minimizing risk, and achieving this objective is based on the ability to predict future stock movements more accurately than others. Investors base their assessments of a company's stock price on an extensive understanding of the company, involving the scrutiny of financial reports, examination of fundamentals, and analysis of future growth and risks. This process, known as fundamental analysis, aims to approximate the intrinsic value of the company.

In addition to fundamental analysis, some investors also incorporate technical analysis into their decision making. This involves examining the company's price chart and trend to make predictions about future price movements. The use of advanced information technology and econometric models has significantly facilitated researchers' work with market data.

The late 1960s and early 1970s saw the publication of groundbreaking articles that revolutionized the understanding of the stock market. During this period, advances in research methodologies and the advent of sophisticated models contributed to a paradigm shift in stock market analysis Rosickỳ (2020).

2.2.1 The efficient market theory

The efficient market theory, also known as the efficient market hypothesis, is a concept proposed by Eugene Fama in his 1970 book "Efficient Capital Markets: A Review of Theory and Empirical Work Fama (1970)." This theory suggests that financial markets are efficient and incorporate all available information, making it impossible for investors to consistently outperform the market or predict future price movements with certainty Fama (1970). However, it is important to note that there are differing opinions on the ability to forecast securities prices Khoa *et al.* (2023). Despite efficient market theory suggesting that stock price fluctuations are random and unpredictable, numerous studies have been conducted using time series analysis and multiple regression models to attempt to forecast stock prices based on historical data Kanehira & Todoroki (2021). According to efficient market theory, all relevant information

is already reflected in stock prices, and therefore it is not possible to consistently outperform the market by predicting future price movements based on historical data alone. Despite efficient market theory suggesting that stock price fluctuations are random and unpredictable, numerous studies have been conducted using time series analysis and multiple regression models to attempt to forecast stock prices based on historical data.

These studies have shown mixed results, some supporting efficient market theory and others finding evidence of predictable patterns in stock price movements. Uncovering asymmetric multilevel fractal behavior in US, European, and global clean energy stock indices reveals distinct patterns. In the US, it stems from fat-tailed and long-range correlation, while in European and global indices, it is solely due to fat-tailed distribution. Efficiency during upward trends is higher in European and global markets compared to the US. Interestingly, with time, clean energy stocks in the US are becoming more efficient, as indicated by the measure of market deficiency that varies over time Kristoufek *et al.* (2020).

Efficient market theory remains a cornerstone of modern finance theory and continues to shape the majority of methodological approaches to valuing financial instruments. In conclusion, while efficient market theory suggests that it is impossible to consistently predict stock prices based on historical data, there are conflicting opinions and studies that have shown potential for predicting stock price movements to some extent. In conclusion, efficient market theory suggests that stock prices fully reflect all available information and cannot be predicted Agarwal *et al.* (2021).

2.2.2 New reporting standards

ESG reporting in the EU and the US differs due to various factors. The EU has implemented the European Non-Financial Reporting Directive (NFRD) that requires disclosure of non-financial and diversity information by certain large companies, which has led to improved disclosure commitment and effectiveness in the region Cicchiello *et al.* (2023). On the contrary, the governance of ESG reporting in the US is institutionally dense and fragmented, with voluntary reporting frameworks created by nonprofit organizations and little government involvement Sulkowski & Jebe (2022). Differences in reporting philosophies between the EU and the US are expected to prevent global consolidation of ESG reporting governance Amesheva (2022). The current state of sustainabil-

ity disclosure is insufficient to effectively integrate ESG data into investment and financial decisions, hindering the implementation of a global net zero trajectory Frecautan & NITA (2022). The complexity of the EU ESG reporting scheme and the existence of multiple frameworks and standards pose challenges for reporting companies, employees, consumers and policymakers Boros *et al.* (2022). The comparability of companies based on ESG indicators is limited due to mandatory and optional parallel disclosure requirements

2.2.3 COVID-19

The COVID-19 pandemic had a significant impact on the global economy. Both the supply and demand sides of the economy were affected, leading to a sharp decline in economic activity. The uncertainty caused by the pandemic was a major factor in the sudden drop in economic growth. However, timely macroeconomic policies, such as monetary easing and fiscal deficits, prevented a global depression. Although effective in preventing a severe economic downturn, these policies have resulted in side effects such as inflation, increased interest rates, and rising sovereign debt Begović *et al.* (2022). The pandemic also disrupted international supply chains, constrained economic activity through nonpharmaceutical measures, and led to unprecedented levels of short-term work and layoffs Bütler (2022). Countries around the world implemented various economic policies to mitigate the negative effects of the pandemic, but the responses varied according to the capabilities and health infrastructure of each country Petrovskaya *et al.* (2022).

Chapter 3

Literature review

This chapter deals with the relationship between ESG scores and financial performance in the banking sector. It discusses how higher ESG scores are associated with better financial stability and lower credit risks, highlighting the need to integrate ESG factors into regulatory frameworks. The chapter proposes hypotheses linking high ESG scores with a lower cost of capital and an improved ROE, suggesting that sustainable practices are increasingly vital for financial success in the banking industry.

3.1 ESG performance in banking

ESG framework has gained significant attention within the financial sector, driven by concerns about corporate responsibility, labor conditions, and the impact of climate change Duan (2023). ESG factors, which encompass environmental, social and governance dimensions, have been identified as contributing to enhanced financial stability by mitigating individual and systemic risks in the financial system Stolbov & Shchepeleva (2022). In particular, investment in ESG value in Chinese manufacturing enterprises has shown superior investment benefits and lower credit risk compared to traditional investment strategies Wenpeng Lu (2022). Recognizing the potential impact of ESG scores, especially within the governance pillar, on banks' contributions to systemic risk, it underscores the critical need to integrate ESG disclosure into regulatory authority surveillance mechanisms Aevoae *et al.* (2023). In pursuit of a comprehensive understanding of the intricate relationship between ESG scores and the financial performance of European banks, our research is guided by two overarching hypotheses.

The relationship between ESG ratings and banking performance is an important area of research. Several studies have found a positive association between ESG ratings and financial performance in the banking industry Bunker *et al.* (2022). For example, Simpson and Kohers found a positive link between measures of corporate social and financial performance in US banks Holland (2022). Similarly, Cornett et al. examined the relationship between ESG scores and financial performance during the 2008-2009 global financial crisis and found that banks with higher ESG scores had better financial performance during this period Yoo *et al.* (2021). The ESG score, which represents the performance achieved by banks in terms of environmental sustainability, stakeholders' relations, and corporate governance, has been used to capture the impact of ESG activities on banking performance D'apolito *et al.* (2019). Furthermore, research indicates that considering ESG issues may benefit financial performance Minkkinen *et al.* (2022). This gives rise to our initial two hypotheses.
Hypothesis 1: Banks with high ESG scores report a lower cost of capital compared to banks with low ESG scores (due to their perceived lower risk and positive environmental impact). A study conducted by Buallay (2019) in European banks found that disclosure of ESG has a significantly positive impact on bank performance, including profitability measures such as return on assets, return on equity, and Tobin's Q.
Hypothesis 2: There is a positive correlation between ESG scores and ROE in the EU banking sector. This suggests that banks that prioritize sustainability and engage in transparent reporting of their environmental, social and governance practices are more likely to experience positive market reactions, indicating the increasing importance of sustainable practices and ESG considerations in the financial industry.

3.2 Abnormal returns

Efficient market theory suggests that all available information is reflected in stock prices, leaving no room for investors to consistently outperform the market. Therefore, if banks with high ESG scores consistently generate abnormal returns, it implies that the market is inefficient or that there might be other factors at play that are not fully captured by traditional financial metrics. In this context, some sources suggest that changes in ESG ratings can have statistically significant short-term effects on the returns of the stock market of listed firms Brogi *et al.* (2022). This aligns with the notion that investors are increasingly

evaluating companies that demonstrate responsible management of ESG issues. However, it should be noted that other studies have found mixed results on the relationship between ESG scores and abnormal returns. Overall, more research is needed to fully understand the relationship between banks' high ESG scores and abnormal returns. In this regard, the study by Takahashia and Yamada on Japanese stock markets during the COVID-19 pandemic found no evidence of high ESG scores leading to abnormal high returns Yadav & Bhama (2023).

3.2.1 ESRS

The introduction of new reporting standards, such as the Corporate Sustainability Reporting Directive or changes to the European Financial Reporting Standards, has led to increased price volatility in bank stocks in the EU Gebhardt & Novotny-Farkas (2011). This volatility is likely due to the uncertainty surrounding how these new accounting standards will impact the financial statements and performance of banks Grewal *et al.* (2019). The implementation of new reporting standards, such as the Corporate Sustainability Reporting Directive or changes to the European Financial Reporting Standards.
Hypothesis 3: There is significant abnormal return of bank stocks in the EU that is higher in anticipation of the release of new accounting standards such as the CSRD or changes to the ESRS.

3.2.2 CSRD

When the Corporate Sustainability Reporting Directive was released, banks with high ESG ratings experienced abnormal returns. This beneficial impact of the ESG rating was observed in the financial sector, which is consistent with previous studies on insurance companies and banks in the research conducted by Sonnenberger & Weiss (2021) for insurance firms and Chiaramonte *et al.* (2020) for banks. Furthermore, a study by Buallay (2019) on European banks found that ESG disclosure has a significantly positive impact on bank performance, including profitability measures such as return on assets, return on equity, and Tobin's Q.

3.2.3 COVID-19

During the COVID-19 pandemic, the impact of ESG scores on bank resilience and stock returns varied between different studies. A study found that banks

with higher ESG scores had more resilient stock returns during the first wave of the pandemic, but this influence became insignificant when considering an extended time period Alkayed *et al.* (2023). Another study focused on the financial performance of banks and found that environmental performance in 2019 had a negative influence on return on equity in 2020, while social responsibility initiatives in 2020 positively influenced bank profitability in 2021 Danisman (2022). In general, the relationship between ESG scores, bank resilience, and stock returns during the COVID-19 pandemic is complex and varies depending on the specific context and time period analyzed. Thus, we would examine the last hypothesis.

Hypothesis 4: Banks with higher ESG scores experience lower abnormal returns in the COVID-19 period due to their resilence.

This suggests that banks that prioritize sustainability and engage in transparent reporting of their environmental, social and governance practices are more likely to experience positive market reactions, indicating the increasing importance of sustainable practices and ESG considerations in the financial industry.

Chapter 4

Methodology

This chapter deals with the specification of the model and the econometric practices, which will be used further. First, we look at the specification of the bank performance model and the common methods used to properly analyze the panel data. Then we specify Abnormal returns calculation and provide a step-by-step explanation of how we treat the time series data.

