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Is ESG Financially (Ir)relevant?

A Panel Data Study of the STOXX Europe 600 Index (2019–2024)

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Abstract

This study examines the relationship between *Environmental, Social, and Governance* (ESG) performance and stock returns within the STOXX Europe 600 Index over the period 2019–2024. A balanced panel dataset was constructed by applying a frozen basket approach including 465 firms with continuous index membership and complete ESG data from Refinitiv Eikon.

The analysis evaluates whether ESG scores, treated as continuous variables and through quintile-based portfolios, are associated with abnormal returns by examining both within-firm and between-firm variation. Financial performance is also assessed using cumulative returns, CAPM-based beta and (Jensen's) alpha, and risk-adjusted metrics including Sharpe and Treynor ratios.

The results show no consistent evidence of a significant relationship between ESG scores and financial performance, based on both regression analysis and risk-adjusted return metrics. Once firm-specific controls such as size, valuation, industry, and country are included, the association between ESG and stock performance disappears. These findings suggest that ESG performance was not a priced factor in European equity markets during the sample period. The initial associations observed in simpler regression models likely reflect omitted variable bias, as ESG scores appear to capture variation related to firm size. Once market capitalization and other firm-level controls are introduced, the ESG-return association becomes statistically insignificant.

Keywords: ESG performance, sustainable investing, STOXX Europe 600, risk-adjusted return, panel data analysis, fixed effects regression, European equity markets, behavioral finance.

Preface

We would like to express our thankfulness to our supervisor, Pol Campos-Mercade, for his insightful advice and constructive guidance throughout this thesis. Thank you, Pol; your dedication and support have been of great value in helping us navigate research methods.

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1. Introduction

This chapter introduces the research topic and outlines the current academic debate on the relationship between *Environmental, Social, and Governance* (ESG) performance and financial returns. It also presents the purpose of the study, intended contribution to the literature, its research question, and key methodological considerations, as well as the study's main limitations.

1.1 Background

"We are the first generation to feel the effect of climate change and the last generation who can do something about it" (Obama, 2014). These were the words of the then President of the United States at the United Nations Climate Summit in New York on 23 September 2014, underscoring the urgency of international climate policy action. The following year (2015) the member states of the United Nations adopted *Agenda 2030*, a universal strategy comprising seventeen global goals to be achieved by the year of 2030 (UN, n.d.). The same year, the 196 Parties at the UN Climate Change Conference (COP21) signed the *Paris Agreement* to combat climate change. With the agreement being legally binding by consensus, it constitutes a milestone in global climate action by bringing together all the world's countries for the first time in a common accord to combat climate change and adapt to its impacts (UNFCCC, n.d.).

As sustainability becomes a defining issue of our time, a global shift is taking place within financial markets. Sustainability-related considerations have emerged as a framework for assessing the sustainability and long-term impact of companies and investments across the three ESG-dimensions. Investors are increasingly prioritizing these factors not only as ethical imperatives, but also as financial drivers that influence firm performance, capital costs, and risk exposure. As a result, companies are under growing pressure to address ESG-related issues transparently, while ESG metrics are being integrated into asset pricing, portfolio management, and valuation models. By incorporating ESG considerations into financial decision-making, investors may enhance risk management, achieve higher long-term returns, and contribute to more stable and sustainable markets (Statista, n.d.; Giese et al., 2019; Friede et al., 2015; UN Global Compact, 2004).

1.2 Previous research

The relationship between the ESG factors and Corporate Financial Performance (CFP) has been widely studied, though the results vary depending on methodology, data source, time period, and geographic focus. Overall, previous research can be divided into three broad strands based on whether it finds a positive, inconclusive, or negative relationship between ESG and financial outcomes.

Numerous previous studies have found a positive link between strong ESG performance and financial returns. The most extensive evidence for this comes from Friede et al. (2015), who conducted a second-order meta-analysis covering approximately 2,200 unique studies published between 1970 and 2014. Their analysis found that 90% of studies reported a non-negative relationship, with the majority being positive. Importantly, these findings remained stable over time and across regions, asset classes, and ESG dimensions, suggesting a broad and consistent financial benefit to ESG integration (Friede et al., 2015). Similarly, Statman and Glushkov (2009), using a factor-based portfolio approach, found that companies with high Corporate Social Responsibility (CSR) ratings tended to yield slightly higher returns. This effect was particularly strong when using a “best-in-class” approach that avoids excluding entire industries (Statman & Glushkov, 2009). Tang and Zhang (2020) add to the positive narrative through their event study of green bond issuances. They show that firms issuing green bonds, especially for the first time, experience short-term stock price gains and increases in institutional ownership and liquidity. This implies that ESG-aligned financial strategies can enhance shareholder value, at least in the short run (Tang & Zhang, 2020).

However, other studies paint a more nuanced picture. Halbritter and Dorfleitner (2015) examined whether ESG scores can predict abnormal returns using both portfolio and regression-based approaches. They found that ESG ratings did not consistently predict excess returns, and that observed outcomes were highly sensitive to the choice of data provider, time period, and model specification. Their findings highlight the methodological fragility of ESG–performance relationships rather than indicating a clear directional effect. Chang and Witte (2010) also found mixed results when comparing the performance of socially responsible mutual funds (SRFs) with conventional funds. While domestic stock SRFs generally underperformed, fixed-income and balanced SRFs showed stronger or comparable results, especially in more recent years. These results suggest that the financial relevance of

ESG varies significantly depending on asset class and time horizon (Chang & Witte, 2010). Muller (2022), analyzing firms from the STOXX Europe 600, also presents mixed evidence. While cross-sectional analyses showed weak or insignificant correlations between ESG scores and performance, time-series regressions indicated that low-ESG portfolios actually delivered higher returns than expected based on their risk levels over the sample period (Muller, 2022). Such findings cast doubt on the generalizability of ESG outperformance claims.

A third group of studies suggests that the relationship between ESG and financial performance may be context-dependent or even inverse in certain cases. For example, Lismoen and Moum (2020) found that in specific market settings, particularly in Norway, firms with lower ESG scores sometimes outperformed in terms of cumulative returns. Their fixed-effects regressions indicated a negative relationship for certain ESG subcomponents, but these results were not consistently robust across all specifications, highlighting the role of market context and model design in ESG-performance outcomes. These results imply that high ESG scores may not be financially rewarded in all contexts and that investor preferences or market inefficiencies might influence ESG pricing (Lismoen & Moum, 2020).

Taken together, previous studies demonstrate both methodological strengths and notable limitations. Many employ robust models, extensive time horizons, and large datasets (e.g., Friede et al., 2015; Muller, 2022; Lismoen & Moum, 2020). Yet, the reliability and generalizability of their findings are often undermined by inconsistencies in ESG ratings, a lack of causal analysis, and context-specific designs. Although the majority of these studies indicate a positive relationship between ESG and financial performance, results remain highly sensitive to factors such as time period, asset class, and methodological approach.

This highlights the need for further research tailored to clearly defined market contexts and time horizons to better assess the financial implications of ESG integration.

1.3 Purpose and Research Question

This study investigates the relationship between firms' ESG scores and stock returns within the STOXX Europe 600 Index during the period 2019 to 2024. In contrast to much of the

existing empirical literature, the analysis focuses on a recent and turbulent period marked by global disruptions such as the COVID-19 pandemic, rising geopolitical tensions both within Europe and globally, and intensified ESG-related regulatory activity within the European equity markets. By selecting this time frame, the study contributes to the literature by examining how ESG performance may influence financial returns.

The central research question guiding this analysis is as follows: *Do ESG scores influence stock returns in the STOXX Europe 600 Index during 2019–2024?*

1.4 Brief Description of the Methodology

This study employs a quantitative research design to examine the relationship between ESG scores and stock performance for firms listed in the STOXX Europe 600 Index over the study period. A frozen basket approach is applied, meaning only the 465 companies that remained continuously listed in the index and had complete ESG data throughout the sample period were included.

Firms are sorted annually into five equally weighted groups based on their ESG quintile rankings, using Refinitiv Eikon scores as of December 31 of the preceding year. These quintile-based groups serve as analytically constructed portfolios, enabling the systematic evaluation of ESG-related performance patterns across varying score levels. This grouping ensures diversification and helps isolate ESG-specific effects from broader market dynamics.

To assess both linear and non-linear relationships between ESG performance and stock returns, the study applies two complementary model specifications at different levels of analysis. In the first model set, a firm-level panel regression is conducted using ESG score as a continuous independent variable, allowing for the analysis of return sensitivity to incremental differences in ESG performance. In the second model set, group-level panel regressions are estimated, in which firms are aggregated into ESG quintiles and treated as equally weighted portfolios. Dummy variables representing these portfolios are included to capture potential threshold effects or non-linear associations.

All estimations are conducted using monthly returns in excess of the risk-free rate. The primary models use fixed effects panel regressions with robust standard errors to capture

within-firm variation, while OLS regressions serve as robustness checks focused on between-firm differences. Control variables include industry and country dummies, firm size (through the natural logarithm of Market Capitalization), Book-to-Market ratio, and excess market return.

The quintile-based grouping of firms is not only a sorting mechanism but also functions analytically as five distinct portfolios, given their structural properties and role in comparative performance assessment. This approach facilitates a structured analysis of return differentials across varying levels of ESG compliance. By combining firm-level and group-level model designs, the study contributes to a more nuanced understanding of the relationship between ESG characteristics and financial performance in European equity markets.

1.5 Limitations

The analysis is limited to firms included in the STOXX Europe 600 Index, as further described in Chapter 3.2. To ensure consistency and comparability over time, a frozen basket approach is applied, including only those companies that remained continuously listed in the index from 31 December 2018 to 31 December 2023. Firms that entered or exited the index during this period are excluded, which may introduce survivorship bias. Additional information on the data collection process and sampling criteria is provided in Chapter 4.1.

While a longer time period could be justified, the authors have chosen to limit the study to these specific years due to the evolving definition and understanding of ESG and its underlying pillars.

2. Theoretical Framework

This chapter outlines the theoretical foundation of the study by integrating perspectives from traditional finance, behavioral finance, and corporate strategy. These frameworks are employed to support the thesis's objective of evaluating the extent to which ESG scores correlate with measures of risk-adjusted financial performance. Traditional finance provides the foundational analytical tools and normative benchmarks for evaluating excess returns and assessing market efficiency. Behavioral finance introduces psychological and social dimensions that help explain deviations from rational investor behavior, particularly in the

context of ESG-related decision-making. Corporate strategy, as reflected in stakeholder theory, offers a firm-level perspective on how ESG engagement may affect long-term financial outcomes independently of market perceptions. Collectively, these theoretical perspectives establish a multidimensional framework for both the construction of the empirical analysis and the interpretation of its results.

2.1 Traditional Finance and Risk-Adjusted Performance

In order to understand how ESG factors may influence financial performance, it is essential to begin with the foundational principles of traditional finance. These theories assume rational investors operating in efficient markets and form the basis for much of modern asset pricing. This section reviews the Efficient Market Hypothesis (EMH), Modern Portfolio Theory (MPT), and related models that explain the risk-return tradeoff and guide the evaluation of investment performance. These theories provide a theoretical benchmark against which ESG-related deviations can be analyzed.

2.1.1 Asset Pricing and Market Efficiency

Markets Hypothesis (EMH)

In 1967, Harry Roberts coined the term Efficient Markets Hypothesis (EMH), which laid the foundation for Fama's influential 1970 study (Sewell, 2011). The hypothesis is based on the idea that stock prices reflect all available information about a given asset. Hence, it is not possible to consistently achieve excess returns in fully efficient markets, since there is no investment with a positive Net Present Value (NPV), as prices already incorporate all known information (Byström, 2007).

Fama (1970) divides the EMH into three parts, depending on the type of information reflected in prices:

- 1) *Weak form*: Prices reflect all historical price information.
- 2) *Semi-strong form*: Prices reflect all publicly available information.
- 3) *Strong form*: Prices reflect all information, both public and private.

Fama concludes that there is strong support for the weak and semi-strong forms of market efficiency, while the strong form is more controversial and harder to prove empirically (Fama, 1970).

EMH is incomplete without a definition of equivalent risk, a theory is needed to explain how investors assess the risk of an investment and, based on that risk, determine its expected return (Byström, 2007).

Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model (CAPM) is an equilibrium model that describes the relationship between asset returns and risk in an efficiently functioning market. In contrast to the Mean-Variance Model (presented in Chapter 2.1.2), which requires portfolio optimization across numerous individual assets, CAPM offers a simplified approach based on the assumption of a single, aggregated market portfolio. The model suggests that only systematic, market-wide risk influences expected returns, as it is the only form of risk that cannot be diversified away. All other forms of risk are considered idiosyncratic and can be eliminated through diversification, and therefore do not affect expected returns. CAPM further assumes that all investors hold a combination of a risk-free asset and the market portfolio, which contains all risky assets in proportion to their market values (Byström, 2007).

The model introduces beta (β) as a measure of an asset's sensitivity to movements in the market portfolio. This measure is used to form expectations about future returns (*Formula 1*). Specifically, the expected return of asset i is equal to the risk-free rate plus a premium that reflects the asset's exposure to the expected systematic market risk. In this context, a higher beta implies greater exposure to market fluctuations and, consequently, a higher expected return is required to compensate investors for assuming this additional risk (Byström, 2007).

$$(1) : E(R_i) = R_f + \beta_i [E(R_m) - R_f]$$

Within the CAPM framework, this premium is commonly expressed in terms of excess return, defined as the return of an asset or portfolio in excess of the risk-free rate. Portfolio and market excess return is calculated via *Formulas 2* and *3*, respectively.

$$(2) : R_{p,t}^{excess} = R_{p,t} - R_{f,t}$$

$$(3) : R_{m,t}^{excess} = R_{m,t} - R_{f,t}$$

In empirical applications, beta is often estimated through a linear regression where the portfolio's excess return is regressed on the market's excess return (Bodie, Kane & Marcus, 2014). The slope coefficient of this regression corresponds to the portfolio's beta.

Alternatively, beta can be calculated by dividing the covariance between the portfolio's and market's excess returns by the variance of the market's excess return as in *Formula 4*.

$$(4) : \beta_{p,t} = \frac{Cov(R_{p,t}^{excess}; R_{m,t}^{excess})}{Var(R_{m,t}^{excess})}$$

The Security Market Line (SML) represents the theoretical relationship between an asset's expected return and its systematic risk, measured by beta. It serves as a benchmark for assessing whether an individual asset or portfolio is fairly valued in accordance with CAPM. Assets positioned above the SML are considered undervalued, as they offer higher expected returns relative to their risk, while those below the line are considered overvalued (Bodie et al., 2014).

While CAPM provides a useful baseline for understanding asset pricing under efficient markets, additional tools are required to evaluate whether ESG factors contribute to excess returns. The next section presents models that allow for performance assessment on a risk-adjusted basis.

2.1.2 Portfolio Theory and Performance Measures

As this study aims to examine whether there is a relationship between financial performance and ESG scores, it is essential to adopt appropriate methods for performance evaluation. The selection of performance measures is informed by prior research and follows established practices in comparable studies assessing financial outcomes. The analysis will investigate whether portfolios with varying ESG scores generate significantly positive or negative abnormal returns, or whether there is any statistically significant relationship at all.

To evaluate a portfolio's performance, Bodie et al. (2014) emphasize that relying solely on average return is insufficient, as returns must be adjusted for risk to enable meaningful comparisons. In this study, several formal risk-adjusted performance measures, originally developed in conjunction with the Capital Asset Pricing Model (CAPM), are applied to assess the financial performance of the portfolios.

Byström (2007) defines a portfolio as a combination of assets in which an investor allocates capital across different holdings to achieve a desired balance between expected return and risk. Building on this concept, Markowitz (1959) argued that a well-constructed portfolio is not merely a collection of individually attractive assets, but a whole that balances risk and return through diversification. This is accomplished by combining assets that are not perfectly correlated, which reduces overall portfolio variance and improves risk-adjusted performance (Markowitz, 1959; Statman, 1987). Since correlations between asset returns vary over time, such fluctuations create opportunities to lower portfolio risk without necessarily sacrificing expected returns. However, insufficient diversification may expose the portfolio to firm-specific risk, leading to less reliable investment outcomes. Ensuring low correlation among included assets is therefore a key component in effective portfolio construction (Markowitz, 1959).

The number of stocks in a portfolio also play a crucial role in achieving diversification. While early research by Evans and Archer (1968) suggested that holding approximately 10 stocks was sufficient, Statman (1987) argues that a well-diversified portfolio requires at least 30 stocks for a borrowing investor and 40 for a lending investor. This highlights that both the number of assets and their intercorrelations must be considered to capture the full benefits of diversification (Statman, 1987).

Mean- Variance Portfolio Theory

The mean-variance methodology lays the foundation for modern portfolio theory (Byström, 2007). As investors are assumed to be risk-averse, meaning they dislike risk and uncertainty, they aim to maximize expected return for a given level of risk, or conversely, minimize risk for a given return. The “efficient frontier” illustrates all possible portfolios that offer the highest expected return for each given level of risk. Portfolios lying outside the efficient frontier are considered suboptimal for the risk-averse investor (Markowitz, 1959).

Within the Mean-Variance Model, risk is measured as the standard deviation (σ) of returns. However, the model presents several inherent limitations. It is highly information-intensive, as key inputs such as expected returns, variances, and covariances must be estimated for all assets in the portfolio. This makes portfolio optimization computationally demanding, particularly when dealing with a large number of assets. Another limitation is that, since

expectations are subjective, they may vary significantly across investors, creating uncertainty and inconsistency in the input values. While the model assumes homogeneous expectations to simplify the optimization process, this assumption does not always hold in practice (Byström, 2007). These limitations highlight the need for more tractable models, such as the Capital Asset Pricing Model (CAPM).

In the context of this thesis, the Mean-Variance Model provides a theoretical basis for evaluating whether firms with high ESG scores offer superior risk-adjusted returns, typically measured by metrics such as the Sharpe ratio, which quantify the return achieved per unit of risk.

Jensen's Alpha

As an extension of the classical CAPM, Michael C. Jensen (1968) introduced a new performance metric known as *Jensen's alpha*. In his seminal study, Jensen evaluated the performance of 115 open-end American mutual funds over a ten-year period, with the primary objective of assessing fund managers' predictive ability, in other words, their capacity to identify and invest in securities that deliver returns exceeding those expected for their level of risk (Jensen, 1968).

