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"ESG and Portfolio Returns Across the EU: A Post-Crisis Analysis"

"ESG e Rendimenti di Portafoglio nell'UE: Un'Analisi Post-Crisi"

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As Molière once wisely said,

"It is not only for what we do that we are held responsible, but also for what we do not do."

Abstract

Over the past two decades, sustainability-focused investment strategies, particularly those that incorporate Environmental, Social, and Governance (ESG) criteria, have gained popularity. This thesis compares the performance of ESG-focused portfolios to Traditional portfolios across major European markets, focusing on periods of global crises.

The analysis examines a sample of the largest companies selected by market capitalization from France, Germany, Italy, the Netherlands, and Spain between 2018 to 2023, using data sourced from Refinitiv. Portfolios are constructed utilizing three strategies: Traditional, Best-in-Class, and Negative Screening, and they are evaluated throughout different time periods, including the pre-COVID-19 era, the COVID-19 pandemic, and the Russia-Ukraine conflict. Key performance indicators such as return, risk, and the Sharpe ratio (SR) are employed to evaluate portfolio outcomes.

The results reveal that Traditional portfolios generally outperformed the ESG strategies, with some notable exceptions. For example, the Best-in-Class approach in Germany excelled during the COVID-19 period, whereas the Negative Screening strategy delivered stronger results in France and Spain over the course of the Ukraine conflict. Nonetheless, ESG portfolios struggled to consistently outperform Traditional strategies over the entire period. Despite these findings, constraints on diversification – particularly in Negative Screening portfolios – limit the ability to produce strong performance of ESG strategies.

While ESG strategies can achieve competitive performance under specific conditions, Traditional portfolios generally provide more consistent and reliable results. The study acknowledges limitations, such as reliance on Refinitiv as the sole ESG data provider, limited data availability for 2023, and the focus on large-cap companies in developed markets. This research highlights the need for standardized ESG metrics to improve transparency and consistency in sustainable investing. Although ESG portfolios demonstrated resilience in certain crises, their inconsistent performance underscores the necessity for further refinement in ESG reporting and integration practices.

Negli ultimi due decenni, le strategie di investimento incentrate sulla sostenibilità, in particolare quelle che incorporano criteri ESG, hanno guadagnato popolarità. Questa tesi confronta la *performance* dei portafogli incentrati sui criteri ESG con quella dei portafogli tradizionali nei principali mercati europei, concentrandosi sui periodi di crisi globale.

La ricerca analizza un campione delle maggiori società selezionate per capitalizzazione di mercato in Francia, Germania, Italia, Paesi Bassi e Spagna tra il 2018 e il 2023, utilizzando i dati di Refinitiv. I portafogli sono costruiti utilizzando tre strategie: Tradizionale, Best-in-Class e Negative Screening, e sono valutati in diversi periodi temporali, tra cui l'era pre-COVID-19, la pandemia COVID-19 e il conflitto Russia-Ucraina. Per valutare i risultati del portafoglio vengono utilizzati indicatori di performance chiave come il rendimento, il rischio e lo SR.

I risultati rivelano che i portafogli Tradizionali hanno generalmente sovraperformato le strategie ESG, con alcune eccezioni di rilievo. Ad esempio, l'approccio Best-in-Class in Germania ha primeggiato per tutto il periodo COVID-19 mentre la strategia Negative Screening ha ottenuto risultati migliori in Francia e Spagna durante il conflitto in Ucraina. Ciononostante, i portafogli ESG hanno faticato a sovraperformare in modo consistente le strategie tradizionali durante l'intero periodo. Al di là di questi risultati, i vincoli di diversificazione - in particolare nei portafogli con screening negativo - limitano la capacità di produrre forti prestazioni delle strategie ESG.

Sebbene le strategie ESG possano ottenere performance competitive in condizioni specifiche, i portafogli tradizionali forniscono generalmente risultati più coerenti e affidabili. Lo studio riconosce i limiti, come la dipendenza da Refinitiv quale unico fornitore di dati ESG, la disponibilità limitata di dati per il 2023 e la particolare attenzione sulle società a grande capitalizzazione nei mercati sviluppati. Questa ricerca evidenzia la necessità di metriche ESG standardizzate per migliorare la trasparenza e la coerenza negli investimenti sostenibili. Sebbene i portafogli ESG abbiano dimostrato resilienza in talune crisi, la loro *performance* incoerente sottolinea la necessità di perfezionare ulteriormente le pratiche di rendicontazione e integrazione ESG.