4.1 ESG performance in banking

4.1.1 Model Specifications Bank performance

Weighted Average Cost of Capital

The WACC formula in line with Fernandez (2010) is given by :

$$WACC = \frac{E}{V} \times Re + \frac{D}{V} \times Rd \times (1 - Tc)$$

Where:

- E is the market value of the equity
- V is the total market value of the firm's financing (Equity + Debt)
- Re is the cost of equity
- D is the market value of the firm's debt
- Rd is the cost of debt
- Tc is the corporate tax rate

To evaluate the impact of individual ESG pillars and the overall ESG score on the WACC, while controlling for bank-specific variables (X) and macroeconomic variables (Y). The models are specified as follows:

Model 1: Environmental Pillar

$$WACC_{it} = \beta_0 + \beta_1 EP_{it} + \beta_2 EP_{it}^2 + \mathbf{X}_{it}\beta + \mathbf{Y}_{it}\gamma + \alpha_i + \varepsilon_{it} \tag{4.1}$$

Model 2: Social Pillar

$$WACC_{it} = \beta_0 + \beta_1 SP_{it} + \beta_2 SP_{it}^2 + \mathbf{X}_{it}\beta + \mathbf{Y}_{it}\gamma + \alpha_i + \varepsilon_{it} \tag{4.2}$$

Model 3: Governance Pillar

$$WACC_{it} = \beta_0 + \beta_1 GP_{it} + \beta_2 GP_{it}^2 + \mathbf{X}_{it}\beta + \mathbf{Y}_{it}\gamma + \alpha_i + \varepsilon_{it} \tag{4.3}$$

Model 4: Overall ESG Score

$$WACC_{it} = \beta_0 + \beta_1 ESG_{it} + \beta_2 ESG_{it}^2 + \mathbf{X}_{it}\beta + \mathbf{Y}_{it}\gamma + \alpha_i + \varepsilon_{it} \tag{4.4}$$

Where:

- EP_{it}, SP_{it}, and GP_{it} represent the environmental, social, and governance components, respectively, of the ESG score for bank i at time t.
- EP_{it}^2, SP_{it}^2, and GP_{it}^2 are the squared terms of environmental, social, and governance scores, respectively, included to capture the potential non-linear effects of each ESG component on the dependent variable.
- ESG_{it} is the overall ESG score for bank i at time t.
- ESG_{it}^2 is the square term of the overall ESG score, included to capture potential non-linear effects of the overall ESG performance on the dependent variable.
- $\mathbf{X}_{it}$ denotes a vector of bank-specific control variables.
- $\mathbf{Y}_{it}$ represents a vector of macroeconomic variables.
- α_i captures the specific fixed effects of the bank, accounting for all factors invariant in time.
- ε_{it} is the error term that captures random deviations from the predicted value.

4.1.2 Panel data analysis

These models 4.1, 4.2, 4.3, 4.4 allow for an exploration of how factors of ESG, along with bank-specific and macroeconomic variables, influence the weighted average cost of capital, which is in line with literature such as Atan *et al.* (2018), providing an understanding of the financial implications of ESG.

Our econometric analysis employs panel data regression techniques to explore the influence of ESG factors along with bank-specific and macroeconomic variables on the WACC. This approach aligns with the methodologies documented in the literature, such as Atan *et al.* (2018), and provides information on the financial impacts of ESG practices.

Initially, the analysis implements pooled OLS regression to establish a baseline understanding. Subsequently, we adopt both fixed effects (FE) and random effects (RE) models to adequately address unobserved heterogeneity within the data. Panel regressions offer a significant advantage by controlling for unobservable variables that vary across entities, but remain constant over time. Additionally, the comprehensive data set inherent in the panel data helps alleviate the issues of multicollinearity among explanatory variables.

Fixed-effects models specifically focus on capturing time-invariant differences among entities, under the assumption that these entity-specific effects are constant throughout the observed period, as described by Wooldridge (2010). This model is particularly adept at analyzing temporal changes and describing the relationships between the dependent variable, WACC, and other pertinent explanatory variables. In contrast, random-effects models provide a more nuanced view by accommodating both time-invariant and time-variant changes, thus offering a more detailed perspective on data variability.

The choice between employing an FE or RE model was guided by the results of the Hausman test, a method consistent with Wooldridge (2010). We determined the appropriate model using the Hausman test, as suggested by Wooldridge (2010). As a result of the Hausman test, we conclude FE as a best approach to our data.

The following diagnostics were conducted to ensure the validity of the model.

Stationarity: The Augmented Dickey-Fuller test was applied to examine stationarity Dickey & Fuller (1979) of the dependent variables from 2014 to 2022. Stationary variables, whose statistical properties remain constant over

time, facilitate simpler analysis. The test's null hypothesis assumes nonstationarity (presence of a unit root), which was rejected, confirming their stationarity.

Homoscedasticity: The Breusch-Pagan test evaluated whether the variance of the residuals was consistent across the dataset. The findings indicated heteroskedasticity Breusch & Pagan (1979), suggesting that the variance of the residuals does not maintain a uniform pattern throughout all observations.

Autocorrelation: The presence of autocorrelation was investigated using the Breusch-Godfrey/Wooldridge test Breusch (1978). Although autocorrelation typically poses a concern in long-term panel data, the issue was addressed by implementing clustered standard errors.

Cross-sectional Dependence: Detected through the Breusch-Pagan LM test, cross-sectional dependence was mitigated by the application of clustered standard errors.

Multicollinearity: The potential for multicollinearity was examined by the Variance Inflation Factor (VIF) Kim (2019). No multicollinearity issues were identified among the variables, which confirms the reliability of the regression coefficients.

Employing heteroskedasticity-robust standard errors, clustered at the region level, was a consistent practice throughout this study to address the identified econometric issues. Medková (2019)

4.2 Abnormal returns

To compute abnormal returns for a security/stock, the first step is to identify an event and define an event window that in our case last 250 days, as Adnan *et al.* (2020) also suggested. We choose the event specification date as 12 March 2020 for COVID according to World Health Organization (2020), 21 April 2021 for CSRD and 31 July 2023 for ESRS according to Council of the European Union (2022). The abnormal return is determined by subtracting the actual stock return from a selected benchmark return, in our case, STOXX 600. Various methods are used in practice to estimate the benchmark return. For example, a straightforward approach involves calculating the stock's abnormal return as its return minus the return of a broad market index. An improved method is to compare the return of the stock with that of other stocks with similar characteristics, such as firm size, beta, recent performance or the ratio of price to book value per share Bodie *et al.* (2013)).

4.2.1 Expected Return Calculation using Market-Adjusted Models

The market adjusted model is a method used to estimate the expected return of a stock based on the overall performance of the market. Unlike more complex models that require estimation of individual stock parameters, the market-adjusted model assumes that the expected return for any stock is simply the market return. This approach is particularly useful for event studies, where the focus is on measuring abnormal returns without the need for extensive parameter estimation.

Given:

- $P_{i,t}$: Daily stock price of company i at time t.
- $P_{i,t-1}$: Daily stock price of company i at time $t-1$ (the previous day).
- I_t: Daily stock market index at time t.
- I_{t-1}: Daily stock market index at time $t-1$ (the previous day).

The actual return of stock i on day t, denoted as $R_{i,t}$, is calculated by:

$$R_{i,t} = \frac{P_{i,t} - P_{i,t-1}}{P_{i,t-1}} \tag{4.5}$$

The market return on day t, denoted as $R_{m,t}$, is calculated by:

$$R_{m,t} = \frac{I_t - I_{t-1}}{I_{t-1}} \tag{4.6}$$

In the market-adjusted model, the expected return of stock i on day t, $\hat{R}_{i,t}$, is assumed to be equal to the market return:

$$\hat{R}_{i,t} = R_{m,t} \tag{4.7}$$

This simplification allows us to make a straightforward comparison of the actual return of a stock with its expected market return, facilitating the analysis of abnormal returns in event studies.

Event studies aim to measure the economic impact of events through "abnormal returns", which are the difference between the actual returns and the "normal returns" that would have been expected if the event had not occurred.

Although actual returns are directly observable, normal returns require estimation through expected-return models, widely used in finance research Brown & Warner (1980).

The model is written as follows, where the abnormal return on a specific day within the event window is calculated as the difference between the stock's actual return ($R_{i,t}$) and the predicted normal return, which is based on the stock's typical relationship with its benchmark index (represented by α_i and β_i) and the actual return of the benchmark market ($R_{m,t}$):

$$AR_{i,t} = R_{it} - (\alpha_i + \beta_i R_{mt}) \tag{4.8}$$

where R_{it} represents the return on stock i at time t, and R_{mt} denotes the return on the market benchmark at the same time. The term ϵ_{it} is the error component, assumed to be a random variable with a mean of zero and a bounded variance, highlighting its unpredictability. This error term is presumed to not be correlated with both the market return R_{mt} and the return of any other firm R_{jt}, for $i \neq j$, ensuring independence across returns and over time, a condition known as homoscedasticity. The coefficient β_i, a regression parameter, quantifies the responsiveness of the return on stock i to movements in the market benchmark.

From this model, we compute the abnormal return (AR) for the stock i at time t by subtracting the expected return, based on the historical relationship of the stock with the market return, from the actual observed return.

In sample studies that examine multiple events of the same type, we can identify patterns in the responses of the stock market to these events. The average abnormal return (AAR) at a specific time relative to the event day is defined as:

$$AAR = \frac{1}{N} \sum_{i=1}^{N} AR_{i,t} \tag{4.9}$$

To quantify the total impact of an event over a defined period, or the event window, the Cumulative abnormal return (CAR) is calculated by summing up the individual abnormal returns:

$$CAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{i,t} \tag{4.10}$$

Typically, the event window spans ten days, starting ten days before the event and concluding ten days after based on Krivin *et al.* (2003).

As part of our regression analysis with time-series data, it is important to verify the classical assumptions as posited by Wooldridge (2010) to confirm that our market model qualifies as the Best Linear Unbiased Estimator (BLUE):

Linear in Parameters: Our first assumption (TS.1) requires that the time series model be linear in parameters. We postulate that the market model is meticulously constructed without structural deficiencies, thus satisfying the linearity of the parameters.

No Perfect Collinearity: The second assumption (TS.2) requires the absence of perfect collinearity among the regressors. Given that our model incorporates only one non-constant explanatory variable, we conclude that this condition is upheld.