Jensen's alpha, defined in *Formula 5*, quantifies the degree to which a fund or portfolio outperforms or underperforms the return predicted by the CAPM, based on its systematic risk.

$$(5) : \alpha_{p,t} = R_{p,t} - [R_{f,t} + \beta_{p,t}(R_{m,t} - R_{f,t})] = R_{p,t}^{excess} - \beta_{p,t} \cdot R_{m,t}^{excess}$$

Jensen's alpha measures the risk-adjusted excess return of an asset or portfolio relative to the return predicted by CAPM, given its level of systematic risk (Jensen, 1968). A positive alpha indicates outperformance, whereas a negative alpha reflects underperformance. The metric is conceptually linked to the Security Market Line (SML), where assets that generate returns above the level implied by their beta are interpreted as having positive alpha. Conversely, returns falling short of the SML benchmark imply negative alpha (Bodie et al., 2014).

Sharpe Ratio

In 1966, William F. Sharpe introduced the Sharpe Ratio, also known as the reward-to-variability ratio, as a tool to evaluate and compare the performance of different mutual funds. Drawing on prior theories of portfolio selection, CAPM, and EMH, Sharpe analyzed the returns of 34 open-end mutual funds during the period 1954–1963. One key finding is that funds with higher average returns also tend to exhibit greater volatility. The Sharpe Ratio thus reflects the excess return an investor receives per unit of risk, where a higher ratio indicates superior risk-adjusted performance (Sharpe, 1966).

$$(6) : \text{Sharpe Ratio} = \frac{r_p - r_f}{\sigma_p}$$

The ratio measures the excess return earned per unit of total risk, with risk defined as the standard deviation of portfolio returns (Bodie et al., 2014).

Treynor Measure

Similar to the Sharpe Ratio, the Treynor Measure evaluates financial performance in relation to risk. However, it differs by measuring excess return per unit of systematic risk, as captured by the portfolio's beta (Bodie et al., 2014).

$$(7) : \text{Treynor Measure} = \frac{r_p - r_f}{\beta_p}$$

The beta used in the denominator can be estimated within the CAPM framework, either through a linear regression or by applying *Formula 4*.

Viewed collectively, these traditional finance models provide a theoretical benchmark for assessing the financial relevance of ESG factors. By assuming efficient markets and rational investors, traditional finance offers a baseline against which any abnormal returns or pricing effects associated with ESG can be evaluated. If ESG scores correlate with systematic risk, influence portfolio efficiency, or lead to persistent deviations in risk-adjusted returns, such outcomes can be meaningfully interpreted within this framework.

2.2 Behavioral Finance and ESG Preferences

While traditional finance provides a baseline for evaluating risk-adjusted returns, behavioral finance challenges the assumption of fully rational investors by introducing psychological, emotional, and social dimensions into financial decision-making (Barberis & Thaler, 2003; Statman, 2004). These perspectives help explain investment behavior and market outcomes

that deviate from standard financial models.

2.2.1 Prosocial and Non-Pecuniary Preferences

Riedl and Smeets (2017) examine why investors allocate capital to socially responsible mutual funds (SRI), even though these funds often yield lower returns and charge higher fees than traditional ones. Using a combination of administrative data, surveys, and incentivized experiments with thousands of participants, they find that social and ethical preferences and not financial performance are the main reason investors choose SRI funds (Riedl & Smeets, 2017).

Their findings show that investors who exhibit strong prosocial tendencies, such as sharing money equally in anonymous trust games, are 14 percentage points more likely to allocate capital to SRI funds. This suggests that many investors are willing to forgo financial returns in order to align their portfolios with personal values, rather than being primarily motivated by performance expectations (Riedl & Smeets, 2017).

Statman introduces the concept of non-pecuniary preferences to describe how ethical and emotional values shape investment behavior. Rather than focusing solely on return maximization, some investors prioritize value alignment with social or environmental causes. This is exemplified in the idea of “warm-glow” investing, where the emotional reward of supporting socially beneficial initiatives outweighs the pursuit of financial gain. Linking these behaviors to the so-called “diversification puzzle,” in which under-diversified portfolios may reflect preferences like home bias and familiarity, which stem from personal comfort or moral conviction rather than irrationality (Statman, 2004).

In the context of this thesis, theories explaining how social and moral preferences influence investment decisions are central to understanding why investors allocate capital to ESG-rated equities. Rather than being solely driven by rational expectations of superior financial performance, investor demand may also reflect personal values, ethical considerations, and emotional motivations. This behavioral lens provides a valuable foundation for interpreting ESG-related return patterns in this empirical analysis.

2.2.2 ESG and Market Segmentation

Building on behavioral insights, Heinkel et al. (2001) develop a theoretical model showing how ESG-driven preferences can affect asset prices. The model suggests that greener investors exclude environmentally harmful firms (i.e., *polluting firms* as defined in the article) from their portfolios, thereby reducing risk-sharing and increasing those firms' cost of capital. If this financial penalty outweighs the cost of adopting more sustainable practices, firms may be incentivized to adjust their behavior. However, the model also suggests that this mechanism only becomes effective once green investors represent a critical mass, estimated at around 20 percent of the market. At the time of the study, this threshold had not been reached, with green investors reaching only about 10 percent, limiting the model's applicability to real-world corporate behavior (Heinkel et al., 2001).

This theoretical mechanism is supported by empirical evidence from Hong and Kacperczyk (2009), who show that companies in controversial industries, often labeled "sin stocks", are systematically avoided by norm-sensitive investors. Their exclusion leads to underpricing and higher expected returns, implying that social preferences can create pricing distortions even in otherwise efficient markets. These results reinforce the idea that market segmentation driven by non-financial motives can affect both risk-return dynamics and capital allocation. (Hong & Kacperczyk, 2009).

Together, these studies show that ESG-related preferences and prevailing social norms can meaningfully affect asset prices, capital allocation, and return patterns. By contrasting with traditional models that assume rational, return-maximizing investors, behavioral finance provides a vital lens for this thesis. It helps explain why ESG portfolios might underperform due to investor over-demand, why excluded "sin stocks" might yield excess returns, and why such pricing effects can persist (Heinkel et al., 2001; Hong & Kacperczyk, 2009; Statman, 2004; Riedl & Smeets, 2017). These theories are therefore included not only to describe alternative investor behavior, but to support the interpretation of empirical findings that deviate from standard risk-return expectations.

2.3 Corporate Perspective on ESG

In addition to the investor-oriented theories discussed in the preceding sections, attention should also be directed toward the motivations underlying firms' own engagement with ESG. The *Stakeholder Theory* provides a firm-level perspective that explains how ESG integration may generate financial value, not by altering investor demand, but by influencing corporate strategy, stakeholder relations, and risk management practices. This perspective is particularly relevant for interpreting whether high ESG scores signal not only ethical alignment but also effective management practices that contribute to long-term firm performance.

The foundation of stakeholder theory was laid by Edward Freeman, who argued that firms operate within a network of relationships involving various actors whose interests and well-being are influenced by corporate activities. A stakeholder is defined as any individual or group that can affect or is affected by the firm's actions (Freeman, 1984).

Donaldson and Preston expanded on this theory by introducing three dimensions of stakeholder theory: *Descriptive*, *Instrumental*, and *Normative* (Donaldson & Preston, 1995). Of these, the instrumental dimension is most relevant to this thesis, as it suggests that firms responsive to stakeholder interests tend to achieve superior strategic and financial outcomes. From this perspective, companies that actively manage stakeholder relationships may benefit from enhanced legitimacy, trust, and resilience. Since ESG scores often reflect such engagement, firms with higher ESG ratings could therefore be expected to outperform those with low ESG scores.

In summary, this chapter has outlined the key theoretical models used to analyze the relationship between ESG scores and financial performance. While CAPM and risk-adjusted return metrics guide the empirical models, behavioral and stakeholder theories provide deeper insight into why ESG may matter in capital markets. These perspectives inform both the variable selection and the interpretation of results in the chapters that follow.

3. Data

This chapter presents the data, including the equity universe, sample selection, and variables used to examine the link between ESG scores and financial performance.

3.1 LSEG ESG Data

The LSEG Eikon database contains ESG scores for all companies within the global ESG coverage, including historical fiscal periods dating back to 2002 (LSEG, 2023). As LSEG, formerly Refinitiv (Refinitiv Eikon), is an internationally trusted database frequently used by researchers, it is considered relevant for the purposes of this study (Bătae et al, 2021).

Through its ESG scores, LSEG aims to provide a transparent and objective assessment of a company's relative performance, commitment, and effectiveness in environmental, social, and governance matters, based on self-reported data. The scoring system is structured around three primary pillars, each drawn from multiple subcategories (see *Table 3.1*), which are aggregated into a composite score for each pillar. These subcategories are scored based on extensive data collection, comprising over 870 company-level ESG measures. From this dataset, a subset of the 186 most relevant and comparable measures within each industry is used to assess a company's ESG performance. These measures are subsequently grouped into ten subcategories. Finally, the pillar scores are normalised to a scale ranging from 0 to 100, enabling comparability across companies, where a score of 100 indicates the highest possible performance (LSEG, 2023).

Table 3.1: LSEG ESG Score > Pillars > Subcategories

This table outlines the composition of the LSEG ESG score, which is structured around three main pillars, each comprising a set of ten underlying categories.

FINAL ESG SCORE		
<i>Environmental</i>	<i>Social</i>	<i>Governance</i>
Resource Use Emissions Innovation	Workforce Human Rights Community Product Responsibility	Management Shareholders CSR Strategy

3.2 STOXX® Europe 600 Index

The equity universe underlying this study is the STOXX® Europe 600 index, which offers a broad representation of developed European markets. Originally launched in 1998, the index

was designed to serve as an extensive and liquid benchmark for the European equity market. Today, it encompasses approximately 90 percent of the investable market across both sectors and geographies in Europe. The index includes large-, mid-, and small-cap companies across 17 different European countries, providing a diverse and well-balanced sample for empirical analysis (STOXX, n.d.).

3.3 Variable description

The following section provides an overview of the variables included in the regression models outlined in Chapter 4.4.

Monthly Excess Return (Firm Level)

- **Exact Definition:** The total monthly return minus the monthly risk-free rate.
- **Data Source:** Refinitiv Eikon (returns), European Central Bank (3-month spot yield for AAA euro area bonds).
- **Justification:** Used as the dependent variable in all regression models. In line with CAPM (Sharpe, 1964; Fama, 1970), using excess returns isolates abnormal performance above the risk-free benchmark.

ESG Score

- **Exact Definition:** A composite score (0-100) measuring firm performance across environmental, social, and governance pillars.
- **Data Source:** Refinitiv Eikon.
- **Justification:** Used as the central explanatory variable. Rooted in stakeholder theory, high ESG scores may reflect better risk management and long-term strategic alignment, attracting norm-sensitive investors (Freeman, 1984; Statman, 2004).

Monthly Excess Market Return

- **Exact Definition:** The monthly excess market return is calculated as the percentage change in the STOXX Europe 600 EUR Gross Index from one month-end to the next, minus the monthly risk-free rate. Returns are expressed in shares and based on end-of-month closing prices.
- **Data Source:** Refinitiv Eikon (data used for calculating market returns), European Central Bank (3-month spot yield for AAA euro area bonds).

- **Justification:** Captures market-wide systematic risk, as defined by CAPM (Fama, 1970). The STOXX Europe 600 EUR Gross Index serves as a proxy for the market portfolio within the CAPM framework, enabling the estimation of firm-level betas and the isolation of idiosyncratic return components.

GICS Industry (Dummy Variable)

- **Exact definition:** Time-invariant dummy variables for each firm's industry based on the Global Industry Classification Standard (GICS). Our sample contains stocks from 68 different industries, resulting in 68 different industry dummies.
- **Data Source:** Refinitive Eikon.
- **Justification:** Included as fixed effects in regressions to control for unobservable sector-specific factors that influence both ESG scores and returns. Justified by segmentation theory (Hong & Kacperczyk, 2009) and standard asset pricing models.
- **Note:** Industry *Aerospace & Defence* was used as the reference category for industry dummies in all models including this variable.

Country of Headquarters (Dummy Variable)

- **Exact definition:** Time-invariant dummy variables indicating each firm's country of where their headquarters are located.
- **Data Source:** Refinitive Eikon.
- **Justification:** Controls for country-specific factors affecting ESG disclosure and stock performance.
- **Note:** Country *Austria* was used as the reference category for country dummies in all models including this variable.

LN(Company Market Cap)

$= \ln(\text{Company Market Cap})$

- **Exact definition:** The natural logarithmic of a firm's market capitalization.
- **Data Source:** Calculated from Company Market Capitalization, retrieved from Refinitiv Eikon.
- **Justification:** Firm size, proxied by $\ln(\text{MarketCap})$, may affect both ESG engagement and financial performance. Larger firms face greater stakeholder pressure (Freeman,

1984) and are perceived as less risky by investors (Statman, 2004). The log transformation reduces skewness and limits the influence of outliers.

Book-to-Market Ratio

$$= \text{Common Shareholder Equity}_{FY-1} \div \text{Company Market Cap}_{FY0}$$

- **Exact Definition:** The Book-to-Market ratio compares a firm's book value to its market value, indicating relative undervaluation or overvaluation. It is calculated as prior-year common equity divided by current-year market capitalization.
- **Data Source:** Calculated from variables "Common Shareholder Equity" and "Company Market Cap", both retrieved from Refinitiv Eikon.
- **Justification:** Captures firm valuation differences. As a key factor in the Fama-French model, high Book-to-Market firms (value stocks) tend to earn higher returns, helping control for performance unrelated to ESG (Fama & French, 1993).

ESG Portfolio Dummy Variables (P1-P5)

- **Exact Definition:** Dummy variables indicating firm assignment to one of five ESG-based portfolios (quintiles) are constructed. The full construction procedure is described in Chapter 4.4.3.
- **Source:** Constructed based on ESG scores retrieved from Refinitiv Eikon.
- **Justification:** These dummies serve a dual purpose: (1) as categorical regressors to test for nonlinear ESG effects on returns, and (2) as the basis for equally weighted portfolio construction used in return aggregation and risk analysis.
- **Clarification:** While referred to as "portfolios," the dummy variables are primarily used as classification tools in regression models. The same ESG-based groupings are furthermore used to construct actual portfolios for performance comparison.
- **Note:** Portfolio 3 (P3) is omitted as the reference category in regression Models 7-12 in *Table 5.5*.

3.4 Potential Measurement Issues

ESG scoring methodologies face several limitations, particularly the reliance on self-reported and non-standardized disclosures, which may compromise objectivity (Pástor et al., 2021). To mitigate this, LSEG offers a *Combined ESGC* score that incorporates a *Controversies*-component alongside the traditional ESG pillars, capturing adverse events

affecting corporate reputation. When such controversies occur, the ESGC score is a weighted average of ESG and Controversies scores; otherwise, it equals the standard ESG score (LSEG, 2023). The potential impact of this adjustment on asset returns lies beyond the scope of this study.

Differences in scoring approaches between providers can further distort ESG assessments, potentially biasing cross-firm comparisons. Additionally, retroactive revisions may misrepresent the information available to investors at the time of portfolio construction (Berg et al., 2020; LSEG, 2023). This risk is minimized in the present analysis by using recent, unrevised scores from a single data version.

Furthermore, financial variables such as Market Capitalization and Book-to-Market ratio may be distorted by reporting lags and accounting inconsistencies, particularly for firms whose fiscal year does not align with the calendar year. External shocks such as the COVID-19 pandemic and the Ukraine-war may have introduced significant volatility and regime shifts during the sample period, potentially affecting the stability and reliability of estimated regression coefficients and performance metrics.

Lastly, constructing equally weighted portfolios assumes that all firms receive equal investor attention and capital allocation. While this assumption enhances comparability across ESG quintiles and reduces skewness caused by large-cap dominance, it may obscure realistic exposure patterns and size-related return effects, thus limiting external validity.

4. Method

This research paper employed a quantitative approach to investigate the relationship between ESG scores and stock performance within the study's data sample. The objective is to evaluate whether ESG ratings are associated with risk-adjusted returns by combining firm-level and portfolio-level¹ analysis.

¹ In this study, “portfolio” refers to analytically constructed ESG quintiles used to examine return differences across ESG levels, serving as a methodological tool for assessing both linear and non-linear ESG–return relationships.

4.1 Data collection and Sample Collection

Data for this study were primarily obtained from Refinitiv Eikon using the Microsoft Excel add-in. ESG scores and financial indicators were collected for each firm in the final sample. The collected data were subsequently used to construct additional variables required for the empirical analysis, including portfolio excess returns, market excess returns, and control variables used in the regression models.

To ensure consistency and comparability, a *frozen basket* approach was adopted. The sample was defined based on the constituents of the STOXX Europe 600, subject to the following selection criteria:

- Firms had to be continuously listed in the STOXX Europe 600 from 31 December 2018 to 31 December 2023. Firms entering or exiting the index during this period were excluded.
- Firms were required to have complete ESG data available in Refinitiv Eikon for the entire period.

Firms meeting these criteria were included in the frozen basket. Following this data cleansing process, the final sample consisted of 465 firms, resulting in a balanced panel dataset.

While the frozen basket approach ensures a balanced panel and facilitates time-series analysis, it introduces survivorship bias by excluding firms that were delisted, merged, or newly added during the period. Consequently, the findings of this study may overstate average performance and understate risk by disproportionately capturing more stable firms (Brown et al., 1992). Despite this limitation, a stable sample was prioritized to minimize distortions arising from changes in index composition.

Monthly annual returns for each constituent firm were retrieved from Refinitiv Eikon and served as the basis for all subsequent performance evaluations. The variable “Monthly Total Return” in Refinitiv Eikon was chosen as the primary return metric as it incorporates both price appreciation and dividend payments, thereby providing a more complete measure of realized shareholder return. This approach ensured comparability across sectors, particularly since some industries tend to have systematically higher dividend yields, which would be overlooked if only price returns were used.