Keywords: COVID-19, crises, diversification, ESG, performance, portfolio, return, risk, Russia-Ukraine conflict, Sharpe ratio, sustainability

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III. Abbreviations

AEX	Amsterdam Exchange Index
APT	Arbitrage Pricing Theory
CAC 40	Cotation Assistée en Continu 40
CAPM	Capital Asset Pricing Model
CML	Capital Market Line
CSR	Corporate Social Responsibility
DAX	Deutscher Aktienindex/ German Stock Index
DEI	Diversity, Equity and Inclusion
DJIA	Down Jones Industrial Average
EC	European Commission
e.g.	exempli gratia
ESG	Environmental, Social, Governance
et al.	et alii
ETF	Exchange-traded Funds
EU	European Union
FTSE MIB	Financial Times Stock Exchange Milano Indice di Borsa
GRI	Global Reporting Initiative
IBEX 35	Índice Bursátil Español 35
IFRS	International Financial Reporting Standards
ISO	International Organization for Standardization
ISSB	International Sustainability Standards Board
KLD	Kinder, Lydenberg, Domini & Co.
NGOs	Non-Governmental Organizations
MDG	Millennium Development Goals
MPT	Modern Portfolio Theory
MSCI	Morgan Stanley Capital International
MVO	Mean-Variance Optimization
PRI	Principles for Responsible Investing
SDG	Sustainable Development Goals
SIM	Single Index Model

SML	Security Market Line
S&P 500	Standard & Poor 500
SR	Sharpe Ratio
SSF	Swiss Sustainable Finance
TBL	Triple Bottom Line
TCFD	Task Force on Climate-Related Financial Disclosure
TPT	Traditional Portfolio Theory
UN	United Nations
WBCSD	World Business Council for Sustainable Development

1. Introduction

In recent years, the global financial landscape has undergone significant transformation, driven by an increasing focus on sustainability and responsible investments. Integrating ESG factors into investment decisions, has evolved from a niche concept to a mainstream approach. This shift indicates a growing recognition of the need to align financial practices with broader societal and environmental goals (Ballate, 2018; Li, Feng, Pan & Sohail, 2022; Teti, Dallocchio & L'Erario, 2023). Investors today are not only concerned with short-term financial returns but also with the long-term impact of their investments on both society and the environment (Billio, Costola, Hristova, Latino & Pelizzon, 2015; Ballate, 2018). As the adage goes, ***"Money is power, and it is crucial not to abuse that power at the expense of future generations,"*** underscoring the ethical imperative that guides the current movement towards more sustainable financial practices (Ballate, 2018).

Despite this progress, a fundamental inconsistency persists within the financial industry: The tension between short-term investment decisions and the long-term interests of future generations. This contradiction has become increasingly apparent as global regulatory frameworks, such as the Paris Agreement and the 2030 Agenda, demand more sustainable approaches from companies and investors alike. Sustainable investment is not merely a trend advocated by millennial investors; it is a necessary discipline that must be fully integrated into the financial system in order to reflect the real economy, address global challenges, and meet societal needs (Ballate, 2018).

The significance of ESG factors in investment decisions cannot be overstated. These factors are vital indicators of a company's long-term viability, risk management, and overall sustainability. Although ESG metrics can be complex, they are indispensable for assessing a company’s long-term performance (Li et al., 2022). Consequently, leading rating agencies focus on developing indicators that accurately capture a company’s social and environmental responsibilities, while academic research is increasingly exploring the influence of ESG factors on corporate outcomes (Li, Ba, Ma, Xu, Huang & Huang, 2023). As the sustainable finance industry continues to expand, the emergence of stricter standards and enhanced transparency is anticipated, enabling investment advisors to make well-informed decisions with greater confidence (Ballate, 2018). Sustainable investing, akin to traditional investing, necessitates thorough due diligence, access to reliable financial data, and the use of credible ESG providers that offer

comprehensive insights (Ballate, 2018). This trend underscores the growing recognition that sustainable investing not only enhances portfolio performance and risk reduction, but also contributes to long-term value creation (Li et al., 2022). As ESG considerations increasingly impact profitability and financial viability, they have become essential tools for navigating the complexities of modern financial markets (Muck & Schmidl, 2024).

However, significant challenges remain in fully integrating ESG principles into the global financial system, despite the substantial growth in sustainable finance. Research indicates that while the industry has made considerable progress, there is still a long way to go to achieve the dual objectives of generating profit and creating positive environmental and social outcomes (Ballate, 2018). The financial crisis serves as a stark reminder of the risks associated with short-termism and the need for a more sustainable approach to finance (Billio et al., 2015). This urgency was dramatically underscored in early 2020, when the COVID-19 pandemic triggered a market-wide financial crisis with consequences more severe than those of the Great Depression in 1929-1933 and the global financial crisis in 2007-2008. These events exposed the global economy's vulnerability and reinforced the critical need for resilient, sustainable investment strategies. The pandemic, as well as other global disruptions like the Russia-Ukraine conflict, have underlined the essential role of sustainable investing practices in risk management and ensuring the long-term stability of financial markets (Billio et al., 2015; Ballate, 2018; Li et al., 2022).

On top of that, the financial sector's changing role in addressing broader societal issues such as climate change, social inequality, and the widening salary gap, has sparked ongoing debates regarding the sector's responsibilities and impact (Friede, Busch & Bassen, 2015). The growing awareness of ESG responsibilities reflects a fundamental shift in how social actors, including corporations, investors, and policymakers, perceive their roles in contributing to a more sustainable and equitable future. This shift is evident in the growing importance attached to ESG ratings and reports, which are now widely used by investors, managers, and other stakeholders to evaluate and measure corporate performance in terms of social and environmental responsibility (Billio et al., 2015; Li et al., 2023; Muck & Schmidl, 2024).