Zero Conditional Mean: Due to the historical application of the model in numerous studies and the foundational work of Brown & Warner (1980), we hypothesize that our model is free from endogeneity issues, thus adhering to the Zero Conditional Mean assumption (TS.3). Wooldridge specifies that, for each time period t, the error term u_t, conditioned on the explanatory variables, has an expected value of zero:

$$\mathbb{E}(u_t|\mathbf{X}) = 0, \quad t = 1, 2, \ldots, n. \tag{4.11}$$

Homoscedasticity: The Homoscedasticity of the error term as our fourth assumption (TS.4). Wooldridge posits that the error variance u_t, conditional on X, remains constant across all time periods t:

$$\mathrm{Var}(u_t|\mathbf{X}) = \sigma^2, \quad t = 1, 2, \ldots, n. \tag{4.12}$$

A Breusch-Pagan test will be utilized to ensure the presence of heteroskedasticity. Our findings indicate a rejection of homoskedasticity at the confidence level 95% for all stocks during all three events. To address heteroscedasticity, we implemented Robust Standard Errors.

Serial Correlation: The final Gauss-Markov condition (TS.5) concerns the absence of serial correlation in error terms. As described by Wooldridge, the errors across different time periods, given X, are not correlated:

$$\mathrm{Corr}(u_t, u_s|\mathbf{X}) = 0, \quad \forall t \neq s. \tag{4.13}$$

The Durbin-Watson test, applied to the OLS residuals, evaluates the null

hypothesis of no serial correlation against the alternative of non-zero correlation.

Having satisfied all necessary assumptions, we opted for estimator is indeed best linear unbiased estimator.

Chapter 5

Data

This chapter deals with assessing ESG performance in the banking sector from 2014-2022, analyzing data from 52 banks using the Refinitiv Eikon database. It underscores the emphasis on social and governance factors over environmental concerns in the industry's ESG evaluations. The analysis incorporates macroeconomic variables such as GDP and HICP and financial metrics such as Tier 1 Capital and Return on Equity to explore the financial health of banks and the broader economic context. Furthermore, the chapter discusses the concept of abnormal returns, examining whether banks with higher ESG scores achieve better financial performance, suggesting that ESG factors may influence market expectations and investment returns.

5.1 ESG performance in banking

Initially, data were obtained using a screening tool within the Refinitiv Eikon database , which included information from 198 banks. Subsequently, through the filtering process, we extracted the essential data required for our analysis, notably focusing on ESG scores. This refinement led us to a final data set consisting of 52 numbers of banks that reported the necessary information. We observe panel data from 2014-2022 as a last fiscal report in Refinitiv. GDP and HICP data were obtained through the Eurostat database. We have to merge these datasets to be able to analyze data complexly. Data sets can be seen in the attached thesis.

Refinitiv ESG scores measure companies' ESG performance based on reported data in the public domain on three pillars and 10 different topics of ESG. Refinitiv methodology London Stock Exchange Group (2021) captures

and calculates more than 630 company-level ESG measures, of which we have carefully selected a subset of the 186 most relevant and comparable data points to power the overall company assessment and scoring process. The measures are based on considerations related to materiality, data availability, and industry relevance. For the banking industry, the weights are as in Table 5.1

Table 5.1: ESG Weights for Banking Services Industry

Category	**Environmental**	**Social**	**Governance**
Emission	0.02		
Innovation	0.10		
Resource Use	0.02		
Human Rights		0.10	
Product Responsibility		0.09	
Workforce		0.19	
Community		0.12	
Management			0.24
Shareholders			0.07
CSR Strategy			0.05
Total	**0.14**	**0.50**	**0.36**

Source: Author's computation based on Refinitiv methodology

The allocation of weights across the ESG pillars of environmental (0.14), social (0.5) and governance (0.36) for the Banking Services industry elucidates the sector's prioritized areas:

- **Social (0.5):** This pillar's prominence underscores the critical role of human rights, customer and employee relations, and community involvement. It reflects the recognition of the banking industry's profound impact on society and the importance of maintaining strong social responsibilities.

- **Governance (0.36):** With significant weight, governance highlights the need for ethical management, risk oversight and transparency. This pillar is essential to ensure trust and stability in the financial sector.

- **Environmental (0.14):** The lowest weight of the environmental pillar recognizes the comparatively indirect environmental impact of the banking industry.

5.1.1 Variables selection

Our variable selection process began with an initial list of 90 variables in the Appendix A.14. However, some were excluded due to insufficient information. By reviewing the relevant literature and performing multicollinearity tests, we refined our list to the final selection of variables. Independent variables included the ESG score. To go deeper into the details of the impacts of ESG, the study also divided the ESG score into its constituent components: the Social Pillar Score (SP), the Environmental Pillar Score (EP) and the Governance Pillar Score (GP), which is in line with Pellegrini *et al.* (2019). The SP measures a company's effectiveness in generating trust and loyalty among its workforce, customers, and society at large. The EP assesses the impact of the company on natural systems, including air, land, water, and ecosystems. Meanwhile, the GP evaluates the robustness of the governance structure of a company, focusing on the alignment of interests between board members and shareholders.

Additionally, macroeconomic variables such as Gross Domestic Product (GDP), the tax rate, and the Harmonized Index of Consumer Prices (HICP) were included to control for economic conditions that could influence the outcomes. The GDP provides a broad measure of economic activity within a country, while the tax rate directly affects corporate profitability. The HICP was considered to adjust for inflationary impacts on financial data.

Other specific financial metrics relevant to the banking sector were also included. Tier 1 Capital (T1), which is a fundamental measure of a bank's financial strength from a regulatory perspective, and ROE suggested by Di Tommaso & Thornton (2020), which indicates the profitability of a company by showing how effectively the financial resources owned by shareholders are used.

Table 5.2: Description of Variables

Abbreviation	**Name of Variable**	**Type**	**Description**
WACC	Weighted Average Cost of Capital	Dependent	A Critical metric reflecting the cost of capital, combining the cost of equity and debt, weighted by their respective uses in the company's capital structure.
ESG	ESG Score	Bank specfic	A Comprehensive Measure assessing a company's environmental sustainability, social responsibility, and governance practices.
SP	Social Pillar Score	Bank specific	Measures a company's ability to generate trust and loyalty with its workforce, customers, and society through best management practices.
EP	Environmental Pillar Score	Bank specific	Assesses a company's impact on natural systems, including air, land, water, and ecosystems.
GP	Governance Pillar Score	Bank specific	Evaluates a company's systems and processes for ensuring board members and executives act in shareholders' long-term interests.
GDP	Gross Domestic Product	Macroeconomic	The total monetary or market value of all finished goods and services produced within a country's borders in a specific period.
taxrate	Tax Rate	Bank specific	The ratio at which a business or individual is taxed, often referring to the corporate income tax rate for companies.
HICP	Harmonized Index of Consumer Prices	Macroeconomic	Measures Changes in the Prices of Consumer Goods and Services Acquired by Households.
T1	Tier 1 Capital	Bank specific	A key measure of a bank's financial strength from a regulator's viewpoint, including equity capital and disclosed reserves.
ROE	Return on Equity	Bank specific	The profitability measure of a corporation, calculated as annual return (net income) divided by total shareholders' equity.
log(Assets)	Assets	Bank specific	The total assets measure the size and overall capacity of a bank for lending, risk taking, and investment.

5.1.2 Descriptive statistics

The table 4.3. presents descriptive statistics for key financial and ESG metrics. The WACC averages at 0.10 with a narrow interquartile range (IQR) from 0.08 to 0.12, indicating relative stability between observations. ESG scores show a higher mean and median, suggesting a generally positive approach to sustainability, although with considerable variability (SD of 20.17) and a wide range (1.53 to 95.74), indicating significant differences in ESG performance between entities.

The Environmental Pillar (EP) score stands out with both high mean and median values, alongside a broad range, reflecting varied environmental commitments. The Social Pillar (SP) and Governance Pillar (GP) scores exhibit similar spread and ranges, underscoring diversity in social and governance practices. The data indicate that the WACC remains relatively consistent

Table 5.3: Descriptive Statistics of Model Variables

Variable	Mean	Median	SD	Min	Max	Q1	Q3
WACC	0.06	0.05	0.04	0.00	0.28	0.03	0.07
COST OF DEBT	0.02	0.02	0.02	-0.00	0.18	0.01	0.03
COST OF EQUITY	0.11	0.10	0.05	0.02	0.39	0.08	0.12
ESG	61.89	66.48	20.17	1.53	95.74	49.69	76.01
EP	66.87	76.70	26.10	0.00	98.11	50.43	87.35
SP	63.52	69.72	22.17	0.40	97.67	49.07	78.34
GP	60.37	63.90	22.42	2.35	95.13	45.88	78.12
Tier1	0.16	0.16	0.04	0.04	0.43	0.14	0.18
taxrate	0.24	0.23	0.05	0.10	0.53	0.20	0.28
HICP	104.40	102.02	6.28	98.78	137.22	100.11	105.41
GDP	2.08	2.20	3.57	-11.20	9.90	1.10	4.30
ROE	0.08	0.09	0.08	-0.43	0.26	0.05	0.12
logAssets	1.18	1.17	0.02	1.08	1.21	1.16	1.19

Source: Author's computation
NOTE: WACC is calculated by Refinitiv Eikon

across various European regions—Central, Eastern Europe (CEE), Northern Europe (NE)), Southern Europe (SE), and Western Europe (WE)—with minor fluctuations, where WACC values span from 5% to 7%. In stark contrast, ESG scores show significant disparities. CEE has the lowest average ESG score at 54.08, with a wide range that highlights various sustainability practices. In comparison, SE records a higher average of 64.83 but also displays the widest range in scores, indicating substantial variations in how companies within the region handle ESG issues. WE, while having a similar average ESG score to SE,

shows less variability, suggesting a more uniform approach to sustainability.

Table 5.4: Descriptive Statistics for WACC and ESG by Region

Region	Variable	Mean	SD	Min	Max
CEE	WACC	0.07	0.04	0.01	0.28
CEE	ESG	54.08	17.79	9.21	87.34
NE	WACC	0.07	0.04	0.01	0.23
NE	ESG	62.42	16.84	16.46	82.76
SE	WACC	0.05	0.04	0.01	0.24
SE	ESG	64.83	22.05	1.53	92.57
WE	WACC	0.05	0.03	0.00	0.18
WE	ESG	63.64	19.44	17.17	95.74

Source: Author's computation

The heteroskedasticity and autocorellation tests are uploaded in Appendix specifically for ESG models Tables A.1, A.2, for EP models Tables A.3, A.4 for SP models Tables A.5, A.6 and lastly for GP models Tables A.7, A.8

5.2 Abnormal return

We obtained stock price data for selected banks listed on the STOXX 600 index from *The Wall Street Journal*. This subset of banks was chosen for a detailed case study to assess performance trends within the European banking sector. The banks analyzed are as follows: STOXX 600 - as the benchmark index, Commerzbank AG, BNP Paribas SA, Credit Agricole SA, Deutsche Bank AG, Erste Group Bank AG, ING Groep NV, KBC Groep NV, Komercni Banka as, OTP Bank Nyrt, Powszechna Kasa Oszczednosci Bank Polski SA, Raiffeisen Bank International AG, Societé Générale SA. UniCredit SpA. Then, from our initial data set, we used the ESG score of Section 5.1 ESG Bank performance.