Accordingly, monthly reported returns were preferred over annual figures to allow for higher-frequency observations within each calendar year. This allows for more precise estimation of return volatility and improves the robustness of performance metrics such as standard deviation. Annual data, by contrast, would yield only a limited number of observations across the entire study period, reducing the statistical reliability of risk assessments.

To account for the risk-free rate, the 3-month yield curve spot rate for AAA-rated euro area government bonds was retrieved from the official databases of the European Central Bank (n.d.). This yield data was used to derive the monthly risk-free rate applied in the analysis, as described in Chapter 4.3.

All raw data were processed, cleaned, and organized in Microsoft Excel prior to analysis.

4.2 Portfolio construction

Based on the final sample of 465 firms from the cleaned dataset, five equally sized groups, referred to as portfolios, were constructed to examine the relationship between ESG performance and financial returns. Each portfolio comprised 93 firms ($465/5 = 93$) and was rebalanced annually based on ESG scores retrieved from Refinitiv Eikon. A detailed list of portfolio constituents is presented in the appendix (*Table 9.1-5*).

The portfolio size aligns with Statman's (1987) recommendation for sufficient diversification, which is essential not only to reduce idiosyncratic risk but also to isolate the effect of ESG performance. A high degree of diversification helps ensure that the results are not driven by firm-specific or sector-specific factors unrelated to the study's objective.

P1 contained the bottom 20% of firms with the lowest ESG scores for a given year, representing the least ESG-compliant companies in the sample. In contrast, P5 included the top 20% of firms with the highest ESG scores, capturing those with the strongest ESG performance. P2 through P4 consisted of firms falling into the second, third, and fourth ESG quintiles, respectively, thereby establishing a gradient of ESG performance across the portfolios.

All portfolios were equally weighted to mitigate the influence of firm size and better isolate the effect of ESG performance. Each stock carried an equal weight of 1.075% ($=1/93$) within its respective portfolio, and the sorting procedure was repeated annually from 2019 to 2024. This approach reduces large-cap dominance in return aggregation and ensures a more balanced representation of ESG effects across firm sizes. While market-cap weighting reflects realistic allocations, it tends to overweight large firms, potentially masking return patterns linked to ESG. Equal weighting, by contrast, gives greater influence to mid- and small-cap firms, which are often underrepresented and have been shown to earn abnormal returns not explained by standard models (Banz, 1981; Hong & Kacperczyk, 2009). Although this deviates from investable index structures, it improves internal validity and aligns with findings that equal weighting often yields more robust results in hypothesis testing contexts (DeMiguel et al., 2009).

ESG scores as of December 31 of year $t-1$ were used to assign firms to portfolios for year t , ensuring that portfolio formation is based solely on information available to investors at the time. This lag structure avoids *look-ahead bias*, which could otherwise distort return estimates and compromise the validity of the results (Mouselli & Massoud, 2016).

4.3 Performance Metrics and Financial Calculations

The financial performance of each ESG quintile portfolio was assessed using a range of established performance metrics. Due to the equal weighting of portfolio constituents, monthly portfolio returns were computed as the arithmetic mean of the monthly returns of all included firms.

To enable a more precise measurement of portfolio performance, annual total returns were converted into effective monthly returns using *Formula 8*.

$$(8) : r_{1\text{ month}} = \left(1 + r_{\text{annual}}\right)^{\frac{1}{12}} - 1$$

This conversion facilitates the use of monthly compounding to calculate cumulative returns over the sample period. By reflecting the reinvestment of returns at monthly intervals, the approach provides a more accurate representation of long-term investment performance.

Cumulative returns were computed under the assumption of full reinvestment and geometric compounding on a monthly basis, consistent with standard asset pricing methodology.

To obtain the monthly risk-free rate, the 3-month spot yield for AAA-rated euro area government bonds, originally reported as an annual percentage rate, was converted using *Formula 9*.

$$(9) : r_{f, 1 \text{ month}} = \left(1 + r_{f, \text{annual}}\right)^{\frac{1}{12}} - 1$$

The resulting monthly rates were then expressed in decimal form to ensure consistency with the format of the return data.

Excess returns were derived by subtracting the monthly risk-free rate from each firm's total monthly return, as shown in *Formula 3*. Similarly, excess market returns were computed using the STOXX Europe 600 EUR Gross Index as the benchmark, based on end-of-month closing prices, in accordance with *Formula 4*. This index, obtained from Refinitiv Eikon, serves as a proxy for the market portfolio within the CAPM framework.

To estimate each portfolio's exposure to systematic risk (β) and its abnormal return (α), Ordinary Least Squares (OLS) regressions were conducted using the statistical software Gretl. One regression was performed per portfolio over the full sample period from 2019 to 2024. The use of monthly return data enhances the number of observations, thereby improving the statistical precision of the estimates. Moreover, monthly data helped smooth the impact of short-term volatility and transitory market events, producing more reliable estimates of beta and alpha. The regression results are presented in *Table 5.1*.

Alternatively, beta and alpha can be derived using *Formula 4* and *5*, respectively, presented in Chapter 2.1.2.

Estimating beta and alpha over an extended period allowed for the identification of stable and persistent relationships in portfolio performance, as opposed to transitory effects that may emerge over shorter horizons. Applying a uniform time frame to all portfolios ensures that estimations are made under consistent market conditions, thereby supporting fair cross-portfolio comparisons. Additionally, conducting a single regression over the full period

reduces sensitivity to anomalies in specific years, improving the model's ability to capture underlying performance trends.

When estimating alpha and beta using regression models, the adjusted R^2 was employed to assess the explanatory power of the model. Given the relatively large sample size (72 observations per portfolio), the adjusted R^2 provides a more reliable measure than the unadjusted R^2 , as it accounts for the number of predictors relative to the sample size.

The standard deviation of monthly portfolio returns was computed on an annual basis to approximate the overall volatility, interpreted as the total risk of each portfolio. This measure forms the basis for subsequent risk-adjusted performance evaluations.

To assess the risk-adjusted performance of each portfolio, the Sharpe Ratio and Treynor Measure were calculated on an annual basis, meaning that both excess return and the respective risk components were computed per year. This approach facilitates the comparison of annual portfolio performance relative to each year's volatility and risk exposure. The formulas and theoretical foundations of these metrics are discussed in Chapter 2.1.2.

4.4 Regression Model Design and Empirical Strategy

4.4.1 Model Overview and ESG Variable Design

To empirically examine the relationship between ESG performance and stock returns, twelve fixed effects panel regression models (Models 1–12) were estimated using monthly data for 465 firms over the period 2019–2024. The results of Models 1–6, estimated at the firm level, and Models 7–12, estimated at the ESG-level portfolio groups, are presented in *Table 5.4* and *5.5*, respectively. In all specifications, the dependent variable is the monthly excess return.

To evaluate both linear and potential non-linear relationships between ESG and stock performance, two complementary model designs were applied. In Models 1–6 (*Table 5.4*), ESG performance is represented by the firm's continuous ESG score, allowing for a direct interpretation of the marginal effect of a one-point increase in ESG rating. In Models 7–12 (*Table 5.5*), ESG portfolio dummy variables were instead used, based on annual ESG quintile rankings to capture return differences across ESG levels without assuming linearity. P3 has been excluded as the reference category to avoid multicollinearity. As the middle ESG

quintile, it serves as a neutral benchmark, facilitating symmetric comparison with both high- and low-ESG portfolios. This enhances interpretability by anchoring effect estimates against a median level of ESG performance.

This dual approach enables a more thorough investigation into whether ESG performance has a consistent, increasing effect on returns or if the relationship varies across different levels of ESG ratings.

4.4.2 Control Variables

To isolate the effect of ESG while accounting for other firm-specific and macroeconomic influences, a set of control variables was included: industry classification (GICS), country of headquarters, firm size (proxied by the natural logarithm of market capitalization), excess market return, and Book-to-Market ratio. These controls were selected based on theoretical relevance and prior ESG–performance literature, as well as their established role in asset pricing models (Halbritter & Dorfleitner, 2015; Fama & French, 1993).

The robustness of ESG coefficient estimates was assessed by examining their sensitivity to the introduction of additional control variables. Increases in explanatory power (R^2) and shifts in coefficient magnitude help indicate whether the results are influenced by observable firm characteristics.

4.4.3 ESG-Level Portfolio Classifications and Regression Dummies

To operationalize the non-linear ESG specification, the ESG quintile portfolios described in Chapter 4.2 were converted into time-varying dummy variables. This transformation enables the detection of non-linear effects in the relationship between ESG scores and financial performance, as firms were grouped into discrete ESG categories rather than evaluated along a continuous scale.

In addition to the ESG classification dummies, categorical dummy variables were constructed for each firm's industry and country of headquarters, based on the GICS and Refinitiv Eikon classifications, respectively. These dummies allow the regression models to control for time-invariant characteristics that may systematically influence both ESG scores and financial performance, such as regulatory environments, reporting standards, or

sector-specific sustainability pressures. These variables were included to isolate the effect of ESG from structural factors tied to sectoral or geographic identity.

For each year, ESG-level portfolio (quintiles) dummies were assigned a value of one (1) if a firm belonged to the respective portfolio and zero (0) otherwise. Similarly, categorical dummies for industry and country were assigned a value of one (1) for a firm's respective classification and zero (0) otherwise.

To prevent perfect multicollinearity, one dummy variable was omitted from each categorical group. P3 was omitted and serves as the reference group in models 7–12, allowing the estimated coefficients to be interpreted relative to this middle category. In the fixed effects regressions, *Aerospace & Defence* was used as the reference category for industry dummies, and *Austria* served as the reference category for country dummies. All estimated coefficients are therefore interpreted relative to these baseline groups. The full lists of industries and countries are provided in *Table 9.6-7*.

4.4.4 Model Specification

To assess the effect of ESG performance on stock returns while controlling for firm-specific and market-related characteristics, two sets of panel regression models were estimated using monthly data from 2019 to 2024. In all models, the firm's monthly excess return was used as the dependent variable.

Models 1–6: ESG Score as a Continuous Variable

The first set of models (Models 1–6) uses the firm's ESG score as a continuous independent variable to estimate the marginal effect of ESG performance on excess returns. The models were built incrementally by successively adding control variables.

Model 1 includes only the ESG score:

$$R_{it}^{excess} = \alpha_i + \beta_1 ESG_{it} + \epsilon_{it}$$

Model 2 adds the excess market return (MKT) to account for overall market movements:

$$+ \beta_2 MKT_t$$

Model 3 controls for firm valuation using the Book-to-Market ratio (BM):

$$+ \beta_3 BM_{it}$$

Model 4 introduces firm size, measured by the natural logarithm of market capitalization ($\ln(MC)$):

$$+ \beta_4 \ln(MC)$$

Model 5 includes country fixed effects to account for country-specific characteristics:

$$+ \beta_5 Country_i$$

Model 6 adds industry fixed effects to control for sector-specific influences:

$$+ \beta_6 Industry_i$$

This stepwise approach ensures that the effect of ESG performance is estimated while progressively isolating it from other potential explanatory variables.

Models 7–12: ESG-Level Portfolios (Dummy Variables)

The second model set (Models 7–12) replaces the continuous ESG score with dummy variables for four ESG quintile portfolios, with P3 omitted as the reference category. This specification enables the analysis of potential non-linearities in the ESG–return relationship and facilitates the identification of systematic differences in return performance among firms with particularly high or low ESG scores. In line with the previous model specifications, the models were constructed stepwise through the successive inclusion of control variables.

Model 7 uses ESG portfolio dummies only:

$$R_{it}^{excess} = \alpha_i + \beta_1 \cdot P1_{it} + \beta_2 \cdot P2_t + \beta_3 \cdot P4_{it} + \beta_4 \cdot P5 + \epsilon_{it}$$

Model 8 adds excess market return (MKT):

$$+ \beta_5 MKT_t$$

Model 9 includes the Book-to-Market ratio (BM):

$$+ \beta_6 BM_{it}$$

Model 10 controls for firm size via the natural logarithm of market capitalization ($\ln(MC)$):

$$+ \beta_7 \ln(MC)$$

Model 11 introduces country fixed effects:

$$+ \beta_8 Country_i$$

Model 12 adds industry fixed effects:

$$+ \beta_9 Industry_i$$

In both sets of models, firm fixed effects were included to account for time-invariant unobserved heterogeneity across firms, such as corporate culture or managerial practices, which could otherwise bias estimates. The fixed effects approach isolates within-firm variation over time, thereby reducing the risk of omitted variable bias arising from time-invariant confounders. To address potential heteroscedasticity, robust standard errors were employed throughout the analysis.

The choice of a fixed effects over a random effects specification was supported by a Hausman test, which indicated that unobserved heterogeneity was likely correlated with the explanatory variables.

4.4.5 Estimation Technique and Robustness

The regression specification comparison, with results presented in *Table 5.6*, used estimates based on both ordinary least squares (Models 1–3) and fixed effects panel regression (Model 4). This comparison was conducted to evaluate how different model specifications influence the estimated relationship between ESG scores and excess stock returns. Coefficients were estimated using four models that sequentially introduced additional controls. In Model 1, only ESG score was included as the explanatory variable. In Model 2, country and industry dummies were additionally added. Model 3 incorporated firm-level controls, including the $\ln(\text{MarketCap})$, the Book-to-Market ratio, and excess market return. Lastly, Model 4 introduced firm fixed effects while retaining all controls from the previous model.

To improve the reliability of coefficient estimates, all fixed effects regressions employed heteroscedasticity-robust standard errors. This adjustment was based on the results of a Breusch–Pagan test, which indicated the presence of heteroscedasticity in the panel data. While robust standard errors correct for heteroscedasticity, they do not address potential autocorrelation, which may still affect inference in the panel context.

5. Results

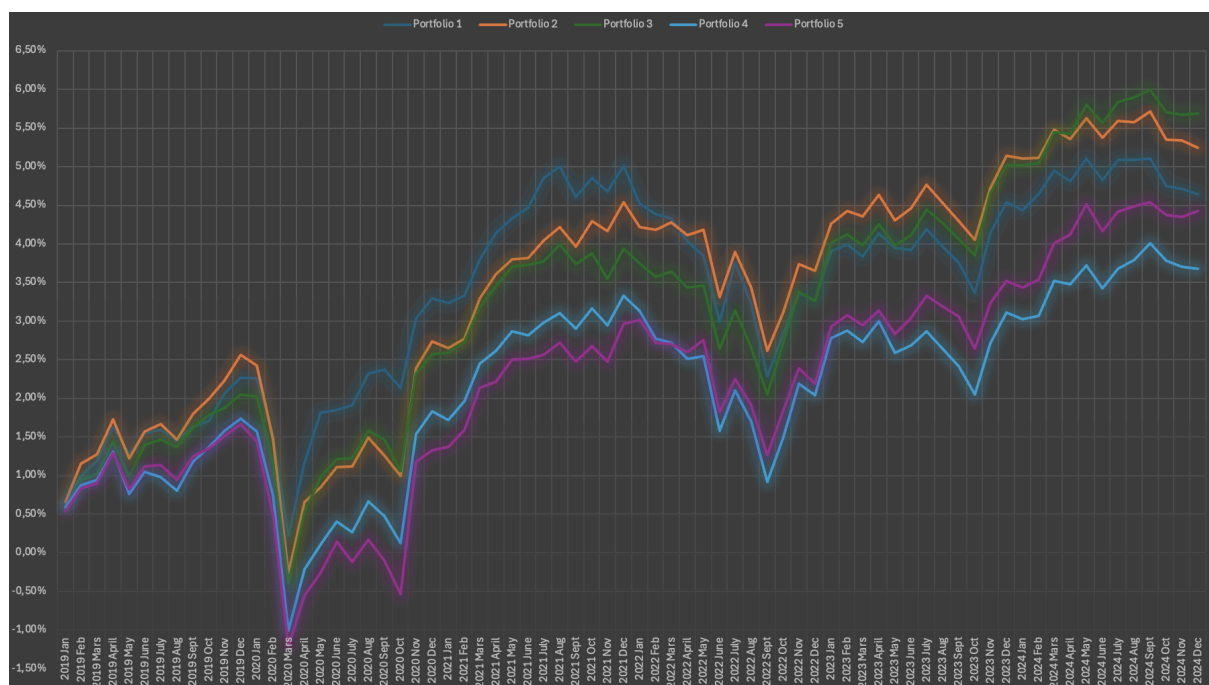
This chapter presents the empirical results of the study. The findings are subsequently analyzed and discussed in the following chapter.

5.1 Financial Performance

This section presents the financial performance of the five portfolios over the evaluation period.

Figure 1: Cumulative Returns of ESG-Sorted Portfolios

This figure illustrates the cumulative performance of the five portfolios over the sample period, calculated using geometrically compounded monthly percentage returns.



The portfolios exhibit highly correlated return patterns, indicating that they respond similarly to market-wide shocks and trends. Although no single portfolio consistently outperforms or underperforms across the entire period, clear performance differentials are observed. P1 and P2, consisting of stocks with the lowest ESG scores, tend to lie in the upper range of the cumulative return distribution. In contrast, P4 and P5, composed of the highest ESG-rated stocks, generally exhibit weaker performance and are positioned toward the lower end of the return paths.

Table 5.1: CAPM Regression Results

	<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>
<i>CAPM Beta</i>	1.06753***	1.18257***	1.1151***	1.1817***	1.16824***
<i>Jensen's Alpha</i>	-0.00091	-0.00071	0.00048	-0.00332**	-0.00196
<i>Adjusted R-squared</i>	0.878836	0.932065	0.927149	0.935668	0.901651

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

As presented in *Table 5.1*, all five portfolios exhibit positive beta coefficients. P1 reports the lowest beta (1.06753), while P2 shows the highest value (1.18257), indicating the greatest estimated exposure to systematic market risk. Moreover, P4 is the only portfolio with a statistically significant alpha coefficient (-0.00332) at the 5% significance level. The alpha estimates for the remaining portfolios are not statistically different from zero at either the 95% or the 90% confidence level.

The adjusted R^2 values across the regressions are high, indicating that a large proportion of the variation in portfolio returns is captured by the included market factor.

Table 5.2: Yearly Risk and Performance Metrics for Portfolios

		<i>Portfolio 1</i>	<i>Portfolio 2</i>	<i>Portfolio 3</i>	<i>Portfolio 4</i>	<i>Portfolio 5</i>
<i>Standard Deviation</i>	2019	0.0311	0.0381	0.0325	0.0358	0.0325
	2020	0.0765	0.0959	0.0892	0.0943	0.1023
	2021	0.0300	0.0276	0.0280	0.0274	0.0292
	2022	0.0643	0.0588	0.0571	0.0611	0.0544
	2023	0.0455	0.0423	0.0457	0.0466	0.0425
	2024	0.0265	0.0258	0.0255	0.0262	0.0275
<i>Sharpe Ratio</i>	2019	0.9534	0.8633	0.8481	0.6799	0.7270
	2020	0.2510	0.1251	0.1676	0.1185	0.0716
	2021	0.8143	0.9173	0.7451	0.8111	0.8089
	2022	-0.2565	-0.1430	-0.1130	-0.2007	-0.1377
	2023	-0.4162	-0.3959	-0.3044	-0.4463	-0.4317
	2024	-1.2086	-1.2439	-1.0351	-1.0500	-0.8762
<i>Treynor Measure</i>	2019	0.0300	0.0264	0.0261	0.0207	0.0220
	2020	0.0193	0.0092	0.0123	0.0087	0.0053
	2021	0.0268	0.0283	0.0242	0.0250	0.0257
	2022	-0.0143	-0.0079	-0.0063	-0.0113	-0.0079
	2023	-0.0154	-0.0143	-0.0112	-0.0160	-0.0154
	2024	-0.0276	-0.0288	-0.0242	-0.0278	-0.0231

The standard deviation values reported in *Table 5.2* show that portfolio-level volatility varied across years. All portfolios record their highest standard deviations in 2020. Over the full

sample period, P4 has the highest average standard deviation, indicating the greatest overall variation in monthly returns.

The Sharpe ratios shown in *Table 5.2* are positive for all portfolios in 2019 and 2021. In 2020, the Sharpe ratios decrease but remain positive. From 2022 onwards, Sharpe ratios are negative across all portfolios. The Sharpe ratios do not exhibit any systematic trend across the ESG quintiles

The Treynor ratios are positive for all portfolios during the years 2019 to 2021. In 2022 to 2024, the Treynor ratios are negative for all portfolios. Similar to the Sharpe ratios, the Treynor ratios do not display any consistent pattern across ESG classification groups over time.

5.2 Descriptive Statistics

Table 5.3: Summary statistics for the main variables used in the empirical analysis

	<i>Mean</i>	<i>Median</i>	<i>Min</i>	<i>Max</i>	<i>Std.Dev</i>	<i>Skewness</i>
<i>ESG Score</i>	71.684	73.804	7.6362	95.968	13.342	-0.89750
<i>ln(MarketCap)</i>	23.225	23.055	20.782	26.632	1.0367	0.60228
<i>Book-to-Market Ratio</i>	0.75127	0.48661	-0.77578	14.148	1.0429	5.9698
<i>Excess Market Return</i>	0.0085431	0.014341	-0.14366	0.13914	0.043078	-0.41517
<i>Excess Monthly Return</i>	0.0084738	0.0084829	-0.59112	0.76814	0.090255	0.12496

As shown in *Table 5.3*, the mean ESG score in the sample is 71.684, and with a standard deviation of 13.342. The distribution is negatively skewed (-0.8975), indicating that most firms have relatively high ESG scores. The natural logarithm of market capitalization ($\ln(\text{MarketCap})$) has a mean of 23.225, implying that most firms in the sample are medium-to-large sized. The slight positive skewness (0.60228) suggests a longer tail of particularly large firms pulling the average upward.

The Book-to-Market ratio exhibits a mean of 0.75127 and a strong positive skewness (5.9698), which reflects the presence of firms with unusually high Book-to-Market values. For the excess market return and excess monthly return, the means are both approximately 0.0085 and the distributions exhibit modest skewness (-0.41517 and 0.12496, respectively).

With regard to industry composition, the three most represented sectors in the sample are Insurance (29 firms), Machinery (27 firms), and Chemicals (19 firms). In terms of geographical distribution, the dataset is dominated by firms headquartered in the United Kingdom (107 firms), followed by France (66 firms) and Germany (60 firms).

5.3 Regression analysis

The regression analyses are conducted under the null hypothesis that the coefficient associated with ESG Score is equal to zero, implying that ESG performance has no statistically significant effect on the dependent variable, Excess Monthly Return.

Table 5.4: Firm-Level Fixed Effects Regression Results

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>	<i>Model 5</i>	<i>Model 6</i>
<i>ESG Score</i>	-0.00075 ***	-0.00033 ***	-0.00033 ***	1.67197e-05	1.67197e-05	1.67197e-05
<i>Within R-squared</i>	0.001535	0.299829	0.300524	0.306990	0.306990	0.306990
<i>ESG Score</i>	✓	✓	✓	✓	✓	✓
<i>Excess Market Return</i>		✓	✓	✓	✓	✓
<i>Book-to-market Ratio</i>			✓	✓	✓	✓
<i>ln Market Cap</i>				✓	✓	✓
<i>Country of Headquarters</i>					✓	✓
<i>GICS Industry Name</i>						✓

Note: ✓ indicates that the variable is included in the model; All models include fixed effects for industry and country. *Aerospace & Defence* is used as the reference category for industry dummies, and *Austria* for country dummies. Robust standard errors are used in all models.

*** p < 0.01; ** p < 0.05; * p < 0.1.

In *Table 5.4*, the ESG Score coefficient is negative and statistically significant at the 1% level in Models 1-3. In Model 4, where ln(Market Cap) is introduced as a control variable, the ESG coefficient becomes statistically insignificant. This result remains consistent in Models 5-6. The Within R² values are low in the initial specifications but increase as additional control variables are included, particularly the excess market return. Country and industry dummies are included in Models 11-12, but they are time-invariant and therefore absorbed by the firm fixed effects.

Table 5.5: ESG Portfolio-Level Fixed Effects Regression Results

	<i>Model 7</i>	<i>Model 8</i>	<i>Model 9</i>	<i>Model 10</i>	<i>Model 11</i>	<i>Model 12</i>
<i>P1</i>	0.00039	0.00039	0.00062	-0.00023	-0.00023	-0.00023
<i>P2</i>	0.00105	0.00105	0.00121	0.00057	0.00057	0.00057
<i>P4</i>	-0.000239 **	-0.00439 **	-0.00425 **	-0.00231	-0.00231	-0.00231
<i>P5</i>	-0.00577 **	-0.00577 **	-0.00571 **	-0.00282	-0.00282	-0.00282
<i>Within R-squared</i>	0.00020	0.299729	0.30043	0.30705	0.30705	0.30705
<i>ESG Score</i>	✓	✓	✓	✓	✓	✓
<i>Excess Market Return</i>		✓	✓	✓	✓	✓
<i>Book-to-market Ratio</i>			✓	✓	✓	✓
<i>ln Market Cap</i>				✓	✓	✓
<i>Country of Headquarters</i>					✓	✓
<i>GICS Industry Name</i>						✓

Note: ✓ indicates that the variable is included in the model; Fixed effects for industry and country are included in all models. Reference categories are the same as in Table 5.2. Robust standard errors are used.

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$.

When the analysis is performed at the ESG quintile levels in *Table 5.5*, the Within R^2 increases progressively across Models 7-12, reaching 0.307 in the final model. In Models 7-9, the coefficients for P4 and P5 are negative and statistically significant at the 5% level, indicating lower excess returns relative to P3 which was omitted and used as the reference group. P1 and P2 do not exhibit statistically significant coefficients in any model. In Models 10-12, none of the ESG quintile dummy variables are statistically significant. Country and industry dummies are included in Models 11-12, but are dropped from estimation due to multicollinearity with fixed effects.

Regression Specification Comparison

The comparison in *Table 5.6* allows us to distinguish between *between-firm effects* (captured in Models 1–3) and *within-firm variation* over time (captured in Model 4). It also clarifies which variables explain the ESG-return relationship depending on model structure.

Table 5.6: Regression Specification Comparison (ESG Score and Excess Return)

	<i>Model 1</i>	<i>Model 2</i>	<i>Model 3</i>	<i>Model 4</i>
<i>ESG Score</i>	-9.80363-e5 ***	-0.00013 ***	-1.88425e-5	1.67197e-5
<i>Country Dummy</i>	-	✓	✓	(absorbed)
<i>Industry Dummy</i>	-	✓	✓	(absorbed)
<i>Market Excess Return</i>	-	-	1.14236***	1.12786***
<i>Book-to-Market Ratio</i>	-	-	0.00173***	0.00144**
<i>ln(MarketCap)</i>	-	-	-0.00140***	-0.02931***
<i>Firm Fixed Effects</i>	-	-	-	✓
<i>Adjusted (1–3) / Within (4) R-squared</i>	0.00022	0.00010	0.29861	0.30699

Note: ✓ indicates that the variable is included in the model; (–) indicates exclusion. Fixed effects are applied only in Model 4, all other models use OLS. Reference categories are consistent with Table 5.2. Robust standard errors are used throughout.

*** p < 0.01; ** p < 0.05; * p < 0.1.

The ESG coefficient is negative and statistically significant at the 1% level in Models 1-2, but becomes statistically insignificant in Model 3 once firm-specific controls are included. In Model 4, the ESG coefficient remains statistically insignificant and changes sign to positive. Notably, the explanatory power of the models increases with the addition of controls, with the adjusted R² reaching its highest value of 0.30699 in Model 4.

6. Analysis

In this section, the results will be analyzed with reference to the study's theoretical framework.

6.1 Summary of Key Findings

The empirical results show no consistent evidence that high ESG scores are associated with superior financial performance among STOXX Europe 600 firms during the period 2019–2024. Across all regressions for Models 1-12 (*Tables 5.4 and 5.5*), ESG coefficients become statistically insignificant once controls for market return, valuation, size, industry, and country are introduced. These findings indicate that ESG scores do not explain variation in excess returns once relevant firm characteristics are accounted for.

Risk-adjusted performance metrics reinforce this conclusion. Sharpe and Treynor ratios (*Table 5.2*) show no systematic differences across ESG quintiles. Although one portfolio (P4) yields a statistically significant alpha under CAPM (*Table 5.1*), the result is isolated, negative in sign, and not consistent across specifications.

Robustness tests in *Table 5.6* reveal that any initial ESG significance disappears when firm-level controls are included, particularly market capitalization. This shift suggests that earlier findings likely reflect omitted variable bias, as larger firms tend to have both higher ESG scores and more stable, lower-risk cash flows. Controlling for size absorbs much of the variation previously attributed to ESG.

Overall, the analysis offers no evidence that ESG performance provides either a pricing advantage or disadvantage. The lack of persistent alpha, combined with flat risk-adjusted returns, supports the view that ESG is not a priced factor in this setting.

6.2 ESG and Financial Performance

Initial observations from *Figure 1* suggest a visual pattern in which portfolios with lower ESG scores (P1 and P2) appear to outperform those with higher ESG scores (P4 and P5). While this pattern could be interpreted as evidence of a negative relationship between ESG scores and cumulative monthly compounded returns, such visual trends do not constitute robust statistical evidence. One potential explanation sometimes proposed is the existence of a “green premium,” wherein investors are willing to accept lower financial returns in exchange for non-financial benefits (Pástor et al., 2021). However, this interpretation is not supported by more rigorous analysis.

As shown in *Table 5.1*, all five portfolios exhibit statistically significant beta values greater than one, indicating that they carry a higher level of systematic risk than the market benchmark. According to the Capital Asset Pricing Model (CAPM) and the Security Market Line (SML), portfolios or assets with positive and significant beta values are expected to generate returns above the market average, as compensation for bearing greater risk. This should, in turn, be reflected in positive alpha values if the assets are fairly priced and perform in line with CAPM expectations. However, *Table 5.1* shows that none of the ESG portfolios generate statistically significant alphas at conventional levels, with the sole exception of P4,

which displays a small, but negative and significant alpha. This suggests that it underperforms relative to its level of systematic risk. From the perspective of the SML, this implies that P4 is positioned below the line, indicating overvaluation. The insignificant coefficients for Jensen's alpha across the remaining portfolios imply that the null hypothesis cannot be rejected, indicating no statistical evidence that alpha differs from zero. This, in turn, suggests neither overvaluation nor undervaluation, and no evidence of abnormal performance relative to market expectations.

The combination of one portfolio displaying a negative and significant alpha, while the others show no statistically significant alpha, suggests that ESG-based investment strategies do not systematically yield returns in excess of what is predicted by exposure to market risk. Moreover, the high adjusted R^2 values across portfolios indicate that return variation is largely explained by systematic market movements, consistent with the CAPM framework.

Although the ESG coefficient initially appears statistically significant in the first three firm-level panel regressions (*Table 5.4*), this result does not hold once firm size is accounted for. Specifically, when the natural logarithm of market capitalization is introduced as a control variable, the ESG coefficient loses significance. This suggests that the initial negative relationship between ESG scores and excess returns is confounded by firm size: larger firms tend to score higher on ESG metrics while also generating lower returns in the observed sample period. In this context, ESG was likely acting as a proxy for firm size, rather than exerting a distinct effect on returns.

The lack of statistically significant alpha values, combined with the insignificance of ESG coefficients in the panel regressions when controlling for firm size, aligns with the semi-strong form of Fama's (1970) hypothesis about efficient markets, which suggests that all publicly available information, including ESG ratings, is already incorporated into asset prices. These results suggest that ESG-related information does not provide a reliable basis for generating abnormal returns, thereby supporting the notion of semi-strong market efficiency.

Taken together, the absence of consistent and statistically significant relationships between ESG scores and abnormal returns in both firm-level and ESG quintile portfolio-level models suggests that ESG-related information did not offer predictive power for excess returns. This

holds for the sample period 2019–2024 in the European equity market context examined in this study.

6.3 Risk Perspective: Volatility and Downside Risk

At first glance, standard deviation metrics in *Table 5.2* suggest a modest tendency for lower-ESG portfolios to exhibit greater volatility, particularly during the latter years of the sample. This might superficially support the notion that investors demand higher returns to compensate for elevated risk among less sustainable firms, an idea consistent with the traditional risk, return tradeoff in asset pricing theory. However, this pattern is neither strong nor consistent enough to draw robust inferences.

In fact, the year 2020 illustrates the instability of such relationships. During the COVID-19 crisis, the lowest-ESG portfolio (P1) displayed the lowest volatility, while the highest-ESG portfolio (P5) showed the highest volatility (*Table 5.2*). This contradicts expectations that ESG compliance offers downside protection in turbulent periods (Pástor et al., 2021). The inconsistency across years additionally calls into question the notion of ESG functioning as a systematic hedge.

Risk-adjusted performance metrics reinforce this uncertainty. Both Sharpe and Treynor ratios fail to reveal any consistent advantage for higher-ESG portfolios. While positive during the first half of the sample period (2019–2021), Treynor values decline and turn negative in the second half (2022–2024), suggesting a failure to outperform even on a beta-adjusted basis. Differences between ESG quintiles remain marginal across these measures, indicating no meaningful link between ESG performance and compensation for risk, systematic or total.

Importantly, these risk profiles may be influenced by the study's use of a frozen basket approach. By limiting the sample to firms that remained in the STOXX Europe 600 throughout the whole study period, the analysis excludes companies that were delisted or underperformed to the point of exclusion. This introduces survivorship bias, which can lead to understated volatility and overstated return stability. The bias may be particularly relevant if high-ESG firms were systematically more likely to survive. As a result, the reported standard deviations and risk-adjusted return measures may not fully reflect the true downside risks present in the broader market during the sample period (Brown et al., 1992).

From the perspective of mean-variance portfolio theory, these findings suggest that ESG-based portfolios do not consistently lie on the efficient frontier. According to Markowitz (1959), portfolios on the efficient frontier offer the highest expected return for each level of risk. Since the ESG portfolios in this study neither exhibit consistently superior returns nor reduced volatility, they do not appear to offer a clearly efficient risk-return trade-off. The absence of positive and significant alpha, together with flat risk-adjusted metrics, provides no evidence that higher ESG exposure is associated with systematically superior or inferior portfolio efficiency compared to lower ESG exposure.

Overall, the results do not support a consistent link between ESG scores and lower volatility or superior risk-adjusted performance. Apparent patterns are weak, unstable across years, and potentially biased by sample selection. These findings suggest that ESG is not a priced risk factor in this setting.

6.4 Robustness and Model Specification

Table 5.6 presents how the relationship between ESG scores and excess returns evolves across alternative model specifications. In the baseline model (Model 1), ESG is negatively and significantly related to returns, though the explanatory power is low (Adjusted $R^2 = 0.00022$), suggesting that the result may be weak or driven by omitted variable bias.

Introducing country and industry fixed effects in Model 2 causes the ESG coefficient to become slightly more negative, reaching -0.00013 , while the adjusted R^2 decreases marginally to 0.00010 . The coefficient remains statistically significant at the 1% level. In Model 3, the inclusion of firm-level financial controls such as excess market return, Book-to-Market ratio, and the log of market capitalization results in the ESG coefficient becoming statistically insignificant, at $-1.88e-5$. Meanwhile, the adjusted R^2 increases substantially to 0.29861 . Among these controls, market capitalization appears to be particularly influential, as it correlates strongly with both ESG scores and returns, thereby absorbing much of the variation that was initially attributed to ESG.

These findings are consistent with Halbritter and Dorfleitner's (2015) results, who demonstrate that larger firms tend to receive higher ESG ratings. This is likely because such firms disclose more detailed sustainability information, adopt formal ESG frameworks, and are more frequently assessed by ESG rating agencies. Although greater transparency may

reveal shortcomings, rating providers often reward firms for proactive ESG management and reporting efforts, contributing to higher scores among large firms (Eccles et al., 2014). As a result, ESG scores may partially reflect firm size rather than actual sustainability performance.

Model 4 introduces firm fixed effects, further reinforcing the insignificance of the ESG coefficient. The explanatory power, measured by the Within R^2 , increases to 0.30699. This model fundamentally shifts the interpretation of the ESG coefficient: while Models 1-3 rely on *between-firm variation*, examining whether firms with higher average ESG scores tend to earn different returns than firms with lower scores, Model 4 isolates *within-firm variation* over time. This means it evaluates whether a given firm's improvement or decline in ESG performance is associated with a change in its own return.