We divide banks into two groups with an ESG score below 75 and above. Banks with low ESG score include (7) and banks with high ESG score include (6) banks. The STOXX Europe 600 Banks Index EUR is a focused gauge of the EU banking sector's performance that encompasses a range of banking equities, thus serving as a benchmark that reflects the vitality and trends within the European banking landscape.

5.2.1 Descriptive statistics

The Table 5.5 present a comparative analysis of banking stocks during a period likely associated with the COVID-19 pandemic, highlighting the impact of ESG scores on bank performance.

In Table 5.5, each row corresponds to a different bank or index, providing metrics on their stock performance and ESG scores. ESG scores range from 60.81 to 94.98, suggesting a varied commitment to ESG principles between different banks. The MEAN column, which shows the average daily return, is mostly negative, indicating an overall decline in stock prices during the observed window. The Min and Max columns show extreme daily losses and gains, which are considerable and reflect high market volatility. This is also supported by the STD (standard deviation) values, which are relatively high for all entities, pointing towards significant fluctuation in returns. The ANT.WINDOW column corresponds to the anticipation window, reflecting projected performance over a specified period before a known event or date, while ADJUST.WINDOW represents the adjustment window, indicating to revise forecasts or outcomes following new information or the event itself. The column labeled 12 March AR denotes the actual abnormal returns observed on 12 March, which may have been a critical date during the COVID-19 crisis, such as a significant market reaction to pandemic developments. The STOXX 600 lacks an ESG score, which is appropriate given that it functions as a benchmark index rather than a single entity.

The Table 5.6 average ESG score for low ESG score banks is 67.618, while high ESG score banks score higher at 84.738. Both groups of banks show negative returns, with banks with a low ESG score showing an AAR of -1.10%, slightly worse than banks with a high ESG score of -0.97%. The close proximity of these percentages may indicate that during this period the difference in ESG scoring had a minimal impact on the average annual returns of banks. A more pronounced disparity is observed in the CAR, where banks with a low ESG score experienced a substantial decrease of -161.84% compared to banks with high ESG score, which decreased by -121.77%. These figures indicate a decrease in value, and banks with high ESG score performed better, suggesting that a higher ESG score could potentially mitigate extreme negative outcomes in periods of abnormal market conditions.

As could be seen at Table 5.7 for CSRD event window ESG score range from 55.88 (Komercni Banka as) to 94.68 (BNP Paribas SA), suggesting a wide vari-

Table 5.5: Abnormal returns COVID-19 window with ESG score

BANK	ESG	MEAN	MIN	MAX	STD	ANT. WIN-DOW	12TH MARCH AR	ADJUST. WIN-DOW
Commerzbank AG	76.60	-0.46%	-10.25%	5.54%	3.80%	-1.46%	1.38%	0.69%
BNP Paribas SA	94.98	-1.14%	-8.95%	5.84%	4.17%	-2.67%	-8.95%	-0.04%
Credit Agricole SA	71.41	-1.27%	-11.73%	7.32%	4.31%	-1.65%	-6.12%	0.62%
Deutsche Bank AG	83.68	0.01%	-7.67%	4.58%	3.22%	-1.65%	4.45%	1.22%
Erste Group Bank AG	80.69	-2.12%	-9.72%	8.26%	4.62%	-2.16%	-9.07%	-1.39%
ING Groep NV	73.23	-1.52%	-12.69%	13.60%	5.52%	-3.20%	-4.08%	0.41%
Kbc Groep NV	62.03	-1.00%	-13.46%	9.05%	5.64%	-1.11%	-12.44%	0.26%
Komercni Banka as	61.39	-1.38%	-7.83%	4.16%	3.23%	-0.65%	-7.83%	-1.47%
OTP Bank Nyrt	73.71	-1.28%	-14.91%	10.82%	5.97%	-1.10%	-4.94%	-1.09%
Powszechna Kasa SA	60.81	-1.04%	-9.85%	6.95%	4.36%	-1.95%	-6.19%	0.39%
Raiffeisen Bank International AG	70.75	-0.22%	-6.39%	8.86%	3.22%	-1.07%	-1.76%	0.78%
Societé Générale SA	86.20	-1.32%	-12.27%	8.73%	5.98%	-2.00%	-10.34%	0.26%
UniCredit SpA	86.27	-0.77%	-6.34%	6.47%	3.45%	-1.38%	-5.07%	0.27%
STOXX 600	–	-2.07%	-18.12%	10.52%	6.70%	-3.82%	-12.04%	0.68%

Source: Author's computation

Table 5.6: ESG Scores, AAR, CAR over COVID-19

	Low ESG score banks	High ESG score banks
AAR	-1.10%	-0.97%
CAR	-161.84%	-121.77%
Average ESG	67.62	84.74

Source: Author's computation

ance. Daily returns range from -0.26% (ING Groep NV) to 0.36% (Powszechna Kasa SA), indicating the variation in profitability between banks during the observed window. Minimum and maximum returns show volatility within the period. Deutsche Bank AG exhibits the widest range, with returns of -2.16% to 8.19%, indicating high volatility. For the anticipation window we can observe a low of -0.36% for UniCredit SpA, indicating an expectation of negative performance, to a high of 0.28% for Powszechna Kasa SA, suggesting a modestly positive outlook. The STOXX 600's minimal change on 21st of April this suggests a steady state in market conditions or investor sentiment. In contrast, Deutsche Bank AG's positive return of 0.35%. A stark contrast is evident

Table 5.7: Abnormal returns CSRD window with ESG score

BANK	ESG	MEAN	MIN	MAX	STD	ANT. WIN-DOW	21ST APRIL AR	ADJUST. WIN-DOW
Commerzbank AG	75.87	0.09%	-2.03%	2.02%	1.07%	-0.22%	2.02%	0.20%
BNP Paribas SA	94.68	-0.15%	-1.64%	1.06%	0.66%	0.02%	-0.41%	-0.28%
Credit Agricole SA	69.50	-0.23%	-1.91%	0.82%	0.62%	-0.07%	0.17%	-0.44%
Deutsche Bank AG	80.33	0.18%	-2.16%	8.19%	2.07%	-0.30%	0.35%	0.63%
Erste Group Bank AG	76.12	0.21%	-1.89%	3.22%	1.07%	-0.20%	0.99%	0.54%
ING Groep NV	73.45	-0.26%	-1.85%	1.20%	0.92%	-0.09%	0.89%	-0.56%
Kbc Groep NV	61.02	0.18%	-0.95%	2.89%	1.05%	0.12%	-0.20%	0.28%
Komercni Banka as	55.89	0.01%	-2.46%	2.80%	1.24%	-0.27%	-1.13%	0.40%
OTP Bank Nyrt	70.335	-0.14%	-2.71%	3.15%	1.33%	-0.30%	0.45%	-0.04%
Powszechna Kasa SA	62.63	0.36%	-1.51%	5.22%	1.75%	0.28%	-0.66%	0.55%
Raiffeisen Bank International AG	63.39	-0.16%	-2.98%	1.57%	0.90%	-0.27%	1.23%	-0.19%
Societé Générale SA	82.92	0.23%	-1.04%	4.68%	1.18%	0.05%	0.27%	0.40%
UniCredit SpA	81.96	0.17%	-1.79%	4.44%	1.25%	-0.36%	0.40%	0.67%
STOXX 600	–	0.31%	-3.94%	2.67%	1.47%	-0.30%	0.02%	0.94%

Source: Author's computation

Table 5.8: ESG Scores, AAR, CAR over CSRD

	Low ESG score banks	High ESG score banks
CAR	-5.25%	15.16%
AAR	-0.04%	0.12%
Average ESG	65.17	81.98

Source: Author's computation

from Table 5.8 between low ESG score banks and high ESG score banks, with the former experiencing a substantial negative CAR of -5.25%, while the latter demonstrates a significant positive CAR of 15.16%. This implies that banks with higher ESG scores, possibly aligned with CSRD guidelines, tend to perform better in terms of growth in stock value over a given period. Banks with a low ESG score show a marginal negative AAR of -0.04%, compared to banks with a high ESG score, which have a slight positive AAR of 0.12%. This suggests that higher ESG scores may correlate with marginally improved average profitability.

As could be seen at Table 5.9 ESG scores range from 58.97 to 91.82. Average

Table 5.9: Abnormal returns ESRS window with ESG score

BANK	ESG	MEAN	MIN	MAX	STD	ANT. WIN-DOW	31ST JULY AR	ADJUST. WIN-DOW
Commerzbank AG	76.16	-0.69%	-3.83%	2.54%	1.60%	-0.46%	-0.50%	-0.94%
BNP Paribas SA	91.82	0.08%	-3.11%	2.86%	1.57%	0.48%	-1.99%	-0.11%
Credit Agricole SA	66.18	0.13%	-2.56%	5.81%	1.60%	0.20%	-1.26%	0.21%
Deutsche Bank AG	85.75	-0.03%	-4.03%	1.98%	1.61%	0.17%	-0.75%	-0.16%
Erste Group Bank AG	73.75	-0.09%	-2.42%	2.10%	0.93%	0.23%	-0.91%	-0.32%
ING Groep NV	76.09	-0.09%	-2.28%	2.16%	1.16%	0.17%	-0.36%	-0.31%
KBC Group NV	58.97	-0.23%	-6.19%	1.99%	1.73%	0.17%	-1.21%	-0.53%
Komercni Banka as	62.16	-0.05%	-1.20%	1.26%	0.69%	-0.02%	0.62%	-0.16%
OTP Bank Nyrt	68.67	0.34%	-1.56%	2.52%	1.20%	0.21%	1.28%	0.38%
Powszechna Kasa SA	65.95	-0.19%	-2.05%	2.08%	1.14%	0.26%	-0.92%	-0.56%
Raiffeisen Bank International AG	73.76	-0.59%	-3.41%	1.40%	1.35%	-0.04%	-3.40%	-0.86%
Societe Generale SA	82.86	0.27%	-1.90%	3.32%	1.27%	0.32%	-1.90%	0.44%
UniCredit SpA	84.27	-0.32%	-6.55%	3.89%	1.92%	0.05%	-2.03%	-0.51%
STOXX 600	–	0.31%	-1.78%	1.80%	0.98%	0.48%	-0.45%	0.22%

Source: Author's computation

abnormal returns oscillate from -0.69% to 0.34%, indicating varying degrees of performance, with the MIN and MAX values highlighting notable volatility, especially for UniCredit SpA with the largest spread -6.55% to 3.89%. The ANT. WINDOW represents the anticipated market performance leading up to an event, and the 31ST JULY AR denotes the actual return on July 31st. These figures highlight how expectations match reality, with noticeable inconsistencies in some cases, such as anticipation versus actual return for BNP Paribas SA. The ADJUST. WINDOW shows the movement of expectations or outcomes post-event, with values ranging from -0.94% to 0.44%. This could reflect adjustments based on actual market movements or new information, such as for Societé Genéralé SA, which ended up with a positive adjustment.