The lack of significance in the within-firm specification suggests that time-series changes in a firm's ESG score do not translate into systematic changes in its return. This finding strengthens the interpretation that ESG-related return differences observed in simpler models were likely driven by structural firm traits, such as size, rather than ESG itself. Once these traits are accounted for, both across firms and within firms over time, ESG no longer explains return variation.

Taken together, the results shown in *Table 5.6* indicate that ESG is not a consistently priced factor across firms or over time. This aligns with the Efficient Market Hypothesis (Fama, 1970), which posits that publicly available information, such as ESG scores, is already incorporated into stock prices, leaving little room for persistent outperformance.

6.5 Interpretation Through Theoretical Lenses

Behavioral Finance

Behavioral finance theories propose that ESG investment decisions may be shaped by non-financial preferences and investor segmentation. For instance, the market segmentation model suggests that norm-sensitive investors might exclude low-ESG firms from their portfolios (Heinkel et al., 2001; Hong & Kacperczyk, 2009). This exclusion can raise demand and valuations for high-ESG firms, thereby reducing their expected returns. Similarly, studies by Statman (2004) and Riedl and Smeets (2017) highlight that some investors gain utility

from holding “responsible” assets, influencing prices in ways not entirely explained by fundamentals.

If such behaviorally driven mechanisms were dominant, one would expect to observe consistent return differentials or altered risk profiles across ESG levels. Yet, the empirical findings of this study offer no robust support for this. In both the firm-level and ESG quintile level regressions (*Tables 5.4 and 5.5*), ESG coefficients lose significance once firm-specific controls, especially market capitalization, are accounted for. Risk-adjusted performance metrics (*Table 5.2*) also show no clear or persistent pattern related to ESG performance.

These outcomes suggest that while some behavioral influences may exist, their impact on pricing appears limited or is counterbalanced by structural firm-level characteristics. Rather than contradicting behavioral finance, the results may be more aligned with specific strands within it. One such strand is the concept of “warm-glow” investing, which posits that individuals derive emotional satisfaction from aligning investments with social values, independent of financial return (Statman, 2004). In this framework, ESG investing is primarily expressive, reflecting personal values rather than return-seeking behavior. The lack of return premium observed in this study is therefore consistent with models where ESG preferences affect portfolio composition rather than asset pricing.

Stakeholder Theory

Stakeholder theory suggests that firms with strong ESG performance benefit from enhanced legitimacy, improved stakeholder relationships, and more effective risk management, which should, in turn, yield superior financial outcomes (Freeman, 1984; Donaldson & Preston, 1995). These benefits are expected to manifest in the form of higher returns and lower volatility.

However, the empirical results do not support these predictions. Portfolios with high ESG scores fail to demonstrate superior performance, and P4, in particular, shows a negative and statistically significant alpha in *Table 5.1*, as well as the highest standard deviation across the sample period in *Table 5.2*. These outcomes run counter to the expectation that ESG leadership consistently translates into financial advantages.

One possible interpretation is that the benefits linked to stakeholder engagement are long term, difficult to quantify, or conditional on specific circumstances. As such, they may not be observable within the shorter time frame of this study. Another explanation is that any such benefits are already incorporated into asset prices, which is consistent with the semi-strong form of the Efficient Market Hypothesis (Fama, 1970). Under this view, ESG characteristics do not offer opportunities for persistent outperformance once public information has been fully reflected in stock valuations.

6.6 Comparison With Previous Research

When compared to previous research, this study presents a more cautious interpretation of the ESG–performance relationship than many earlier works. For example, Friede et al. (2015) found that the majority of ESG studies reported neutral or positive effects, and Statman and Glushkov (2009) identified modest outperformance for high-CSR portfolios. Tang and Zhang (2020) also found short-term gains for firms issuing green bonds.

In contrast, this analysis finds no consistent evidence that ESG scores are associated with superior returns or improved risk-adjusted performance. Alpha values across ESG portfolios are largely insignificant (*Table 5.1*), and performance metrics such as Sharpe and Treynor ratios (*Table 5.2*) reveal no systematic relationship with ESG levels. Panel regressions at both the firm and ESG quintile levels (*Tables 5.4 and 5.5*) confirm that ESG scores do not predict excess returns once key control variables are accounted for.

These results align more closely with recent critical research, such as Halbritter and Dorfleitner (2015), who found that ESG effects were highly sensitive to model specifications and the choice of data inputs. Similarly, Müller (2022) and Lismoen and Moum (2020) reported that any observed outperformance by low- or high-ESG firms tended to be unstable and context-dependent.

Taken together, the findings of this study challenge the assumption that ESG integration consistently improves financial performance. While previous literature may have identified favorable associations, this analysis suggests that such effects are not robust to rigorous empirical testing and are likely influenced by methodological choices, timeframe, and unobserved heterogeneity.

6.7 Industry and Country Composition Effects

An important consideration when interpreting the results is the composition of the sample, particularly the concentration of firms across specific industries and countries. The largest sectors represented are Insurance (29 firms), Machinery (27), and Chemicals (19), while firms headquartered in the United Kingdom (107), France (66), and Germany (60) dominate geographically. Such clustering may introduce systematic biases, as ESG scores and financial performance are shaped by institutional and sectoral contexts.

Cross-country institutional differences likely contribute to the absence of a robust ESG–return relationship in our results. The UK, which makes up a large portion of the sample, has adopted one of Europe’s most developed stewardship codes, requiring institutional investors to integrate ESG considerations (Lopez-de-Silanes et al., 2020). This may incentivize firms to improve ESG disclosures without corresponding improvements in underlying practices. In contrast, Germany and France operate within more bank-oriented systems with different disclosure expectations, making ESG scores less comparable (David et al., 2024). These differences introduce noise that may mask true performance effects.

Industry-level patterns also influence results. Insurance firms tend to exhibit high governance scores and low return volatility due to regulatory oversight, but rarely deliver ESG-driven outperformance. In contrast, ESG initiatives in the machinery and chemical sectors are harder to implement or measure, which may result in lower ESG scores despite strong returns (Haavisto, 2024).

The disappearance of ESG significance in the fixed-effects models (*Table 5.4* and *5.5*) suggests that the observed ESG–return relationship in simpler models was likely driven by time-invariant firm characteristics, such as industry affiliation or home country, rather than genuine within-firm variation in ESG performance.

7. Conclusion and Further Reflections

This chapter concludes the thesis by summarizing the main findings, highlighting key insights, and outlining suggestions for future research.

7.1 Concluding remarks

The purpose of this study was to examine whether firms' ESG scores are associated with stock returns within the defined equity universe and time period. The regression analyses reveal no consistent statistical evidence of such an association, suggesting that ESG factors are not systematically linked to return differences. This conclusion holds in both the time-series and cross-sectional specifications. The lack of significance in both specifications implies that changes in a firm's ESG score over time do not translate into systematic changes in its return, once firm-specific controls such as size are accounted for. Taken together, the results suggest that ESG does not have an independent influence on returns, either between or within firms over time.

Overall, these findings support the notion that ESG factors are not mispriced and do not offer exploitable return advantages, which is in line with the concept of market efficiency as described by Fama (1970). These results suggest that incorporating ESG considerations does not have a consistent positive or negative effect on financial performance, indicating that investors can pursue sustainability goals without incurring clear financial sacrifices.

7.2 Research quality

The study demonstrates a high degree of replicability and reliability, as the research process is thoroughly documented and all data sources are publicly available. It also exhibits strong validity, as it systematically addresses the research purpose through both firm-level regression analysis and a quintile grouping procedure, in which five well-diversified portfolios were constructed to isolate ESG effects. Complementary to this, relevant performance measures, aligned with those applied in previous empirical research, were employed to ensure methodological consistency.

Furthermore, careful attention was given to the selection and handling of the dataset. All data were treated with scientific integrity, and no adjustments or exclusions were made with the aim of influencing the results.

7.3 Directions for Future Research

Future research could build on this study by addressing some of its methodological limitations. Extending the time horizon may help determine whether ESG-related effects

persist over time or vary across economic cycles, while also reducing the impact of short-term shocks. Building on this, analyzing ESG momentum could provide insights into how quickly changes in ESG scores are priced by the market.

Another possibility for refinement involves allowing for dynamic firm entry and exit, rather than relying on a static sample. This would reduce survivorship bias and better reflect the evolving nature of equity markets, while also enabling further analysis of the relationship between high ESG performance and firm-level stability, such as continued index inclusion or lower bankruptcy risk.

Additionally, refining portfolio construction methods, by applying market capitalization weights rather than equal weights, may better reflect actual investment behavior and clarify how firm size-related factors influence ESG-linked return patterns. Finally, alternative formulations of ESG as an explanatory variable, such as incorporating the controversies component, or disaggregating the three ESG pillars, could offer deeper insight into which dimensions drive financial outcomes.

Taken together, these suggestions underscore the evolving role of ESG in financial analysis and point to the potential for future research to refine our understanding of its impact on financial performance.

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9. Appendix

Table 9.1: Constituents of portfolio 1 (first quintile)

2019	2020	2021	2022	2023	2024
Porsche Automobil Holding SE Sofina SA Intermediate Capital Group PLC Ryanair Holdings PLC VAT Group AG Swatch Group AG L E Lundbergforetagen AB (publ) Flughafen Zuerich AG freenet AG SES SA Inchcape PLC Nemetschek SE SalMar ASA PSP Swiss Property AG Bunzl plc argenx SE Hexagon AB Auto Trader Group PLC Adyen NV Sampo Oyj Virgin Money UK PLC Ackermans & Van Haaren NV Dchra Pharmaceuticals Ltd Ashtead Group PLC Demant A/S Spirax Group PLC Ocado Group PLC Baloise Holding AG Fuchs Se DCC PLC Partners Group Holding AG B&M European Value Retail SA Tryg A/S Tomra Systems ASA Bechtle AG GN Store Nord A/S Royal Unibrew A/S Ubisoft Entertainment SA Fastighets AB Balder Interpump Group SpA Kinnevik AB Tecan Group AG Amundi SA Beazley PLC Jyske Bank A/S IMCD NV Cellnex Telecom SA Howden Joinery Group PLC DiaSorin SpA Hays PLC K+S AG Dassault Aviation SA Eurazeo SE Hargreaves Lansdown PLC Schindler Holding AG Sage Group PLC Tate & Lyle PLC Mediobanca Banca di Credito Finanziario SpA Bucher Industries AG Ambu A/S Glanbia PLC Davide Campari Milano NV Scout24 SE Bellway PLC Rockwool A/S Hannover Rueck SE Halma PLC Bollere SE Gemmab A/S Pennon Group PLC Elisa Oyj Hiscox Ltd Smiths Group PLC Bank Polska Kasa Opieki SA Direct Line Insurance Group PLC J Sainsbury PLC Orlen SA Admiral Group PLC AAK AB (publ) Safran SA Experian PLC St James's Place PLC Cembra Money Bank AG Swiss Prime Site AG Hexpol AB TAG Immobilien AG Dassault Systemes SE Sopra Steria Group SA Seyren Trent PLC Sartorius Stedim Biotech SA Rightmove PLC IG Group Holdings PLC	Porsche Automobil Holding SE Sofina SA Intermediate Capital Group PLC Ryanair Holdings PLC VAT Group AG Swatch Group AG L E Lundbergforetagen AB (publ) Flughafen Zuerich AG freenet AG SES SA Inchcape PLC Nemetschek SE SalMar ASA PSP Swiss Property AG Bunzl plc argenx SE Hexagon AB Auto Trader Group PLC Adyen NV Sampo Oyj Virgin Money UK PLC Ackermans & Van Haaren NV Dchra Pharmaceuticals Ltd Ashtead Group PLC Demant A/S Spirax Group PLC Ocado Group PLC Baloise Holding AG Fuchs Se DCC PLC Partners Group Holding AG B&M European Value Retail SA Tryg A/S Tomra Systems ASA Bechtle AG GN Store Nord A/S Royal Unibrew A/S Ubisoft Entertainment SA Fastighets AB Balder Interpump Group SpA Kinnevik AB Tecan Group AG Amundi SA Beazley PLC Jyske Bank A/S IMCD NV Cellnex Telecom SA Howden Joinery Group PLC DiaSorin SpA Hays PLC K+S AG Dassault Aviation SA Eurazeo SE Hargreaves Lansdown PLC Schindler Holding AG Sage Group PLC Tate & Lyle PLC Mediobanca Banca di Credito Finanziario SpA Bucher Industries AG Ambu A/S Glanbia PLC Davide Campari Milano NV Scout24 SE Bellway PLC Rockwool A/S Hannover Rueck SE Halma PLC Bollere SE Gemmab A/S Pennon Group PLC Elisa Oyj Hiscox Ltd Smiths Group PLC Bank Polska Kasa Opieki SA Direct Line Insurance Group PLC J Sainsbury PLC Orlen SA Admiral Group PLC AAK AB (publ) Safran SA Experian PLC St James's Place PLC Cembra Money Bank AG Swiss Prime Site AG Hexpol AB TAG Immobilien AG Dassault Systemes SE Sopra Steria Group SA Seyren Trent PLC Sartorius Stedim Biotech SA Rightmove PLC IG Group Holdings PLC	Porsche Automobil Holding SE Sofina SA freenet AG Swatch Group AG VAT Group AG Flughafen Zuerich AG B&M European Value Retail SA Ackermans & Van Haaren NV Intermediate Capital Group PLC Inchcape PLC L E Lundbergforetagen AB (publ) Hargreaves Lansdown PLC SES SA Adyen NV PSP Swiss Property AG Ashtead Group PLC Sage Group PLC Baloise Holding AG Jyske Bank A/S Ryanair Holdings PLC Interpump Group SpA DCC PLC MERLIN Properties SOCIMI SA Adyen NV Jyske Bank A/S Avolta AG SalMar ASA Hays PLC Ocado Group PLC Schindler Holding AG Dassault Aviation SA Tomra Systems ASA Nemetschek SE Eurazeo SE Partners Group Holding AG Tryg A/S Ocado Group PLC Howden Joinery Group PLC Fuchs Se SalMar ASA Bechtle AG Dassault Aviation SA Nemetschek SE Beazley PLC Mediobanca Banca di Credito Finanziario SpA Spirax Group PLC K+S AG Dchra Pharmaceuticals Ltd Virgin Money UK PLC IMCD NV GN Store Nord A/S J Sainsbury PLC Hiscox Ltd Bucher Industries AG Tomra Systems ASA Bollere SE Hexpol AB Bellway PLC Tecan Group AG Rockwool A/S Securitas AB Cellnex Telecom SA Unite Group PLC Orlen SA Tate & Lyle PLC IG Group Holdings PLC Admiral Group PLC SSP Group PLC DiaSorin SpA Amundi SA Halma PLC Schindler Holding AG Elisa Oyj Sopra Steria Group SA Berkeley Group Holdings PLC KGHM Polska Miedz SA Ubisoft Entertainment SA Ferrari NV Direct Line Insurance Group PLC Cembra Money Bank AG Powszechna Kasa Oszczednosci Bank Polski SA Thales SA Thales SA Remy Cointreau SA Pennon Group PLC Brenntag SE Sartorius Stedim Biotech SA LPP SA Phoenix Group Holdings PLC Aalberts NV National Grid PLC	Porsche Automobil Holding SE B&M European Value Retail SA Sofina SA Flughafen Zuerich AG freenet AG argenx SE Ackermans & Van Haaren NV Inchcape PLC Baloise Holding AG Ryanair Holdings PLC Howden Joinery Group PLC Fastighets AB Balder Glanbia PLC Sage Group PLC L E Lundbergforetagen AB (publ) VAT Group AG Ashtead Group PLC Interpump Group SpA Bunzl plc MERLIN Properties SOCIMI SA Adyen NV Jyske Bank A/S Avolta AG SalMar ASA Hays PLC Ocado Group PLC Schindler Holding AG Dassault Aviation SA Tomra Systems ASA DCC PLC Nemetschek SE Eurazeo SE Partners Group Holding AG SES SA Spirax Group PLC Fuchs Se Virgin Money UK PLC Hexagon AB GN Store Nord A/S DiaSorin SpA Demant A/S Direct Line Insurance Group PLC St James's Place PLC Hargreaves Lansdown PLC Swatch Group AG Tecan Group AG Elisa Oyj PSP Swiss Property AG Admiral Group PLC Hexpol AB Berkeley Group Holdings PLC IG Group Holdings PLC Amundi SA Orlen SA Smiths Group PLC Rockwool A/S Mediobanca Banca di Credito Finanziario SpA Halma PLC Bellway PLC Royal Unibrew A/S Bellway PLC Auto Trader Group PLC Brenntag SE Viscofan SA KGHM Polska Miedz SA Hiscox Ltd Derwent London PLC Ubisoft Entertainment SA Ferrari NV Cembra Money Bank AG Sartorius Stedim Biotech SA Ambu A/S Spectris PLC St James's Place PLC Bucher Industries AG Intermediate Capital Group PLC Thales SA Travis Perkins PLC Beazley PLC Telenor ASA Rockwool A/S Sartorius Stedim Biotech SA Cembra Money Bank AG Finanziario SpA Swatch Group AG SSP Group PLC Halma PLC Derwent London PLC Aker BP ASA Schroders PLC Remy Cointreau SA Auto Trader Group PLC Hiscox Ltd Helvetia Holding AG RWE AG Sampo Oyj Heineken Holding NV Saab AB Ipsen SA Persimmon PLC Scout24 SE Intermediate Capital Group PLC Rubis SA Brenntag SE voestalpine AG Orlen SA	Porsche Automobil Holding SE Sofina SA freenet AG Baloise Holding AG L E Lundbergforetagen AB (publ) Inchcape PLC Fastighets AB Balder Flughafen Zuerich AG Ackermans & Van Haaren NV Jyske Bank A/S Howden Joinery Group PLC Bunzl plc SalMar ASA VAT Group AG DCC PLC Hays PLC Ashtead Group PLC Ryanair Holdings PLC Dchra Pharmaceuticals Ltd Dassault Aviation SA B&M European Value Retail SA Sage Group PLC SES SA Adyen NV Spirax Group PLC Hexagon AB Interpump Group SpA Tomra Systems ASA Schindler Holding AG Securitas AB MERLIN Properties SOCIMI SA Fuchs Se Bellway PLC argenx SE Direct Line Insurance Group PLC DiaSorin SpA Eurazeo SE Smiths Group PLC Avolta AG IG Group Holdings PLC PSP Swiss Property AG K+S AG St James's Place PLC Dchra Pharmaceuticals Ltd Elisa Oyj Hargreaves Lansdown PLC Amundi SA Ubisoft Entertainment SA Hexpol AB Travis Perkins PLC Amundi SA Bank of Ireland Group PLC Berkeley Group Holdings PLC Nemetschek SE Hermes International SCA Tryg A/S Ubisoft Entertainment SA Hexpol AB Direct Line Insurance Group PLC Amundi SA Bank of Ireland Group PLC Berkeley Group Holdings PLC Nemetschek SE Hermes International SCA Royal Unibrew A/S GN Store Nord A/S Davide Campari Milano NV Admiral Group PLC Kbc Groep NV Cembra Money Bank AG Partners Group Holding AG Unite Group PLC KGHM Polska Miedz SA Thales SA Telenor ASA Aalberts NV Rockwool A/S Sartorius Stedim Biotech SA Mediobanca Banca di Credito Finanziario SpA Swatch Group AG SSP Group PLC Halma PLC Derwent London PLC Aker BP ASA Schroders PLC Remy Cointreau SA Auto Trader Group PLC Hiscox Ltd Helvetia Holding AG RWE AG Sampo Oyj Heineken Holding NV Saab AB Ipsen SA Persimmon PLC Scout24 SE Intermediate Capital Group PLC Rubis SA Brenntag SE voestalpine AG Orlen SA	Porsche Automobil Holding SE Sofina SA L E Lundbergforetagen AB (publ) freenet AG Baloise Holding AG Inchcape PLC Howden Joinery Group PLC Jyske Bank A/S DCC PLC Bunzl plc SES SA Flughafen Zuerich AG Ryanair Holdings PLC VAT Group AG PSP Swiss Property AG Ashtead Group PLC B&M European Value Retail SA Dchra Pharmaceuticals Ltd Sage Group PLC Eurazeo SE Dassault Aviation SA Hargreaves Lansdown PLC Schindler Holding AG Fuchs Se Direct Line Insurance Group PLC Spirax Group PLC Ackermans & Van Haaren NV IG Group Holdings PLC Elisa Oyj Securitas AB SalMar ASA Ashtead Group PLC Interpump Group SpA Hexagon AB Smiths Group PLC Hypox AB Tomra Systems ASA Hays PLC Ocado Group PLC Admiral Group PLC Telenor ASA Demant A/S Halma PLC Ferrari NV Hermes International SCA Amundi SA GN Store Nord A/S Avolta AG IMCD NV voestalpine AG Glanbia PLC Cembra Money Bank AG Hiscox Ltd Bank of Ireland Group PLC Auto Trader Group PLC Aalberts NV Adecco Group AG K+S AG Intermediate Capital Group PLC Royal Unibrew A/S Davide Campari Milano NV Mediobanca Banca di Credito Finanziario SpA Nemetschek SE Heineken Holding NV Travis Perkins PLC BAE Systems PLC Dnb Bank ASA Sartorius Stedim Biotech SA Rockwool A/S Unite Group PLC St James's Place PLC Partners Group Holding AG Deutsche Lufthansa AG Trelleborg AB Beazley PLC Remy Cointreau SA Ipsen SA Sampo Oyj Investec PLC Berkeley Group Holdings PLC Skanaviska Enskilda Banken AB Pernod Ricard SA Saab AB KGHM Polska Miedz SA Kbc Groep NV Dassault Systemes SE SSP Group PLC Verbund AG Ubisoft Entertainment SA Thales SA