Interestingly in Table 5.10, both the low and high ESG score groups show negative CAR values, and the high ESG group experienced a slightly larger loss (-16.17%) compared to the low ESG score group (-14.21%). This outcome suggests that higher ESG scores do not necessarily protect companies from experiencing overall negative cumulative returns in the context of this analysis.

Table 5.10: ESG Scores, AAR, CAR over ESRS

	Low ESG score banks	High ESG score banks
CAR	-14.21%	-16.17%
AAR	-0.10%	-0.13%
ESG	67.06	82.83

Source: Author's computation

The average returns are also negative for both groups, with the high ESG score group seeing greater decline (-0.13%) than the low ESG score group (-0.10%). This could indicate that during the period studied, firms with higher ESG scores did not perform better on average compared to their lower-scored peers.

Chapter 6

Results

This chapter provides detailed results on the impact of ESG on the WACC and abnormal returns in the banking sector. Using both linear and non-linear models, the study investigates how governance, environmental, and social practices influence financial metrics such as WACC, while also examining the dynamic response of stock prices to changes in regulatory frameworks concerning ESG reporting standards and during COVID-19. By analyzing the multifaceted influence of ESG factors, this chapter highlights their role in shaping both the cost of capital and market behavior during periods of significant regulatory updates and COVID-19, thus providing insights into the broader financial performance of banks.

6.1 ESG performance in banking

6.1.1 Hypothesis 1

The overall ESG score (`ESGpercent`) exhibits a more pronounced effect in both linear and non-linear models. The linear model shows a subtle but significant influence (0.01, $p < 0.1$) and a stronger effect in the nonlinear model (0.22, $p < 0.05$), with a decreasing trend observed at very high ESG scores ($\texttt{ESGpercent}^2 = -0.19, p < 0.05$) in Table 6.2. This pattern suggests that while initial increases in ESG scores generally elevate the WACC, extremely high levels might reduce it, indicating a nonlinear response where ESG investment beyond a certain level could be financially advantageous.

The governance pillar score, measured by `GPpercent`, in the linear model shows a minimal but weakly significant negative coefficient (-0.03, $p < 0.1$) in Table 6.4, suggesting that slight improvements in governance can slightly de-

crease the WACC. The positive linear term in the non-linear model (`GPpercent` $= 0.13, p < 0.05$) indicates that initial increases in governance significantly heighten WACC. However, the quadratic term ($\texttt{GPpercent}^2 = -0.13, p < 0.01$) exhibits a U-shaped relationship, revealing that very high levels of governance pillar score might lead to a decrease in WACC, highlighting a non-linear interaction where an optimal governance pillar score level minimizes WACC.

For the environmental pillar score represented by `EPpercent`, the linear model shows a minor but significant increase in WACC with increasing environmental scores (0.03, $p < 0.05$). In the quadratic term, the influence is still positive but not statistically significant, indicating an upward trend rather than a reversal in the relationship between environmental engagement and WACC, as seen in Table 6.3.

Similarly, the social pillar score indexed by `SPpercent` demonstrates a significant positive linear effect in the linear model (0.02, $p < 0.05$). The nonlinear model initially reveals a moderate positive correlation (`SPpercent` $= 0.16, p < 0.05$), implying an increase in WACC with higher social scores. However, the quadratic component ($\texttt{SPpercent}^2 = -0.13, p < 0.1$) indicates a possible reversal or diminishing effect at higher social pillar scores, as detailed in Table 6.1.

These results illustrate the complex interactions between different ESG pillars scores and WACC. Although governance, the social pillars score shows a potential for reducing WACC at optimal levels, all ESG pillars scores generally increase the cost of capital up to a point beyond which further improvements could begin to reduce costs. The overall ESG score suggests a similar pattern, indicating that simplistic views of ESG impacts on finance costs might not capture the full dynamics, and that ESG factors might have both cost-increasing and cost-decreasing effects depending on their levels.

Despite observing these patterns, we cannot conclusively state that banks with higher ESG scores have significantly lower WACC, as illustrated in Figures A.1, A.2, A.3, and A.4 shown in the appendix. However, we find that, from certain levels, ESG, EP, and GP have a statistically significant effect on lowering WACC. We do not have sufficient evidence to support our initial hypothesis with these data.

Furthermore, we performed a robustness check for the time period 2014-2019 due to WACC heterogeneity, as can be seen in Figure 6.1 to account for the impact of COVID-19 on financial markets. The results are detailed in the Appendix Tables A.10, A.11, A.12, and A.13.

Figure 6.1: WACC data heterogenity across years

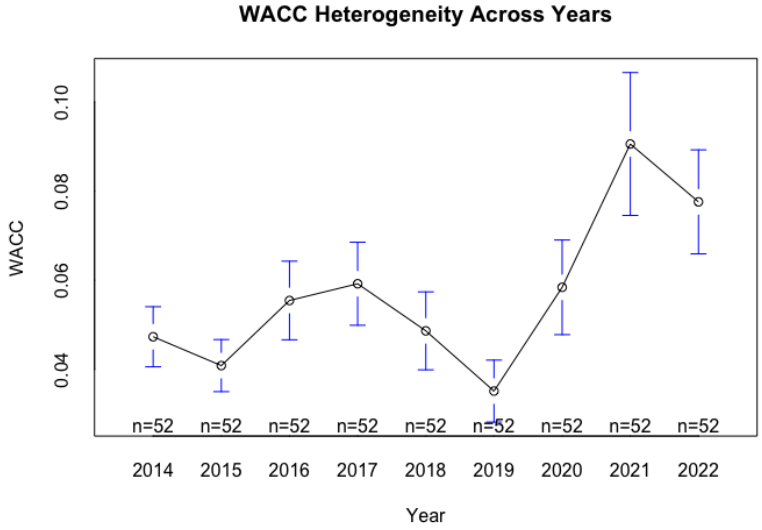


Table 6.1: FE model results for SP

	Dependent variable: WACC	
	FE SP	FE SP^2
SPpercent	0.02	0.16**
	(0.02)	(0.06)
I(SPpercent^2)		−0.13*
		(0.05)
Tier1	0.03	0.002
	(0.09)	(0.09)
taxrate	0.02	0.01
	(0.04)	(0.04)
HICPpercent	0.18***	0.18***
	(0.05)	(0.05)
GDP	0.001	0.001
	(0.0005)	(0.0005)
ROE	0.06*	0.07*
	(0.03)	(0.03)
log(Assets)	0.01	0.01
	(0.02)	(0.02)
Observations	331	331
R^2	0.15	0.17
F Statistic	7.12*** (df = 7; 274)	7.08*** (df = 8; 273)
Note:		*p<0.1; **p<0.05; ***p<0.01

Source: Author's computation

Table 6.2: FE model results for ESG

	Dependent variable: WACC	
	FE ESG	FE ESG^2
ESGpercent	0.01	0.22**
	(0.02)	(0.08)
I(ESGpercentˆ2)		-0.19**
		(0.07)
Tier1	0.04	0.002
	(0.09)	(0.09)
taxrate	0.02	0.02
	(0.04)	(0.04)
HICPpercent	0.18***	0.19***
	(0.05)	(0.05)
GDP	0.001	0.001
	(0.0005)	(0.0005)
ROE	0.06*	0.07*
	(0.03)	(0.03)
log(Assets)	0.01	0.01
	(0.02)	(0.02)
Observations	331	331
R^2	0.15	0.17
F Statistic	6.89*** (df = 7; 274)	7.15*** (df = 8; 273)
Note:		*$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Source: Author's computation

Table 6.3: FE model results for EP

	Dependent variable:	
	WACC	
	FE EP	FE EP^2
EPpercent	0.03**	0.02
	(0.01)	(0.05)
I(EPpercentˆ2)		0.01
		(0.05)
Tier1	0.04	0.04
	(0.09)	(0.09)
taxrate	0.01	0.01
	(0.04)	(0.04)
HICPpercent	0.19***	0.19***
	(0.05)	(0.05)
GDP	0.001	0.001
	(0.0005)	(0.0005)
ROE	0.07**	0.07**
	(0.03)	(0.03)
log(Assets)	0.01	0.01
	(0.01)	(0.01)
Observations	331	331
R^2	0.16	0.16
F Statistic	7.60*** (df = 7; 274)	6.64*** (df = 8; 273)
Note:		$^*p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Source: Author's computation

Table 6.4: FE model results for GP

	Dependent variable: WACC	
	FE GP	FE GP^2
GPpercent	-0.03^{*}	0.13^{*}
	(0.02)	(0.06)
I(GPpercentˆ2)		-0.13^{**}
		(0.05)
Tier1	0.07	0.04
	(0.09)	(0.09)
taxrate	0.01	0.01
	(0.05)	(0.04)
HICPpercent	0.19^{***}	0.21^{***}
	(0.05)	(0.05)
GDP	0.001	0.001
	(0.0005)	(0.0005)
ROE	0.07^{*}	0.07^{*}
	(0.03)	(0.03)
log(Assets)	0.02	0.01
	(0.01)	(0.01)
Observations	331	331
R^2	0.16	0.18
F Statistic	7.33^{***} (df = 7; 274)	7.54^{***} (df = 8; 273)
4.60^{***} (df = 8; 270)		

Note: $^{\cdot}$p<0.1; **p<0.05; ***p<0.01

Source: Author's computation

6.1.2 Hypothesis 2

The analysis of the Pearson correlation coefficients for ROE, as shown in Table 6.5, indicates generally weak relationships with ESG components. The overall ESG score has a very weak positive correlation with ROE (cor = 0.02, p-value = 0.63), showing no statistically significant link.

The social pillar (SP) is weakly and negatively correlated with ROE (cor = -0.01, p-value = 0.78), suggesting an insignificant impact.

The governance pillar (GP) displays a weak positive correlation with ROE (cor = 0.08, p-value = 0.09), hinting at a potential, yet non-significant, relationship.

The environmental pillar (EP) exhibits a very weak negative correlation with ROE (cor = -0.02, p-value = 0.64), also indicating no significant correlation.