Table 9.2: Constituents of portfolio 2 (second quintile)

2019	2020	2021	2022	2023	2024
Phaleas SA Amundi SA Dassault Systemes SE Hexopol AB Helvetia Holding AG DKSH Holding AG Persimmon PLC Euronext NV Burberry Group PLC Italgas SpA Eurazeo SE Hiscox Ltd Orlen SA Sopra Steria Group SA Tate & Lyle PLC J Sainsbury PLC Securitas AB DiaSorin SpA Aalberts NV RS Group PLC Anheuser-Busch Inbev SA Berkeley Group Holdings PLC Rubis SCA Kone Oyj Kesko Oyj Aker BP ASA Admiral Group PLC Getinge AB LEG Immobilien SE Melrose Industries PLC Ferrovial SE Bank of Ireland Group PLC Sartorius Stedim Biotech SA Rightmove PLC Coloplast A/S Mediobanca Banca di Credito Finanziario SpA Svenska Handelsbanken AB Delivery Hero SE Evotec SE Subsea 7 SA Tenaris SA Centrica PLC Hannover Rueck SE Epiroc AB Carl Zeiss Meditec AG Heineken NV voestalpine AG Pandora A/S Kion Group AG Swedish Orphan Biovitrum AB (publ) Pennon Group PLC AP Moeller - Maersk A/S SSE PLC Hikma Pharmaceuticals PLC Tencoes AG Entain PLC ACS Actividades de Construcción y Servicios SA Travis Perkins PLC Asa Abloy AB Gjensidige Forsikring ASA Straumann Holding AG Brenntag SE Barratt Redrow PLC Huhtamaki Oyj Spie SA IMI PLC Tele2 AB Johnson Matthey PLC Aena SME SA Storebrand ASA Valmet Oyj WH Smith PLC Knorr Bremse AG Capgemini SE Covivio SA Bank Polska Kasa Opieki SA Beiersdorf AG Trelleborg AB Biomerieux SA Essity AB (publ) Alten SA Legal & General Group PLC Randstad NV Adecco Group AG Logitech International SA LVMH Moët Hennessy Louis Vuitton SE Prudential PLC Orion Oyj DSV A/S Julius Baer Gruppe AG Britvic Ltd Credit Agricole SA ASM International NV	WH Smith PLC KGHM Polska Miedz SA Getinge AB Travis Perkins PLC Investor AB SSP Group PLC Viscofan SA RS Group PLC Kone Oyj Bank of Ireland Group PLC Ferrari NV Berkeley Group Holdings PLC Phoenix Group Holdings PLC Securitas AB Groep Brussel Lambert NV Brenntag SE Investec PLC Hermes International SCA Thales SA Remy Cointreau SA Centrica PLC SSE PLC LEG Immobilien SE Aker BP ASA Anheuser-Busch Inbev SA Spie SA Gjensidige Forsikring ASA Informa PLC Derwent London PLC voestalpine AG Aalberts NV Melrose Industries PLC ASM International NV Coloplast A/S Prudential PLC LPP SA Heineken Holding NV MERLIN Properties SOCIMI SA Kion Group AG Carl Zeiss Meditec AG Koninklijke Ahold Delhaize NV Ferrovial SE Powszechna Kasa Oszczednosci Bank Polski SA AIB Group PLC Tenaris SA Burberry Group PLC Epiroc AB Julius Baer Gruppe AG Barratt Redrow PLC NN Group NV Johnson Matthey PLC Telenor ASA Schroders PLC Heineken NV Bouygues SA RWE AG DSV A/S ACS Actividades de Construcción y Servicios SA Unite Group PLC Italgas SpA Nibe Industrier AB Helvetia Holding AG ABN Amro Bank NV AP Moeller - Maersk A/S Ageas SA Man Group PLC Temenos AG ACS Actividades de Construcción y Servicios SA Compagnie Financiere Richemont SA Richtermont SA Beiersdorf AG Carl Zeiss Meditec AG Pernod Ricard SA Mowi ASA Engie SA Dnb Bank ASA Man Group PLC Savern Trent PLC Temenos AG ACS Actividades de Construcción y Servicios SA Compagnie Financiere Richemont SA Beiersdorf AG Banko BPM SpA Persimmon PLC Straumann Holding AG Temenos AG ConvaTec Group PLC IMI PLC Evotec SE ITV PLC Euronext NV Hikma Pharmaceuticals PLC Wolters Kluwer NV British Land Company PLC LVMH Moët Hennessy Louis Vuitton SE Knorr Bremse AG Mowi ASA National Grid PLC Saab AB Kesko Oyj Britvic Ltd Entain PLC	Kbc Groep NV Royal Unibrew A/S Derwent London PLC Bank Polska Kasa Opieki SA TAG Immobilien AG ASM International NV LEG Immobilien SE Smiths Group PLC Davide Campari Milano NV Telenor ASA Dassault Systemes SE Rentokil Initial PLC Safran SA AP Moeller - Maersk A/S RS Group PLC Christian Dior SE Anheuser-Busch Inbev SA Experian PLC Nibe Industrier AB Informa PLC Hermes International SCA Helvetia Holding AG Prudential PLC Investor AB Swiss Prime Site AG Straumann Holding AG Ageas SA Eurazeo SE Tenaris SA Capgemini SE Euronext NV Viscofan SA Centrica PLC Melrose Industries PLC Gjensidige Forsikring ASA AAK AB (publ) Koninklijke KPN NV E.ON SE Heineken Holding NV Persimmon PLC Wienerberger AG Barratt Redrow PLC Kone Oyj Genmab A/S Saab AB Trelleborg AB Aker BP ASA St James's Place PLC Rightmove PLC GEA Group AG Svenska Handelsbanken AB Compagnie Financiere Richemont SA Spectris PLC RWE AG LVMH Moët Hennessy Louis Vuitton SE Investec PLC Hannover Rueck SE Deutsche Lufthansa AG Rubis SCA Beiersdorf AG Carl Zeiss Meditec AG Pernod Ricard SA Engie SA Dnb Bank ASA Man Group PLC Savern Trent PLC Temenos AG ACS Actividades de Construcción y Servicios SA Scor SE Epiroc AB voestalpine AG Wolters Kluwer NV IMI PLC Heineken NV Imperial Brands PLC Scout24 SE Oersted A/S Swedish Orphan Biovitrum AB (publ) Antofagasta PLC ABN Amro Bank NV Kuehne und Nagel International AG H & M Hennes & Mauritz AB Essity AB (publ) BAE Systems PLC Veolia Environnement SA EssilorLuxottica SA Galp Energia SGPS SA Credit Agricole SA Biomerieux SA Kerry Group PLC Burberry Group PLC Logitech International SA	Kinnevik AB Melrose Industries PLC Investor AB Oersted A/S Swiss Prime Site AG AP Moeller - Maersk A/S Remy Cointreau SA Bank of Ireland Group PLC Tryg A/S voestalpine AG Schroders PLC Persimmon PLC Heineken Holding NV Sampo Oyj Wolters Kluwer NV Trelleborg AB Gjensidige Forsikring ASA Helvetia Holding AG Svenska Handelsbanken AB Carl Zeiss Meditec AG Koninklijke KPN NV Beiersdorf AG Dnb Bank ASA Rightmove PLC Scor SE Euronext NV Credit Agricole SA Johnson Matthey PLC Aeroports de Paris SA Dassault Systemes SE London Stock Exchange Group PLC Swisscom AG Imperial Brands PLC Cellnex Telecom SA GEA Group AG RS Group PLC Nibe Industrier AB E.ON SE ABN Amro Bank NV Straumann Holding AG RWE AG ACS Actividades de Construcción y Servicios SA Ipsen SA LEG Immobilien SE Centrica PLC Investec PLC Saab AB ASM International NV Next PLC Aker BP ASA Galenica AG Essity AB (publ) Pernod Ricard SA Swedish Orphan Biovitrum AB (publ) Bouygues SA Tenaris SA TAG Immobilien AG Inmobiliaria Colonial SOCIMI SA AAK AB (publ) National Grid PLC BAE Systems PLC Grifols SA Compagnie Financiere Richemont SA Veolia Environnement SA Rubis SCA Groep Brussel Lambert NV Scout24 SE Kone Oyj Capgemini SE Man Group PLC Johnson Matthey PLC thyssenkrupp AG International Consolidated Airlines Group SA Zalando SE Kingfisher PLC Kion Group AG Kuehne und Nagel International AG Skanska AB Christian Dior SE Galp Energia SGPS SA Wienerberger AG Banco BPM SpA Heineken NV Engie SA Forvia SE ITV PLC Informa PLC Subsea 7 SA Pennon Group PLC Ageas SA Intertek Group PLC Adecco Group AG Vestas Wind Systems A/S Temenos AG	Tate & Lyle PLC Aeroports de Paris SA Dassault Systemes SE Beiersdorf AG Melrose Industries PLC Trelleborg AB Beazley PLC Kinnevik AB Investec PLC Pernod Ricard SA Danske Bank A/S Viscofan SA Bolloré SE Ferrari NV Kingfisher PLC Dnb Bank ASA LPP SA Nibe Industrier AB Ocado Group PLC Tecan Group AG Capgemini SE Rightmove PLC BAE Systems PLC Wolters Kluwer NV Galp Energia SGPS SA Credit Agricole SA Johnson Matthey PLC Straumann Holding AG Powszechna Kasa Oszczednosci Bank Polski SA TAG Immobilien AG Swiss Prime Site AG AIB Group PLC Spectris PLC ABN Amro Bank NV Bucher Industries AG AP Moeller - Maersk A/S ISS A/S Galenica AG Zalando SE Gjensidige Forsikring ASA Vestas Wind Systems A/S thyssenkrupp AG EssilorLuxottica SA Julius Baer Gruppe AG Kone Oyj Safran SA Ambu A/S Christian Dior SE Tenaris SA Svenska Handelsbanken AB Scor SE Associated British Foods PLC Verbund AG London Stock Exchange Group PLC Adecco Group AG Kion Group AG Euronext NV Heineken NV Mowi ASA Skandinaviska Enskilda Banken AB BT Group PLC Carl Zeiss Meditec AG Centrica PLC HSBC Holdings PLC Alten SA National Grid PLC Oersted A/S British Land Company PLC ASM International NV Skanska AB Carlsberg A/S Groep Brussel Lambert NV Virgin Money UK PLC Marks and Spencer Group PLC IMCD NV AAK AB (publ) Experian PLC Swedbank AB Kuehne und Nagel International AG Informa PLC Swedish Orphan Biovitrum AB (publ) Savern Trent PLC United Utilities Group PLC Novozymes A/S Koninklijke Ahold Delhaize NV Deutsche Boerse AG Forvia SE ITV PLC Bechtel AG RS Group PLC Koninklijke KPN NV Asa Abloy AB Britvic Ltd	thyssenkrupp AG Investor AB Aeroports de Paris SA Swatch Group AG Orlen SA Tate & Lyle PLC RWE AG Wolters Kluwer NV Helvetia Holding AG Aker BP ASA AP Moeller - Maersk A/S AAK AB (publ) Capgemini SE ABN Amro Bank NV Bolloré SE Credit Agricole SA Kinnevik AB Rubis SCA Swiss Life Holding AG Heineken NV Bechtel AG Oersted A/S Svenska Handelsbanken AB Persimmon PLC Nibe Industrier AB Rightmove PLC Associated British Foods PLC Koninklijke KPN NV Powszechna Kasa Oszczednosci Bank Polski SA ISS A/S Scor SE TAG Immobilien AG Beiersdorf AG Danske Bank A/S Tecan Group AG Carl Zeiss Meditec AG Groep Brussel Lambert NV Bucher Industries AG Grifols SA Euronext NV Fabege AB Johnson Matthey PLC Marks and Spencer Group PLC BT Group PLC Forvia SE Tenaris SA argens SE Barratt Redrow PLC Swiss Prime Site AG Gjensidige Forsikring ASA Adyen NV Aena SME SA Galp Energia SGPS SA EssilorLuxottica SA Safran SA Julius Baer Gruppe AG Skanska AB Euronext NV Scout24 SE Alten SA Galenica AG Compagnie Financiere Richemont SA Bank Polska Kasa Opieki SA Equinor ASA Swisscom AG LEG Immobilien SE Vestas Wind Systems A/S International Consolidated Airlines Group SA RS Group PLC Melrose Industries PLC Gerresheimer AG HSBC Holdings PLC Straumann Holding AG LPP SA Kion Group AG Spectris PLC Intertek Group PLC Taylor Wimpey PLC Kuehne und Nagel International AG United Utilities Group PLC MERLIN Properties SOCIMI SA AZA SpA SEGRO PLC Asa Abloy AB Antofagasta PLC Virgin Money UK PLC Siemens Healthineers AG Next PLC Covestro AG Deutsche Boerse AG Experian PLC Brenntag SE National Grid PLC

Table 9.3: Constituents of portfolio 3 (third quintile)

2019	2020	2021	2022	2023	2024
Ipsen SA Kbc Groep NV National Grid PLC Heineken Holding NV Compagnie Financiere Richemont SA Banco BPM SpA Antofagasta PLC ITV PLC Kerry Group PLC Sika AG Grifols SA Nibe Industrier AB British Land Company PLC Bouygues SA RWE AG AZA SpA NN Group NV Unitec Group PLC Mowi ASA Swiss Life Holding AG thyssenkrupp AG WPP PLC Immobiliaria Colonial SOCIMI SA Verbund AG Prismian SpA Investec PLC Spectris PLC L'Air Liquide Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges Claude SA Forvia SE Skandinaviska Enskilda Banken AB Dnb Bank ASA BT Group PLC Swiss Re AG AIB Group PLC Poste Italiane SpA Man Group PLC Telenor ASA Rentokil Initial PLC Kuehne und Nagel International AG FinecoBank Banca Fineco SpA GEA Group AG Veolia Environnement SA Carlsberg A/S Wolters Kluwer NV Scor SE MERLIN Properties SOCIMI SA Edenred SE Skanska AB Saab AB London Stock Exchange Group PLC ConvaTec Group PLC Banco Comercial Portugues SA Christian Dior SE Gerresheimer AG Commerzbank AG Henkel AG & Co KGaA Swisscom AG Andritz AG Elis SA Bureau Veritas SA Jerónimo Martins SGPS SA SKF AB Rolls-Royce Holdings PLC Konecranes Abp United Utilities Group PLC Symrise AG Galp Energia SGPS SA Croda International PLC Intertek Group PLC Schneider Electric SE Koninklijke KPN NV Wienerberger AG Electrolux AB Aurubis AG Imperial Brands PLC SEGRO PLC Mancor SpA ABN Amro Bank NV Puma SE Terna Rete Elettrica Nazionale SpA Compass Group PLC ING Groep NV Rexel SA Pernod Ricard SA Next PLC Sartorius AG InterContinental Hotels Group PLC Qorsted A/S Teleperformance SE Tesco PLC Covestro AG Fabege AB Zalando SE	GEA Group AG Koninklijke KPN NV Logitech International SA Skanska AB Delivery Hero SE Symrise AG Antofagasta PLC Ipsen SA Storebrand ASA Kerry Group PLC Tele2 AB Rheinmetall AG Swedish Orphan Biovitrum AB (publ) Capgemini SE Adecco Group AG Spectris PLC Swiss Life Holding AG Trelleborg AB Next PLC Christian Dior SE thyssenkrupp AG Schneider Electric SE Biomerieux SA EssilorLuxottica SA Deutsche Lufthansa AG Rentokil Initial PLC Prismian SpA Akzo Nobel NV Valmet Oyj Esisity AB (publ) Edenred SE Wienerberger AG Recordati Industria Chimica e Farmaceutica SpA Pandora A/S Kuehne und Nagel International AG Galp Energia SGPS SA International Consolidated Airlines Group SA Alten SA Aeroports de Paris SA Novoniva SE H & M Hennes & Mauritz AB United Utilities Group PLC Swisscom AG DS Smith Ltd Credit Agricole SA Skandinaviska Enskilda Banken AB Engie SA Veolia Environnement SA Andritz AG Kingfisher PLC Givaudan SA Yara International ASA Vestas Wind Systems A/S Danske Bank A/S DKSH Holding AG Carlsberg A/S Gerresheimer AG Grifols SA Swisscom AG Randstad NV Orion Oyj BT Group PLC Elis SA Balfour Beatty PLC Neste Oyj Commerzbank AG Aena SME SA Equinor ASA Sartorius AG E.ON SE Deutsche Boerse AG Imperial Brands PLC Covestro AG L'Air Liquide Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges Claude SA Unilever SA Associated British Foods PLC Georg Fischer AG Leonardo SpA	Ferrovial SE Schroders PLC Aeroports de Paris SA DSV A/S Galenica AG Kesko Oyj AIB Group PLC Ipsen SA Swiss Life Holding AG Skanska AB Hikma Pharmaceuticals PLC WH Smith PLC Danske Bank A/S Grifols SA Schneider Electric SE Neste Oyj Britvic Ltd Taylor Wimpey PLC United Utilities Group PLC Swedbank AB London Stock Exchange Group PLC Adecco Group AG Next PLC EssilorLuxottica SA Julius Baer Gruppe AG Bouygues SA Getinge AB ING Groep NV Redeia Corporacion SA Swiss Re AG Unicore SA Groep Brussel Lambert NV Verbund AG NN Group NV L'Air Liquide Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges Claude SA Coloplast A/S Orion Oyj Pandora A/S SSE PLC Spie SA Tele2 AB International Consolidated Airlines Group SA ConvaTec Group PLC Banco Comercial Portugues SA Evotec SE Gerresheimer AG Johnson Matthey PLC Givaudan SA Valmet Oyj Randstad NV Prismian SpA ISS A/S Carlsberg A/S Aviva PLC Kingfisher PLC Subsea 7 SA Kleppner SA Edenred SE BT Group PLC ASML Holding NV Powszechny Zaklad Ubezpieczen SA Banco BPM SpA DKSH Holding AG Swisscom AG DS Smith Ltd Tesco PLC Carrefour SA Teleperformance SE thyssenkrupp AG Balfour Beatty PLC Legal & General Group PLC Equinor ASA Siemens Healthineers AG Akzo Nobel NV Covestro AG Deutsche Boerse AG Andritz AG Rolls-Royce Holdings PLC Holcim AG Assa Abloy AB Associated British Foods PLC Konecranes Abp Weir Group PLC Novozymes A/S Knorr Bremse AG Whitbread PLC Aurubis AG Eurofins Scientific SE L'Oréal SA SEGRO PLC ITV PLC Entain PLC	Hikma Pharmaceuticals PLC Mowi ASA Bank Polska Kasa Opieki SA Carlsberg A/S Deutsche Boerse AG Julius Baer Gruppe AG Antofagasta PLC DSV A/S Severn Trent PLC ING Groep NV L'Air Liquide Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges Claude SA Spie SA Bollere SE ISS A/S Ferrovial SE Balfour Beatty PLC Rentokil Initial PLC Biomerieux SA Equinor ASA Verbund AG Aena SME SA Symrise AG Experian PLC Prismian SpA EssilorLuxottica SA Danske Bank A/S Pandora A/S AIB Group PLC Taylor Wimpey PLC Kesko Oyj Orange SA United Utilities Group PLC Recordati Industria Chimica e Farmaceutica SpA DKSH Holding AG Aviva PLC Fortum Oyj Rolls-Royce Holdings PLC Kingspan Group PLC Givaudan SA Novozymes A/S Compass Group PLC Schneider Electric SE DS Smith Ltd Deutsche Lufthansa AG Konecranes Abp Weir Group PLC Continental AG Assa Abloy AB Unilever SA Associated British Foods PLC Symrise AG Gerresheimer AG Valeo SE Swedbank AB Britvic Ltd Orion Oyj Kleppner SA ConvaTec Group PLC Holcim AG Tele2 AB Barratt Redrow PLC Legal & General Group PLC Covestro AG WPP PLC HSBC Holdings PLC Commerzbank AG Carrefour SA Banco Comercial Portugues SA Powszechny Zaklad Ubezpieczen SA Swiss Life Holding AG J Sainsbury PLC Rheinmetall AG ASML Holding NV LVMH Moët Hennessy Louis Vuitton SE Barry Callebaut AG Prudential PLC Bankinter SA Arkema SA IMI PLC Akzo Nobel NV Siemens Healthineers AG NN Group NV Kering SA TUI AG Aurubis AG Edenred SE Hannover Rueck SE BT Group PLC Alfa Laval AB Teleperformance SE Poste Italiane SpA	Antofagasta PLC Hannover Rueck SE Gerresheimer AG Fortum Oyj Poste Italiane SpA WPP PLC E.ON SE Phoenix Group Holdings PLC Barratt Redrow PLC Intertek Group PLC DS Smith Ltd Subsea 7 SA Sopra Steria Group SA Fabege AB Biomerieux SA Swisscom AG Temenos AG Deutsche Lufthansa AG Grifols SA Deutsche Post AG Kering SA Investor AB Bank Polska Kasa Opieki SA Imperial Brands PLC Givaudan SA ACS Actividades de Construcción y Servicios SA Aviva PLC Next PLC International Consolidated Airlines Group SA Wartsila Oyj Abp Banco BPM SpA Bouygues SA ConvaTec Group PLC Spie SA Taylor Wimpey PLC SSE PLC Wienerberger AG Veolia Environnement SA Hikma Pharmaceuticals PLC Fresenius SE & Co KGaA Husqvarna AB Andritz AG Aena SME SA ASML Holding NV Prudential PLC AZA SpA Kingspan Group PLC Weir Group PLC Engie SA Swiss Life Holding AG ING Groep NV Tele2 AB Anheuser-Busch Inbev SA Bureau Veritas SA Givaudan SA Infineon Technologies AG Schneider Electric SE Erste Group Bank AG Compagnie Financiere Richemont SA Diageo PLC NN Group NV Kleppner SA Henkel AG & Co KGaA Orion Oyj Aegae SA Equinor ASA Cellnex Telecom SA Compass Group PLC Pennon Group PLC Commerzbank AG Orange SA Kesko Oyj Siemens Healthineers AG Powszechny Zaklad Ubezpieczen SA SEGRO PLC Logitech International SA Industria de Diseno Textil SA Sodexo SA Symrise AG Gemmab A/S Naturgy Energy Group SA TUI AG Castellum AB Man Group PLC Balfour Beatty PLC Rolls-Royce Holdings PLC H & M Hennes & Mauritz AB LEG Immobilien SE Aurubis AG Neste Oyj Akzo Nobel NV J Sainsbury PLC Randstad NV	Hannover Rueck SE Fresenius SE & Co KGaA ASM International NV Husqvarna AB Kingfisher PLC Rolls-Royce Holdings PLC Centrica PLC Ambu A/S Hikma Pharmaceuticals PLC Fortum Oyj Subsea 7 SA Randstad NV E.ON SE Coloplast A/S Man Group PLC Kone Oyj Barry Callebaut AG Erste Group Bank AG Telecom Italia SpA Britvic Ltd TUI AG Pandora A/S Banco BPM SpA Aviva PLC Givaudan SA Koninklijke Ahold Delhaize NV Sodexo SA Severn Trent PLC Weir Group PLC Deutsche Post AG Christian Dior SE Swedbank AB Zalando PLC Zalando SE Akzo Nobel NV Naturgy Energy Group SA Continental AG Viscofan SA Storebrand ASA Carlsberg A/S NN Group NV Logitech International SA Poste Italiane SpA Temenos AG Compass Group PLC ITV PLC Biomerieux SA Wienerberger AG SSE PLC British Land Company PLC Teleperformance SE Whitbread PLC Aurubis AG Mencor SpA Anheuser-Busch Inbev SA Novozymes A/S Veolia Environnement SA ASML Holding NV Kleppner SA London Stock Exchange Group PLC Wartsila Oyj Abp Imperial Brands PLC Atlas Copco AB Commerzbank AG Derwent London PLC Alfa Laval AB Neste Oyj Balfour Beatty PLC Sopra Steria Group SA Valeo SE Smurfit WestRock PLC Terna Rete Elettrica Nazionale SpA SKF AB ConvaTec Group PLC IMI PLC Engie SA Gemmab A/S Pennon Group PLC Kesko Oyj Orange SA Powszechny Zaklad Ubezpieczen SA Industria de Diseno Textil SA Aegae SA Henkel AG & Co KGaA Elis SA ACS Actividades de Construcción y Servicios SA Orion Oyj Tesco PLC Novo Nordisk A/S Symrise AG DS Smith Ltd Bouygues SA

Table 9.4: Constituents of portfolio 4 (fourth quintile)

2019	2020	2021	2022	2023	2024
Fresenius SE & Co KGaA Danske Bank A/S DS Smith Ltd BAE Systems PLC Vonovia SE Balfour Beatty PLC Orange SA International Consolidated Airlines Group SA Fortum Oyj Yara International ASA E.ON SE Galenica AG Deutsche Boerse AG Umicore SA Kingspan Group PLC Givaudan SA Qiagen NV CaixaBank SA Associated British Foods PLC Redeia Corporacion SA Lanxess AG Atlas Copco AB Lloyds Banking Group PLC Siemens Healthineers AG Deutsche Lufthansa AG Recordati Industria Chimica e Farmaceutica SpA Leonardo SpA Banco de Sabadell SA Aeroports de Paris SA ASML Holding NV Powszechny Zaklad Ubezpieczen SA Telia Company AB ISS A/S OMV AG Infineon Technologies AG Intesa Sanpaolo SpA Neste Oyj Koninklijke Ahold Delhaize NV Aviva PLC EssilorLuxottica SA Smurfit WestRock PLC Wartsila Oyj Abp Bankinter SA Barry Callebaut AG Weir Group PLC Accor SA H & M Hennes & Mauritz AB Georg Fischer AG L'Oreal SA SEB SA Clariant AG EDP SA Taylor Wimpey PLC Cofinimmo SA Valero SE Boliden AB Deutsche Telekom AG Novozymes A/S Holcim AG Naturgy Energy Group SA Novo Nordisk A/S ASR Nederland NV Kering SA Engie SA Getlink SE Vestas Wind Systems A/S Akzo Nobel NV Heidelberg Materials AG Continental AG Carrefour SA Land Securities Group PLC Swedbank AB Enagas SA Wendel SE Deutsche Post AG Husqvarna AB Fresenius Medical Care AG Sonova Holding AG Kingfisher PLC Deutsche Bank AG Uch SA Vodafone Group PLC Compagnie Generale des Etablissements Michelin SCA Stora Enso Oyj Arkema SA Sodexo SA Aberdeen Group PLC NatWest Group PLC Smith & Nephew PLC MTU Aero Engines AG Whitbread PLC Equinor ASA Compagnie de Saint Gobain SA	Qiagen NV Intesa Sanpaolo SpA Heidelberg Materials AG ISS A/S InterContinental Hotels Group PLC Rexel SA SEGRO PLC Telia Company AB BAE Systems PLC WPP PLC Infineon Technologies AG thyssenkrupp AG Eiffage SA Barry Callebaut AG Redeia Corporacion SA Henkel AG & Co KGaA ASR Nederland NV Eurofins Scientific SE Terna Rete Elettrica Nazionale SpA Kingspan Group PLC Clariant AG Banco de Sabadell SA Compass Group PLC Siemens Healthineers AG Kering SA Holcim AG Taylor Wimpey PLC Aurubis AG Fabergé AB Puma SE TUI AG Smith & Nephew PLC SEB SA Arkema SA Whitbread PLC Teleperformance SE Orange SA Marks and Spencer Group PLC Intesa Sanpaolo SpA OMV AG SKF AB LASM Holding NV Konecranes Abp Banco Comercial Portugues SA Swedbank AB L'Oreal SA NatWest Group PLC Fresenius SE & Co KGaA Enagas SA Zalando SE Fresenius Medical Care AG Carrefour SA Electrolux AB Lloyds Banking Group PLC Novozymes A/S Valero SE Husqvarna AB Naturgy Energy Group SA Industria de Diseno Textil SA Rolls-Royce Holdings PLC Covivio SA Lanxess AG Intertek Group PLC Puma SE Inmobiliaria Colonial SOCIMI SA Pearson PLC Boliden AB Getlink SE Bankinter SA Tesco PLC A2A SpA Moncler SpA Novo Nordisk A/S Accor SA Weir Group PLC ArcelorMittal SA Anglo American PLC Vodafone Group PLC SEB SA Smurfit WestRock PLC Eni SpA Land Securities Group PLC Continental AG Cofinimmo SA Telefonica SA Croda International PLC FincoBank Banca Finco SpA Stora Enso Oyj Uch SA Atlas Copco AB SGS SA Deutsche Telekom AG Wartsila Oyj Abp Powszechny Zaklad Ubezpieczen SA MTU Aero Engines AG	Bureau Veritas SA Kion Group AG Telefonica SA Poste Italiane SpA Continental AG Orange SA Fortum Oyj Alten SA Barry Callebaut AG Commerzbank AG Terna Rete Elettrica Nazionale SpA Novo Nordisk A/S Sartorius AG Recordati Industria Chimica e Farmaceutica SpA British Land Company PLC Rheinmetall AG Clariant AG Banco Bilbao Vizcaya Argentaria SA ASR Nederland NV Vestas Wind Systems A/S Aena SME SA Intertek Group PLC Sodexo SA Kering SA Valero SE Rexel SA Fabergé AB Puma SE TUI AG Smith & Nephew PLC SEB SA Moncler SpA Elis SA Koninklijke Ahold Delhaize NV Naturgy Energy Group SA Sika AG Henkel AG & Co KGaA Lanxess AG Telia Company AB Husqvarna AB Banco de Sabadell SA Croda International PLC Arkema SA ArcelorMittal SA Compass Group PLC A2A SpA Erste Group Bank AG Yara International ASA WPP PLC Infineon Technologies AG Accor SA SKF AB Iulgas SpA AXA SA Inmobiliaria Colonial SOCIMI SA Amadeus IT Group SA Delivery Hero SE Heidelberg Materials AG OMV AG Bankinter SA HSBC Holdings PLC Fresenius SE & Co KGaA Electrolux AB Enagas SA Industria de Diseno Textil SA Huhtamaki Oyj NatWest Group PLC Kingspan Group PLC Alfa Laval AB Renault SA Skandinaviska Enskilda Banken AB Airbus SE Castellum AB Getlink SE InterContinental Hotels Group PLC Georg Fischer AG Merck KGaA Eni SpA Covivio SA Anglo American PLC Land Securities Group PLC Fresenius Medical Care AG Zalando SE Barclays PLC Vinci SA Vodafone Group PLC Deutsche Bank AG Evonik Industries AG Smurfit WestRock PLC Lloyds Banking Group PLC Boliden AB	Sodexo SA Neste Oyj SSE PLC A2A SpA Phoenix Group Holdings PLC WH Smith PLC Redeia Corporacion SA Erste Group Bank AG Coloplast A/S Husqvarna AB Rexel SA Sopra Steria Group SA Henkel AG & Co KGaA Sika AG Whitbread PLC Skandinaviska Enskilda Banken AB Logitech International SA Deutsche Bank AG British Land Company PLC Naturgy Energy Group SA Genmab A/S Telefonica SA Qiagen NV Fresenius SE & Co KGaA Iulgas SpA Terna Rete Elettrica Nazionale SpA AXA SA Smith & Nephew PLC Wartsila Oyj Abp Alten SA SEGRO PLC ASR Nederland NV NatWest Group PLC Delivery Hero SE Clariant AG Yara International ASA Iberdrola SA Kerry Group PLC Vivendi SE Santander Bank Polska SA Elis SA Infineon Technologies AG Knorr Bremse AG Telia Company AB Enagas SA Bureau Veritas SA Evotec SE Valmet Oyj Accor SA Novo Nordisk A/S Sartorius AG Sandvik AB Accor SA Lloyds Banking Group PLC ArcelorMittal SA Burberry Group PLC Pearson PLC SKF AB Rio Tinto PLC Boliden AB Eurofins Scientific SE Volkswagen AG Heidelberg Materials AG Getinge AB Anglo American PLC International Distribution Services PLC UniCredit SpA L'Oreal SA Deutsche Post AG Uch SA Marks and Spencer Group PLC Epiroc AB Anheuser-Busch Inbev SA Fabergé AB Muenchener Rueckversicherungs-Gesellschaft in Muenchen AG Societe Generale SA Puma SE CaixaBank SA Smurfit WestRock PLC Entain PLC Eni SpA Moncler SpA Evonik Industries AG Sonova Holding AG Eni SpA InterContinental Hotels Group PLC Swiss Re AG Cofinimmo SA SEB SA Wendel SE Publicis Groupe SA TotalEnergies SE Lanxess AG Industria de Diseno Textil SA	Terna Rete Elettrica Nazionale SpA Legal & General Group PLC Holcim AG Burberry Group PLC LVMH Moet Hennessy Louis Vuitton SE DKSH Holding AG SKF AB Recordati Industria Chimica e Farmaceutica SpA Alfa Laval AB Teleperformance SE Whitbread PLC Essity AB (publ) Sandvik AB Prysmian SpA Anheuser-Busch Inbev SA Barry Callebaut AG IMI PLC Wendel SE Banco Comercial Portugues SA Iulgas SpA Edenred SE Novo Nordisk A/S Delivery Hero SE Atlas Copco AB Ferrovia SE Konecranes Abp AXA SA Evotec SE Santander Bank Polska SA Telecom Italia SpA Rentokil Initial PLC Coloplast A/S Anglo American PLC NatWest Group PLC Tesco PLC Elis SA Knorr Bremse AG Continental AG Arkema SA Telia Company AB Deutsche Bank AG Bankinter SA Eiffage SA Sika AG Carrefour SA Telefonica SA Land Securities Group PLC DSV A/S Clariant AG Accor SA Rexel SA Croda International PLC Eurofins Scientific SE Redeia Corporacion SA Pearson PLC Covestro AG SEB SA Umicore SA Publicis Groupe SA Boliden AB Rio Tinto PLC InterContinental Hotels Group PLC Swiss Re AG RELX PLC ArcelorMittal SA Smurfit WestRock PLC Vivendi SE Yara International ASA Moncler SpA GEA Group AG Heidelberg Materials AG Enagas SA Smith & Nephew PLC Siemens AG TotalEnergies SE Covivio SA OMV AG Inmobiliaria Colonial SOCIMI SA Entain PLC Volkswagen AG ASR Nederland NV FincoBank Banca Finco SpA WH Smith PLC Electrolux AB Vonovia SE MTU Aero Engines AG Valmet Oyj EDP SA Deutsche Telekom AG Getinge AB Airbus SE International Distribution Services PLC Stora Enso Oyj	Kering SA Phoenix Group Holdings PLC Infineon Technologies AG Rio Tinto PLC Carrefour SA Getinge AB Swedish Orphan Biovitrum AB (publ) Andritz AG DKSH Holding AG Burberry Group PLC J Sainsbury PLC Evotec SE Legal & General Group PLC Telefonica SA Entain PLC Holcim AG WH Smith PLC Santander Bank Polska SA IMI PLC DSV A/S Prysmian SpA Rexel SA Recordati Industria Chimica e Farmaceutica SpA Croda International PLC WPP PLC Informa PLC Delivery Hero SE Tele2 AB Umicore SA H & M Hennes & Mauritz AB Pearson PLC ArcelorMittal SA InterContinental Hotels Group PLC Clariant AG Anglo American PLC Arkema SA Telefoniebolaget LM Ericsson International Distribution Services PLC Banco Comercial Portugues SA Iulgas SpA Mowi ASA Bankinter SA Evonik Industries AG AXA SA Essity AB (publ) Telia Company AB Inmobiliaria Colonial SOCIMI SA Bureau Veritas SA ING Groep NV Wendel SE UniCredit SpA Heidelberg Materials AG Sika AG Sartorius AG Eurofins Scientific SE Cellnex Telecom SA Knorr Bremse AG Prudential PLC Redeia Corporacion SA EDP SA Boliden AB Deutsche Telekom AG Sandvik AB Orkla ASA Eiffage SA Land Securities Group PLC LVMH Moet Hennessy Louis Vuitton SE Konecranes Abp ASR Nederland NV Valmet Oyj Siemens AG Spie SA L'Air Liquide Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges Claude SA Deutsche Bank AG Rentokil Initial PLC Accor SA SEB SA Yara International ASA Uch SA Publicis Groupe SA Stora Enso Oyj Kerry Group PLC Castellum AB Lanxess AG Nokia Oyj FincoBank Banca Finco SpA Vodafone Group PLC Novartis AG Schneider Electric SE Volkswagen AG Swiss Re AG Stellantis NV Georg Fischer AG