These results imply that the ESG components do not have a direct or significant influence on the ROE within the examined data set.

Table 6.5: Pearson correlation coefficients for ROE

	ROE	ESG	SP	GP	EP
ROE	1	0.024	−0.014	0.084	−0.023
ESG	0.024	1	0.918	0.758	0.716
SP	−0.014	0.918	1	0.472	0.685
GP	0.084	0.758	0.472	1	0.309
EP	−0.023	0.716	0.685	0.309	1

Source: Author's computation

In contrast to previous findings regarding ROE, the relationship between ESG components and WACC presents a different picture as reflected in Table 6.6. The overall ESG score shows no significant correlation with WACC (cor = $-0.007, p$-value = 0.8881), indicating that the relationship is not statistically significant.

The social pillar (SP) is also not significantly correlated with WACC (cor = $-0.033, p$-value = 0.4857), suggesting a lack of significant relationship.

Similarly, the governance pillar (GP) shows a very weak and not statistically significant positive correlation with WACC (cor = $0.025, p$-value = 0.5964), indicating a non-robust connection.

Furthermore, the environmental pillar (EP) exhibits a very weak and non-

significant negative relationship with WACC (cor $= -0.019, p$-value $= 0.6785$), suggesting that the connection is not robust.

These results show that there is no statistically significant correlation between the components of ESG and WACC, contrary to what might be expected. This suggests that higher ESG scores are not associated with a higher cost of capital, challenging previous assumptions about the direct financial impacts of ESG performance.

Table 6.6: Pearson correlation coefficients for WACC

	WACC	ESG	SP	GP	EP
WACC	1	−0.007	−0.033	0.025	−0.019
ESG	−0.007	1	0.929	0.786	0.744
SP	−0.033	0.929	1	0.530	0.714
GP	0.025	0.786	0.530	1	0.377
EP	−0.019	0.744	0.714	0.377	1

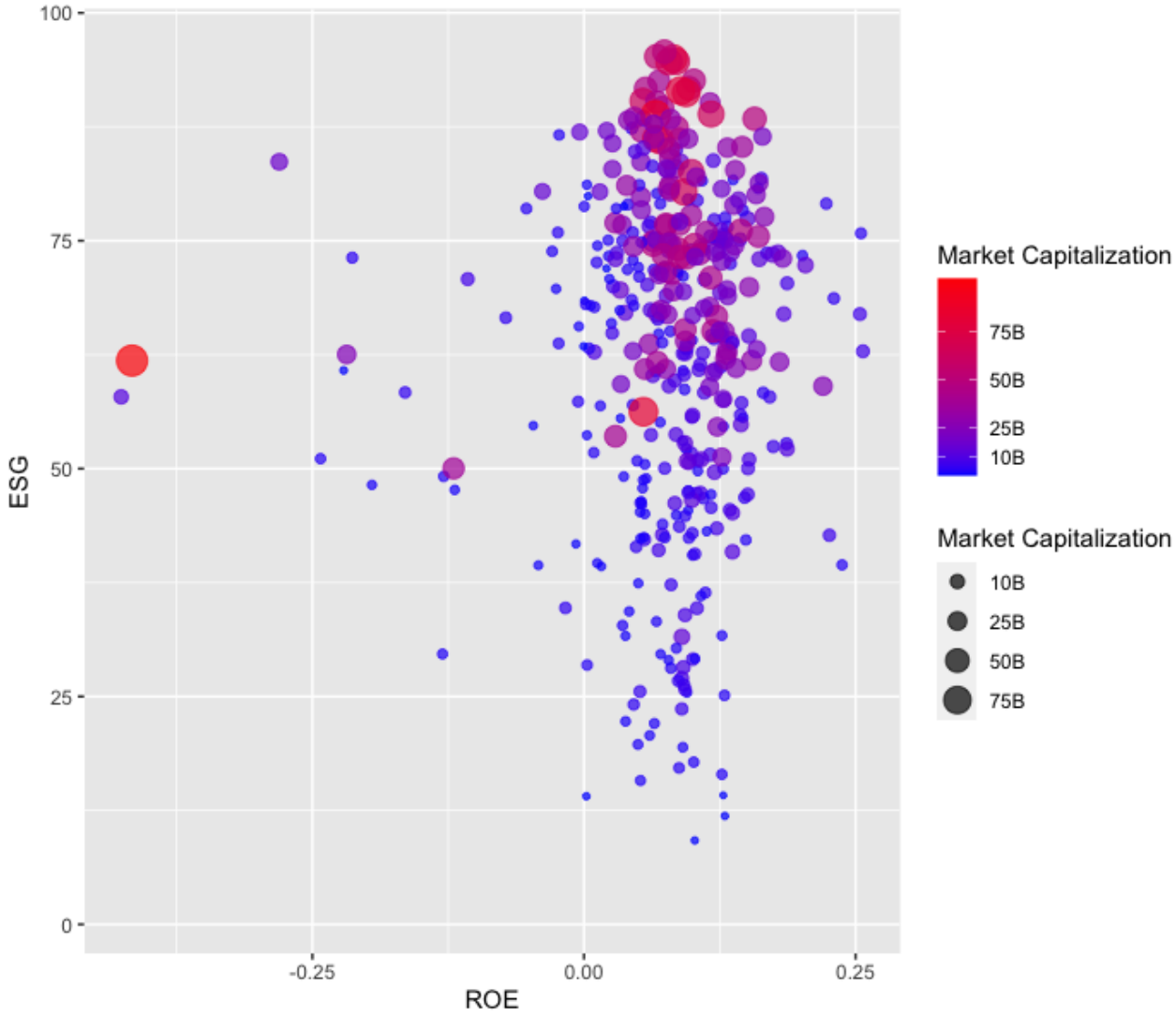
In Figure 6.2 we can observe a wide spread of data points across the ROE axis, suggesting variability in how banks perform in terms of ROE regardless of their ESG scores. The ESG scores are also quite varied, indicating a range of ESG practices among banks.

Larger and brighter points, which represent banks with higher market capitalizations, tend to cluster in the mid to upper range of ESG scores. This might imply that banks with larger market caps generally have higher ESG scores, although there are exceptions. Most of the data points are clustered around the ROE of 0, with very few banks showing negative ROE and some showing ROE slightly above 0.25. This clustering could suggest that most banks have an ROE close to zero, with fewer banks achieving higher profitability.

Most banks appear to have higher ESG scores than 25, with a concentration of banks in the range of 50-75 ESG scores. This could indicate a tendency among banks to achieve a moderate level of ESG performance.

Although we did not find a statistically significant correlation between ROE and ESG, we cannot support our initial hypothesis; however, there is a weak positive correlation between ESG and ROE.

Figure 6.2: ROE vs. ESG based on size of European bank



Source: Author's computation

Table 6.7: Comparison of ESG Impact Studies

Study Aspect	**This Study**	**Di Tommaso & Thornton (2020)**	**Kim & Li (2021)**	**Chiaramonte *et al.* (2021)**
Model Used	Linear and Nonlinear Models (FE)	System GMM	Correlation Analysis and Regression Analysis (FE)	Differences-in-differences (DID) Analysis
Main Variables of Interest	Environmental, Social, Governance pillars scores and ESG score	ESG Score	ESG Variables (Environmental, Social, Governance)	Environmental, Social, Governance pillars and ESG Score
Impact on Performance	U-shaped relationship for ESG, GP and SP statistically significant for EP not	ESG scores associated with reduced bank risk-taking	Social variable significant for firm size and credit ratings. Governance factor significant for profitability.	ESG scores reduce bank fragility during distress.
Key Findings	High levels of ESG, GP and SP minimizes WACC.	ESG scores modestly reduce risk taking.	Weak correlations between ESG variables and firm performance.	ESG improves bank stability during financial turmoil.
Statistical significance	Significant U-shaped relationship for ESG, GP and SP.	Negative impact on risk measures is statistically significant.	Social variable significant for credit ratings. Governance affects profitability.	Significant relationship between ESG scores and bank stability.
Regression model estimates	Linear terms for non-linear model shows increase ESG (0.22) GP (0.13) non-linear terms decrease ESG (-0.19) GP(-0.13)	ESG score reduces bank risk by 0.01 to 0.02 percentage points.	Governance variable coefficient: 0.0291. Total coefficient of the ESG factor: About 0.05781.	Not specified, but emphasizes the protective role of ESG.
Correlation Analysis	The pillars of the ESG demonstrate statistically not significant negative correlation with WACC.	Larger boards increase risk, diverse boards reduce risk.	Size variable correlated with profitability and credit rating.	Supports ESG as a factor in reducing financial distress risks.

6.2 Abnormal returns

6.2.1 Hypothesis 3

The analysis of abnormal returns during the CSRD and ESRS event windows reveals mixed results among banks with varying ESG scores. For the CSRD window, while some banks such as Deutsche Bank AG and Erste Group Bank AG exhibited positive abnormal returns (0.35% and 0.99%, respectively), Komercni Banka as and Powszechna Kasa SA experience negative abnormal returns (-1.13% and -0.66%, respectively). In particular, Deutsche Bank AG shows high volatility with returns ranging from -2.16% to 8.19%, suggesting significant market reactivity during the CSRD event window.

For the ESRS window, banks such as Komercni Banka and OTP Bank Nyrt have positive abnormal returns (1.28% and 0.62%, respectively), while others such as BNP Paribas SA and Raiffeisen Bank International AG experienced negative returns (-1.99% and -3.40%, respectively). This indicates that anticipating regulatory changes did not always lead to positive abnormal returns. Furthermore, the general market during CSRD, represented by the STOXX 600 index, showed a minimal change (0.02%), suggesting a lack of significant market-wide anticipation effects, while during ESRS it exhibits a slight decline (-0.45%). Neither of these abnormal returns was statistically significant.

During the CSRD event window, banks with higher ESG scores demonstrated a positive CAR of 15.16%, as opposed to a substantial negative CAR of -5.25% in banks with lower ESG scores. This suggests that higher ESG scores could be associated with better performance during regulatory changes.

Furthermore, the comparison between banks with low and high ESG scores in terms of CAR during the ESRS anticipation period also presents an interesting dynamic. High ESG score banks did not consistently outperform banks with low ESG score. In fact, in the ESRS window, banks with a high ESG score experienced a slightly larger loss in CAR (-16.17%) compared to banks with low ESG scores (-14.21%), contradicting the expectation that higher ESG scores could mitigate negative market outcomes in times of regulatory changes. None of these abnormal returns were statistically significant.

Therefore, we cannot support our initial hypothesis with sufficient evidence.

Although some individual banks could benefit from the effects of regulatory changes due to their internal management practices or investor perceptions, there is no conclusive evidence to support that higher ESG scores confer a

general advantage in terms of abnormal returns in anticipation of new sustainability reporting standards. This implies that other factors, perhaps specific to each bank's operational and financial circumstances, play a more critical role in influencing stock performance during such periods.

6.2.2 Hypothesis 4

High ESG score banks experienced slightly less negative returns (-0.97%) compared to low ESG scores banks (-1.10%). This difference, although modest, suggests that higher ESG scores may offer some resilience against extreme market fluctuations, although limited.

There was a significant difference in CAR between banks with high and low ESG scores, with banks with high ESG score experiencing a less severe decline (-121.77%) compared to their banks with lower ESG scores counterparts (-161.84%). This indicates that during the period studied, banks with higher ESG scores were somewhat more resilient, possibly due to better risk management practices associated with high ESG standards, although it is necessary to be aware, because other factors can also influence these results, such as bank size or different market environment.

Data show high volatility across all banks during the period, as evidenced by significant fluctuations in daily returns Min and Max columns in Table 5.5. However, the adjustment windows after major events (like March 12) suggest that banks with higher ESG scores were more quickly able to stabilize or adjust to market conditions, as indicated by less negative or more stable adjustment metrics.

Compared to the broader market index (STOXX 600), which experienced very high volatility and significant declines, banks with higher ESG scores performed better, reinforcing the notion that such scores could correlate with some level of protective effect during crises.

Although banks with higher ESG scores did not completely escape the market downturn caused by the COVID-19 pandemic, evidence suggests that they managed the crisis with slightly better outcomes in terms of less negative returns and possibly quicker adjustments to changing conditions.

On the other hand, we do not have enough evidence to prove our initial hypothesis while all our abnormal returns were not statistically significant.

Table 6.8: Comparative Analysis of Abnormal return studies

Study	**This study**	**Danisman (2022)**	**Bruno *et al.* (2018)**	**Bolibok (2014)**
Main Focus	Rate of return change over COVID, CSRD, ESRS	ESG Scores and Bank Performance	Effect of Bank Liquidity Regulation	Impact of IFRS Implementation
Methodology	Event-Study Methodology	Event-Study Methodology	Event-Study Methodology	Regression Analysis, Chow Test
Key Findings	CAR higher over COVID, CSRD period for high ESG score banks not statistically significant	Higher ESG scores linked to resilience	Negative reaction to liquidity regulation, weak significance	Increase in value relevance of accounting data
Period Analyzed	2020-2023	COVID-19 period (2020-2021)	Approx. 5 years of regulatory announcements	1998-2012
Country/Region Focus	13 banks European banks	1927 EU banks	128 European banks	17 banks listed on the Warsaw Stock Exchange (WSE)
Outcomes on Bank Performance	No statistically significant effect	Minimal impact from ESG on stock returns over extended period	Market anticipates marginal value of regulation	Statistically significant differences in some periods

6.3 Summary of results

Hypothesis 1: Banks with high ESG scores report a lower capital cost compared to banks with low ESG scores (due to their perceived lower risk and positive environmental impact).
We rejected our first hypothesis. We do not have sufficient evidence that effect of ESG lower the WACC that we can support this hypothesis.
Hypothesis 2: There is a positive correlation between ESG scores and ROE in the EU banking sector.
Since the correlation is statistically insignificant we reject our second hypothesis. The correlation between ROE and ESG is 0.024.
Hypothesis 3: There is significant abnormal return of bank stocks in the EU that is higher in anticipation of the release of new accounting standards such as the CSRD or changes to the ESRS.
Non of our abnormal return was statistically significant, so we reject our third hypothesis.

Hypothesis 4: Banks with higher ESG scores experience lower abnormal returns during the COVID-19 period due to their resilence.
As none of our results was statistically significant, we also reject our fourth hypothesis. Nonetheless high ESG score banks experienced greater CAR than low ESG score banks.

6.4 Further research opportunities

The presented analysis opens several avenues for future research, particularly in regard to the integration of advanced econometric techniques and the broadening of the empirical scope of the study. Employing the Generalized Method of Moments (GMM) is particularly promising, as this method is well suited for addressing potential endogeneity issues within panel data, allowing for more robust inference of the dynamic relationships between ESG scores and financial performance metrics such as the WACC). This approach has been effectively used in similar studies, such as those highlighted by Azmi *et al.* (2021), which examined the impacts of ESG initiatives under dynamic conditions.

Expanding the temporal scope of the data set is crucial to understanding the long-term impacts of ESG factors on financial metrics through multiple business cycles. This longitudinal approach would clarify how ESG influences

financial outcomes in different economic conditions by differentiating short-term fluctuations from long-lasting trends.

Furthermore, including a more diverse array of banks from various geographic and regulatory contexts would enhance the applicability of the findings. An expanded data set would facilitate comparative analyzes, illuminating how regional variations in ESG compliance and market maturity influence the relationship between ESG scores and WACC.

Another limitation of this study stems from potential biases in the dataset, as it only includes banks that have ESG scores. This selection criterion can restrict our understanding of the broader banking sector.

Chapter 7

Conclusion

This thesis aimed to explore the influence of ESG factors on bank financial performance, focusing especially on the WACC and abnormal returns during periods of significant regulatory changes and the COVID-19 pandemic. Our analysis has indicated complex relationships and nuanced insights into how ESG pillars impact financial metrics in the banking sector. Although the topic of ESG resonates worldwide, we focus on the European continent based on the similarity of the banking segment.

Data were obtained from the Refinitiv Eikon, providing us with the latest information that ended up with panel data from 2014-2022. We analyze exactly 52 banks in our study because we needed data that describe ESG practices. Macroeconomic data was obtained through Eurostat as described in more detail in Chapter 5. In addition, we used data provided from WSJ for stock price for our abnormal return case study.

To investigate our research questions, we used two main approaches. Firstly, we apply standard panel data methods which ended up using the fixed-effects method to obtain our results. For each regression within our models, we analyzed the influence of the overall ESG score as well as the individual pillars. To ensure the reliability and accuracy of our findings, all models were adjusted to account for serial correlation and heteroskedasticity.

Hypothesis 1 suggesting that higher ESG score lower WACC was utilized the WACC as the dependent variable, with the ESG score and each specific pillar serving as independent variables to assess their impact on the bank's cost of capital, along with bank-specific and macroeconomic variables.

For our hypothesis 2 suggesting a positive correlation between ESG, we used standard statistical techniques, specifically Pearson's correlation, to explore the

relationships between ROE, WACC, the ESG score, and each ESG pillar.

Our hypothesis 3,4 that there is abnormal return during CSRD, ESRS and COVID, was investigated using the event study methodology to calculate abnormal returns. We analyzed three distinct periods for these event studies, two of which focused on regulatory changes and one on the COVID-19 pandemic.

Hypothesis 1 suggests a complex, nonlinear relationship between ESG scores and WACC. The overall ESG score and its pillars initially increase WACC, but higher scores eventually lead to a decrease that goes in line with Chiaramonte *et al.* (2021), suggesting an optimal threshold that minimizes WACC. The results of the environmental pillar that are statistically significant suggest only an increase inWACC by a linear term. However, this single evidence is insufficient to support our first hypothesis, leading us to reject it.

Hypothesis 2, observed only a weak correlation between ROE and the ESG score, leading us to also reject this hypothesis. Unlike Kim & Li (2021), our findings reveal a weak negative correlation between the ESG score and WACC, albeit statistically insignificant. However, the trend suggests that higher ESG scores may be associated with a reduced capital cost.

Hypothesis 3, we reject our third hypothesis, as none of the results was statistically significant, in contrast to Bolibok (2014). However, during the CSRD event window, we observed that banks with higher ESG scores demonstrated a positive CAR of 15.16%, while banks with lower ESG scores showed a negative CAR of -5.25%. In contrast, during the ESRS event window, we observed that both banks with high and low ESG scores experienced negative CAR, contrary to our expectations of lower declines for banks with higher ESG scores.

Hypothesis 4, the data indicated that banks with higher ESG scores experienced a less severe decline compared to those with lower scores, although these results were not statistically significant, which is consistent with Danisman (2022). Consequently, reject this hypothesis.

These results provide valuable information on the relationship between ESG scores and key financial indicators such as stock returns and bank profitability. Tables 6.7 and Table 6.8 provide a comparison with other similar studies with the contribution of this work.

The main contribution of this work lies in its focus on ESG and its impact on WACC, a topic that has not been extensively explored in the existing literature. In particular, there is a dearth of studies that employ WACC as the dependent variable in this context. Furthermore, the influence of CSRD and ESRS has not previously been examined. Further research in this area would

be advantageous and the use of a broader dataset encompassing various banks could offer additional insights and understanding.

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Appendix A

Appendix

Table A.1: Serial Correlation and Heteroskedasticity tests ESG

Test	**Statistic**	**p-Value**
Breusch-Pagan Test	BP = 14.75	0.04
Breusch-Godfrey/Wooldridge Test for Serial Correlation	$\chi^2 = 0.85$	0.36

Table A.2: Serial Correlation and Heteroskedasticity tests ESG^2

Test	**Statistic**	**p-Value**
Breusch-Pagan Test	BP = 15.14	0.06
Breusch-Godfrey/Wooldridge Test for Serial Correlation	$\chi^2 = 0.12$	0.73

Table A.3: Serial Correlation and Heteroskedasticity tests EP

Test	**Statistic**	**p-Value**
Breusch-Pagan Test	BP = 14.33	0.05
Breusch-Godfrey/Wooldridge Test for Serial Correlation	$\chi^2 = 0.45$	0.50

Table A.4: Serial Correlation and Heteroskedasticity tests EP^2

Test	**Statistic**	**p-Value**
Breusch-Pagan Test	BP = 14.52	0.07
Breusch-Godfrey/Wooldridge Test for Serial Correlation	$\chi^2 = 0.42$	0.51

Table A.5: Serial Correlation and Heteroskedasticity tests SP

Test	**Statistic**	**p-Value**
Breusch-Pagan Test	BP = 14.11	0.05
Breusch-Godfrey/Wooldridge Test for Serial Correlation	$\chi^2 = 0.90$	0.34

Table A.6: Serial Correlation and Heteroskedasticity tests SP^2

Test	**Statistic**	**p-Value**
Breusch-Pagan Test	BP = 14.72	0.06
Breusch-Godfrey/Wooldridge Test for Serial Correlation	$\chi^2 = 0.32$	0.57