Table 9.5: Constituents of portfolio 5 (fifth quintile)

2019	2020	2021	2022	2023	2024
Vivendi SE Marks and Spencer Group PLC Kleppierre SA Eiffage SA Anglo American PLC Aegon Ltd International Distribution Services PLC Reckitt Benckiser Group PLC ArcelorMittal SA Renault SA Volkswagen AG Muenchener Ruckversicherungs-Gesellschaft in Muenchen AG Orkla ASA Rio Tinto PLC Erste Group Bank AG Endesa SA Elekta AB (publ) Pearson PLC Siemens AG Bayerische Motoren Werke AG Eni SpA Castellum AB Industria de Diseno Textil SA Merck KGaA Repsol SA RELX PLC Telefonaktiebolaget LM Ericsson SGS SA Airbus SE Novartis AG Hochtief AG TUI AG Vinci SA Volvo AB TotalEnergies SE Publicis Groupe SA Iberdrola SA Santander Bank Polska SA Hugo Boss AG Telecom Italia SpA UPM-Kymmene Oyj Telefonica SA AXA SA Standard Chartered PLC Adidas AG Sandvik AB Societe Generale SA Danone SA Banco Bilbao Vizcaya Argentaria SA Evonik Industries AG Gecina SA Zurich Insurance Group AG Svenska Cellulosa Aktiebolaget SCA UniCredit SpA Signify NV HSBC Holdings PLC GSK plc Unibail-Rodamco-Westfield SE SA Koninklijke Philips NV Shell PLC British American Tobacco plc Alfa Laval AB Coca Cola HBC AG Legrand SA Sanofi SA Amadeus IT Group SA Enel SpA Norsk Hydro ASA BASF SE Bayer AG Geberit AG Banco Santander SA Barclays PLC Alstom SA Roche Holding AG BP PLC Nestle SA STMicroelectronics NV Glencore PLC Snam SpA Assicurazioni Generali SpA Nokia Oyj Diageo PLC Stellantis NV UBS Group AG Mondi PLC Abb Ltd Unilever PLC SAP SE Mercedes-Benz Group AG AstraZeneca PLC BNP Paribas SA Allianz SE	International Distribution Services PLC Publicis Groupe SA Danone SA Aberdeen Group PLC Amadeus IT Group SA Kleppierre SA Airbus SE Renault SA Vinci SA Rio Tinto PLC Aegon Ltd Reckitt Benckiser Group PLC RELX PLC Merck KGaA Banco Bilbao Vizcaya Argentaria SA Telecom Italia SpA Erste Group Bank AG Vivendi SE AXA SA Compagnie Generale des Etablissements Michelin SCA TUI AG HSBC Holdings PLC Telefonaktiebolaget LM Ericsson Endesa SA Smith & Nephew PLC Sonova Holding AG Hochtief AG Iberdrola SA TotalEnergies SE Siemens AG Societe Generale SA Castellum AB Wendel SE Muenchener Ruckversicherungs-Gesellschaft in Muenchen AG Svenska Cellulosa Aktiebolaget SCA Deutsche Bank AG Snam SpA Evonik Industries AG Novartis AG Standard Chartered PLC Hugo Boss AG Elekta AB (publ) Orkla ASA Deutsche Post AG Alfa Laval AB Gecina SA BP PLC Santander Bank Polska SA Alstom SA UniCredit SpA Volkswagen AG Standard Chartered PLC Elekta AB (publ) Compagnie de Saint Gobain SA Enel SpA Legrand SA Bayerische Motoren Werke AG CaixaBank SA UPM-Kymmene Oyj Shell PLC Sanofi SA BASF SE Mondi PLC Nestle SA Volvo AB Zurich Insurance Group AG BASF SE Adidas AG Unibail-Rodamco-Westfield SE SA Assicurazioni Generali SpA GSK plc British American Tobacco plc Unilever PLC UBS Group AG Stellantis NV Banco Santander SA Glencore PLC Signify NV Nokia Oyj Mercedes-Benz Group AG Roche Holding AG Allianz SE AstraZeneca PLC Abb Ltd STMicroelectronics NV BNP Paribas SA	Aberdeen Group PLC Repsol SA Atlas Copco AB Svenska Cellulosa Aktiebolaget SCA Eiffage SA Sonova Holding AG Societe Generale SA Iberdrola SA Deutsche Post AG Santander Bank Polska SA Publicis Groupe SA Wartsila Oyj Abp Wendel SE Bayerische Motoren Werke AG Ucb SA Compagnie de Saint Gobain SA Rio Tinto PLC Compagnie Generale des Etablissements Michelin SCA Vivendi SE Sandvik AB Jeronimo Martins SGPS SA TUI AG Storebrand ASA Telefonaktiebolaget LM Ericsson Cofinimmo SA Marks and Spencer Group PLC SGS SA Endesa SA Stora Enso Oyj Pearson PLC FincoBank Banca Finco SpA Qiagen NV Deutsche Telekom AG Vonovia SE Siemens AG CaixaBank SA Alstom SA Aegon Ltd Unicredit SpA MTU Aero Engines AG Telecom Italia SpA Novartis AG RELX PLC International Distribution Services PLC Novartis AG Gecina SA Hochtief AG Hugo Boss AG Norsk Hydro ASA Muenchener Ruckversicherungs-Gesellschaft in Muenchen AG Leonardo SpA BP PLC Volkswagen AG Standard Chartered PLC Diageo PLC Koninklijke Philips NV Unibail-Rodamco-Westfield SE SA Zurich Insurance Group AG Mondi PLC Legrand SA TotalEnergies SE Reckitt Benckiser Group PLC Stellantis NV Unilever PLC Sanofi SA UPM-Kymmene Oyj Glencore PLC Bayer AG Coca Cola HBC AG Assicurazioni Generali SpA Enel SpA UBS Group AG Geberit AG Adidas AG Snam SpA BASF SE Nokia Oyj Banco Santander SA Signify NV British American Tobacco plc Nestle SA Roche Holding AG Intesa Sanpaolo SpA Volvo AB Shell PLC Allianz SE Mercedes-Benz Group AG GSK plc SAP SE AstraZeneca PLC STMicroelectronics NV BNP Paribas SA	Covivio SA Diageo PLC Eiffage SA OMV AG Aberdeen Group PLC Banco de Sabadell SA Telefonaktiebolaget LM Ericsson Huhtamaki Oyj H & M Hennes & Mauritz AB Land Securities Group PLC Electrolux AB Koninklijke Philips NV Georg Fischer AG Atlas Copco AB Stora Enso Oyj Telecom Italia SpA Danone SA Siemens AG Nestle SA Vonovia SE Barclays PLC Vinci SA Fresenius Medical Care AG Deutsche Telekom AG Croda International PLC MTU Aero Engines AG Endesa SA Banco Bilbao Vizcaya Argentaria SA Getlink SE Gecina SA Mondi PLC Leonardo SpA Repsol SA Merck KGaA EDP SA Alstom SA Novartis AG Aegon Ltd RELX PLC Nokia Oyj Svenska Cellulosa Aktiebolaget SCA Jeronimo Martins SGPS SA Castellum AB Hugo Boss AG Elekta AB (publ) FincoBank Banca Finco SpA Aegon Ltd Standard Chartered PLC Renault SA Compagnie de Saint Gobain SA SGS SA Legrand SA Norsk Hydro ASA Compagnie Generale des Etablissements Michelin SCA Geberit AG Unibail-Rodamco-Westfield SE SA Glencore PLC Stellantis NV UBS Group AG Vodafone Group PLC Amadeus IT Group SA Coca Cola HBC AG BP PLC Unilever PLC Bayer AG Bayerische Motoren Werke AG Enel SpA Reckitt Benckiser Group PLC Orkla ASA Sanofi SA Signify NV Assicurazioni Generali SpA Allianz SE Snam SpA BASF SE Standard Chartered PLC Unilever PLC Abb Ltd Banco Bilbao Vizcaya Argentaria SA Banco Santander SA SAP SE AstraZeneca PLC Intesa Sanpaolo SpA BNP Paribas SA Roche Holding AG GSK plc	Leonardo SpA Sonova Holding AG Evonik Industries AG Kerry Group PLC Georg Fischer AG Telefonaktiebolaget LM Ericsson Hochtief AG L'Air Liquide Societe Anonyme pour l'Etude et l'Exploitation des Procédes Georges Claude SA Huhtamaki Oyj Societe Generale SA Nokia Oyj Lanxess AG Endesa SA Reckitt Benckiser Group PLC UniCredit SpA Jeronimo Martins SGPS SA L'Oreal SA Qiagen NV Mondi PLC Norsk Hydro ASA Sartorius AG Fresenius Medical Care AG Renault SA Storebrand ASA CaixaBank SA Puma SE Svenska Cellulosa Aktiebolaget SCA Orkla ASA Aberdeen Group PLC Koninklijke Philips NV Lloyds Banking Group PLC Merck KGaA Elekta AB (publ) Legrand SA Muenchener Ruckversicherungs-Gesellschaft in Muenchen AG Rheinmetall AG Vinci SA Amadeus IT Group SA Epiroc AB SGS SA Eni SpA Vodafone Group PLC Barclays PLC UBS Group AG Iberdrola SA Stellantis NV Getlink SE Zurich Insurance Group AG Geberit AG Nestle SA Novartis AG Gecina SA UPM-Kymmene Oyj Compagnie Generale des Etablissements Michelin SCA Signify NV Compagnie de Saint Gobain SA Danone SA Aegon Ltd Coca Cola HBC AG Repsol SA Hugo Boss AG Banco Santander SA Allianz SE Cofinimmo SA Enel SpA Alstom SA Glencore PLC Unibail-Rodamco-Westfield SE SA Volvo AB STMicroelectronics NV BASF SE Standard Chartered PLC Unilever PLC Abb Ltd Banco Bilbao Vizcaya Argentaria SA Roche Holding AG Bayerische Motoren Werke AG GSK plc Assicurazioni Generali SpA British American Tobacco plc Shell PLC Bayer AG Banco Bilbao Vizcaya Argentaria SA BNP Paribas SA Danone SA Intesa Sanpaolo SpA Snam SpA AstraZeneca PLC	Merck KGaA Smith & Nephew PLC Enagas SA Sonova Holding AG Muenchener Ruckversicherungs-Gesellschaft in Muenchen AG Kingspan Group PLC Huhtamaki Oyj Qiagen NV RELX PLC Renault SA NatWest Group PLC Airbus SE Siemens AG Getlink SE Svenska Cellulosa Aktiebolaget SCA Electrolux AB OMV AG Eni SpA L'Oreal SA TotalEnergies SE Societe Generale SA Reckitt Benckiser Group PLC Aberdeen Group PLC Rheinmetall AG Elekta AB (publ) Norsk Hydro ASA Ferrovial SE Jeronimo Martins SGPS SA Hochtief AG SGS SA Endesa SA Iberdrola SA GEA Group AG Zurich Insurance Group AG Covivio SA Barclays PLC Aegon Ltd Legrand SA Epiroc AB Koninklijke Philips NV Lloyds Banking Group PLC Vonovia SE UPM-Kymmene Oyj Sanofi SA Volvo AB BP PLC Fresenius Medical Care AG Banco Santander SA Roche Holding AG UBS Group AG SAP SE Leonardo SpA Vinci SA MTU Aero Engines AG Mondi PLC Compagnie Generale des Etablissements Michelin SCA Hugo Boss AG Repsol SA Signify NV Alstom SA Nestle SA Allianz SE BASF SE Compagnie de Saint Gobain SA Amadeus IT Group SA Glencore PLC Puma SE Enel SpA Gecina SA Cofinimmo SA CaixaBank SA British American Tobacco plc Unibail-Rodamco-Westfield SE SA GSK plc Banco de Sabadell SA Coca Cola HBC AG Abb Ltd Adidas AG Bayerische Motoren Werke AG STMicroelectronics NV Standard Chartered PLC Assicurazioni Generali SpA Shell PLC Mercedes-Benz Group AG Bayer AG Banco Bilbao Vizcaya Argentaria SA BNP Paribas SA Danone SA Intesa Sanpaolo SpA Snam SpA AstraZeneca PLC

Table 9.6: GICS Industry Names (in alphabetical order)

1. Aerospace & Defense	24. Electrical Equipment	47. Metals & Mining
2. Air Freight & Logistics	25. Electronic Equipment, Instruments & Components	48. Multi-Utilities
3. Automobiles	26. Energy Equipment & Services	49. Office REITs
4. Automobile Components	28. Financial Services	50. Oil, Gas & Consumable Fuels
5. Banks	29. Food Products	51. Paper & Forest Products
6. Beverages	30. Gas Utilities	52. Passenger Airlines
7. Biotechnology	31. Health Care Equipment & Supplies	53. Personal Care Products
8. Broadline Retail	32. Health Care Providers & Services	54. Pharmaceuticals
9. Building Products	33. Health Care REITs	55. Professional Services
10. Capital Markets	34. Hotels, Restaurants & Leisure	56. Real Estate Management & Development
11. Chemicals	35. Household Durables	57. Residential REITs
12. Commercial Services & Supplies	36. Household Products	58. Retail REITs
13. Communications Equipment	37. Independent Power and Renewable Electricity Producers	59. Semiconductors & Semiconductor Equipment
14. Construction & Engineering	38. Industrial Conglomerates	60. Software
16. Consumer finance	39. Industrial REITs	61. Specialty Retail
17. Consumer Staples Distribution & Retail	40. Insurance	62. Technology Hardware, Storage & Peripherals
18. Containers & Packaging	41. Interactive Media & Services	63. Textiles, Apparel & Luxury Goods
19. Distributors	42. IT Services	64. Tobacco
20. Diversified Consumer Services	43. Life Sciences Tools & Services	65. Trading Companies & Distributors
21. Diversified REITs	44. Machinery	66. Transportation Infrastructure
22. Diversified Telecommunication Services	45. Marine Transportation	67. Water Utilities
23. Electric Utilities	46. Media	68. Wireless Telecommunication Services

Table 9.7: Countries (in alphabetical order)

1. Austria	10. Netherlands
2. Belgium	11. Norway
3. Denmark	12. Poland
4. Finland	13. Portugal
5. France	14. Spain
6. Germany	15. Sweden
7. Ireland	16. Switzerland
8. Italy	17. United Kingdom
9. Luxembourg	