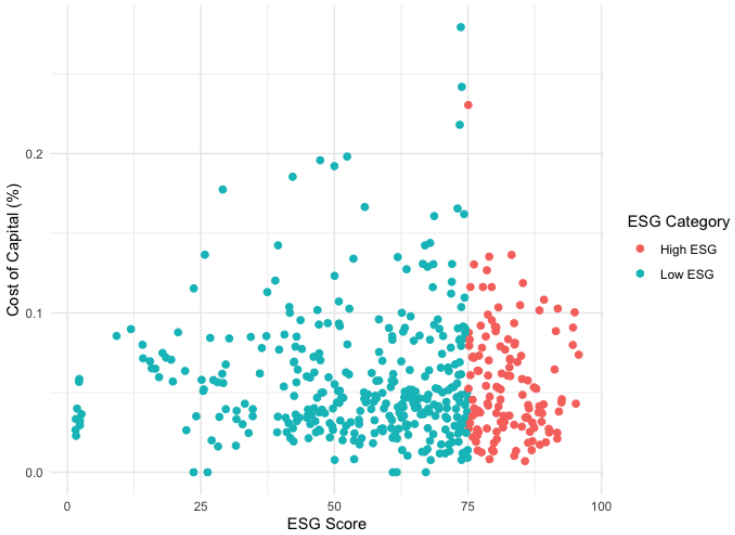
Table A.7: Serial Correlation and Heteroskedasticity tests GP

Test	**Statistic**	**p-Value**
Breusch-Pagan Test	BP = 15.79	0.03
Breusch-Godfrey/Wooldridge Test for Serial Correlation	$\chi^2 = 0.28$	0.60

Table A.8: Serial Correlation and Heteroskedasticity tests GP^2

Test	**Statistic**	**p-Value**
Breusch-Pagan Test	BP = 16.56	0.04
Breusch-Godfrey/Wooldridge Test for Serial Correlation	$\chi^2 = 0.04$	0.83

Figure A.1: ESG score of European banks vs. WACC



Source: Author's computation

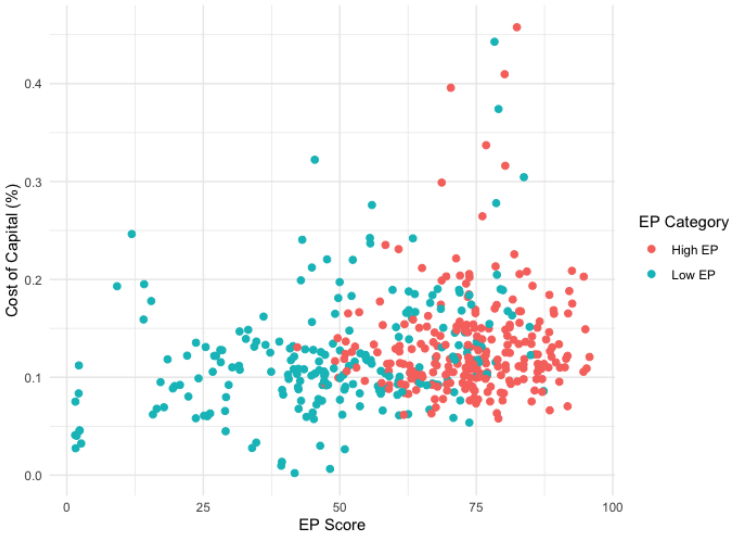
Figure A.2: SP score of European banks vs. WACC

Source: Author's computation

Figure A.3: GP score of European banks vs. WACC

Source: Author's computation

Figure A.4: EP score of European banks vs. WACC



Source: Author's computation

Table A.9: Descriptive Statistics of Model Variables 2014 to 2020

Variable	**Mean**	**Median**	**SD**	**Min**	**Max**	**Q1**	**Q3**
WACC	0.05	0.04	0.03	0.00	0.18	0.03	0.07
COST OF DEBT	0.02	0.01	0.02	-0.00	0.18	0.01	0.02
COST OF EQUITY	0.09	0.09	0.03	0.02	0.19	0.08	0.11
ESG	59.94	63.70	20.71	1.53	95.74	47.16	74.97
EP	66.05	76.03	26.64	0.00	98.11	49.43	87.35
SP	61.48	68.21	22.91	0.52	97.67	45.98	77.42
GP	58.89	61.42	22.72	2.41	95.13	43.56	76.90
Tier1	0.16	0.16	0.04	0.04	0.43	0.14	0.18
taxrate	0.24	0.24	0.06	0.11	0.53	0.20	0.28
HICP	101.97	101.17	2.41	98.78	113.15	100.00	103.20
GDP	1.12	1.70	3.38	-11.20	6.60	0.80	2.90
ROE	0.07	0.08	0.08	-0.43	0.26	0.05	0.11

Table A.10: Robustness check for ESG on European banks

	Dependent variable: WACC	
	FE ESG	FE ESG^2
ESGpercent	0.05**	0.17**
	(0.03)	(0.08)
$I(ESGpercent\hat{}2)$		-0.10
		(0.07)
Tier1	-0.13	-0.15
	(0.10)	(0.10)
taxrate	-0.004	0.0001
	(0.04)	(0.04)
HICPpercent	-0.20**	-0.18*
	(0.10)	(0.10)
GDP	0.004*	0.003*
	(0.002)	(0.002)
ROE	-0.01	-0.01
	(0.03)	(0.03)
log(Assets)	-0.03	-0.03*
	(0.02)	(0.02)
Observations	244	244
R^2	0.08	0.09
F Statistic	2.24** (df = 7; 187)	2.26** (df = 8; 186)
7.08*** (df = 8; 273)		
Note:		*p<0.1; **p<0.05; ***p<0.01

Source: Author's computation

Table A.11: Robustness check for EP on European banks

	Dependent variable: WACC	
	FE EP	FE EP^2
EPpercent	0.03**	0.01
	(0.01)	(0.04)
$I(EPpercent\hat{}2)$		0.02
		(0.04)
Tier1	-0.10	-0.10
	(0.09)	(0.09)
taxrate	-0.01	-0.01
	(0.04)	(0.04)
HICPpercent	-0.08	-0.07
	(0.09)	(0.09)
GDP	0.004**	0.004**
	(0.002)	(0.002)
ROE	-0.0001	-0.0002
	(0.03)	(0.03)
log(Assets)	-0.02	-0.02
	(0.02)	(0.02)
Observations	244	244
R^2	0.08	0.08
F Statistic	2.46** (df = 7; 187)	2.16** (df = 8; 186)
Note:		*p<0.1; **p<0.05; ***p<0.01

Source: Author's computation

Table A.12: Robustness check for SP on European banks

	Dependent variable: WACC	
	FE SP	FE SP^2
SPpercent	0.06***	0.14**
	(0.02)	(0.06)
I(SPpercent^2)		-0.07
		(0.05)
Tier1	-0.14	-0.15
	(0.09)	(0.09)
taxrate	-0.01	-0.01
	(0.04)	(0.04)
HICPpercent	-0.25**	-0.22**
	(0.10)	(0.10)
GDP	0.002	0.002
	(0.002)	(0.002)
ROE	-0.01	-0.01
	(0.03)	(0.03)
log(Assets)	-0.03*	-0.03*
	(0.02)	(0.02)
Observations	244	244
R^2	0.11	0.12
F Statistic	3.26*** (df = 7; 187)	3.14*** (df = 8; 186)
Note:		*p<0.1; **p<0.05; ***p<0.01

Source: Author's computation

Table A.13: Robustness check for GP on European banks

	Dependent variable: WACC	
	FE GP	FE GP^2
GPpercent	-0.02	0.03
	(0.02)	(0.06)
I(GPpercentˆ2)		-0.04
		(0.05)
Tier1	-0.07	-0.07
	(0.09)	(0.09)
taxrate	-0.003	-0.003
	(0.04)	(0.04)
HICPpercent	-0.08	-0.07
	(0.09)	(0.09)
GDP	0.004**	0.004**
	(0.002)	(0.002)
ROE	-0.003	-0.001
	(0.03)	(0.03)
log(Assets)	-0.02	-0.02
	(0.02)	(0.02)
Observations	244	244
R^2	0.07	0.07
F Statistic	1.91* (df = 7; 187)	1.74* (df = 8; 186)
Note:		*p<0.1; **p<0.05; ***p<0.01

Source: Author's computation

Table A.14: Comprehensive Table of Financial and ESG Variables

Financial Variables	**ESG Variables**
Cash & Due From Banks	ESG Score Grade
Other Earning Assets, Total	ESG Score
Net Loans	ESG Combined Score Grade
Property, Plant And Equipment, Total - Gross	ESG Combined Score
Property/Plant/Equipment, Total - Net	ESG Controversies Score Grade
Goodwill, Net	ESG Controversies Score
Intangibles, Net	Social Pillar Score Grade
Long Term Investments	Social Pillar Score
Other Long Term Assets, Total	Governance Pillar Score Grade
Other Assets	Governance Pillar Score
Total Assets, Reported	Environmental Pillar Score Grade
Total Deposits	Environmental Pillar Score
Total Short Term Borrowings	Resource Use Score
Other Current liabilities, Total	Emissions Score
Total Long Term Debt	Environmental Innovation Score
Total Debt	Workforce Score
Deferred Income Tax - LT Liability	Human Rights Score
Minority Interest	Community Score
Other Liabilities	Product Responsibility Score
Total Liabilities	Management Score
Common Stock, Total	Shareholders Score
Additional Paid-In Capital	CSR Strategy Score
Retained Earnings (Accumulated Deficit)	ESG Assets Under Management
	Other Financial Variables
Unrealized Losses (Gains)	Market Capitalization
Other Equity, Total	Weighted Average Cost of Debt
Total Equity	P/E (Daily Time Series Ratio)
Total Liabilities And Shareholders' Equity	
Interest Income, Bank	Reinvestment Rate
Total Interest Expenses	Return On Equity - Actual
Net Interest Income	
Loan Loss Provisions - Actual	
Net Interest Income After Loan Loss Provision	
Non-Interest Income, Bank	ROA Total Assets, Percent
Non-Interest Expense, Bank	Securities % Avg. Earning Assets
Net Income Before Taxes	Tier 1 Capital %
Net Income After Taxes	
Minority Interest	
Net Income Before Extraordinary Items	
Net Income Reported - Actual	
Basic Weighted Average Shares	
Basic EPS Excluding Extraordinary Items	
Basic EPS Including Extraordinary Items	
Diluted Net Income	
DPS - Common Stock Primary Issue	
Bank Total Revenue	
Current Tax - Total	
Income Tax - Total	
Cash Dividends Paid - Common	
Net Interest Margin - Actual	
Efficiency Ratio - Actual	
Operating Leverage - Actual	
Non-interest Income/Op Inc	
Fee Revenue %	
Net Loans, % Period/Period	
Deposits, % Period/Period	
Non-Performing Loans Actual	