The objective of this thesis is to analyze the recent evolution of ESG factors and their integration into investment strategies, particularly in contrast to traditional portfolio theory. The analysis will begin with a review of traditional investment strategy, followed by the

development and evaluation of two sustainable investment strategies based on ESG-focused indices from Refinitiv.

The empirical study will then examine whether these Sustainable strategies can achieve financial success. Additionally, the study will explore the behavior of these strategies over time, comparing them to Traditional strategies across three distinct sub-periods.

The central research question investigates whether integrating ESG factors into investment strategies can yield positive economic returns, reduce risk, and contribute to environmental and social well-being. The research seeks to demonstrate the dual benefits of sustainable investing – both financial and social – offering a competitive advantage within the financial industry (Ballate, 2018). Furthermore, the study will assess the impact of ESG performance on stock prices during financial market crises, such as those caused by the COVID-19 pandemic and the Russia-Ukraine conflict, to highlight the resilience of ESG-based strategies in volatile markets.

This thesis contributes to the ongoing discussion and academic research on sustainable investing by exploring the efficacy of integrating ESG factors into Traditional portfolio theory (TPT). By managing different investment strategies, the study provides insights into the synergy between financial performance and sustainability, encompassing both economic and non-financial outcomes. Additionally, the study will analyze the role of diversification in sustainable investing compared to a traditional approach.

The thesis is structured as follows: It begins with an in-depth examination of the theoretical framework, focusing on both traditional and sustainable finance. The analysis draws on existing academic literature to establish the foundational concepts and key findings, laying the groundwork for the entire study.

Central to this research is the formulation of critical research questions that will guide the analytical and computational processes. These questions are designed to address the complexities and challenges associated with integrating sustainability into investment strategies and to assess the impact of these strategies under varying economic conditions.

The methodology chapter outlines the data collection process, the creation of the dataset for the portfolio analysis, and the presentation of the developed investment strategies. It also details the data preparation and portfolio construction processes that underpin the subsequent calculation methodologies.

Next, the empirical results are discussed, focusing on the performance of various investment strategies, including an analysis of their effectiveness during periods of economic crises. The impact of the crises is analyzed to assess how it has influenced the overall performance of sustainable strategies. This analysis sets the stage for answering the research questions.

Finally, the thesis concludes with a discussion of the findings and limitations, summarizing the key insights gained. The conclusion offers suggestions for future research and emphasizes the ongoing importance of sustainable finance in a rapidly changing global financial environment.

2. Theoretical Background and Related Literature

This chapter begins by outlining the theoretical foundations of existing financial frameworks, providing a comprehensive overview of the key concepts and models that underpin traditional investment strategies and portfolio analysis. These fundamental theories are crucial for understanding the mechanisms of conventional financial practices and their implications for portfolio management.

Subsequently, the focus shifts to sustainable finance, delving into its core principles and growing significance within the financial sector. This section critically examines how sustainable finance integrates with traditional models, drawing on existing literature and studies to provide a well-rounded perspective. The findings from these studies are contextualized within the scope of this thesis, ensuring relevance and alignment with the research objectives.

Finally, this chapter establishes the theoretical groundwork necessary for the calculation methodology discussed later in the thesis. It provides the essential framework for effectively addressing the research questions, linking theoretical insights to the practical analysis that follows.

2.1. Traditional Finance

The first section of this chapter provides a thorough overview of portfolio selection theory, covering key concepts such as risk, return, and portfolio optimization. It begins with an analysis of the Markowitz Model, which introduces the principles of diversification and the efficient frontier, followed by a discussion of the Capital Asset Pricing Model (CAPM), which integrates systematic risk into expected returns. The section also examines the Single Index Model (SIM), which simplifies portfolio selection by attributing variance in stock returns to a single market index.

The Multi-Index Model is not covered in this thesis, since it lies beyond the scope of this research, which focuses on the fundamental models that underpin traditional portfolio theory.

In addition, this section evaluates traditional investment strategies, particularly focusing on risk-adjusted performance measures like the SR. It also outlines the key methodologies for

calculating traditional financial indices, setting the stage for the analysis that follows in subsequent chapters.

2.1.1. Portfolio Theory: Selection Criteria and Traditional Investment Strategies

Before exploring the various aspects of portfolio theory essential for constructing an efficient portfolio, it is important to first recognize some key assumptions and critical criteria that are fundamental to the theory and crucial for understanding investor behavior.

2.1.1.1. Investors Preferences and Risk Attitudes

Investors generally rely on a set of fundamental assumptions that guide their decision-making process. The initial assumption states that investors are non-satiable, indicating their continues preference for assets that offer higher returns. This aligns with the notion that larger returns are always favored, as more is considered better in terms of investment gains. The second assumption is that investors exhibit risk aversion, indicating a preference for investments characterized by lower levels of uncertainty and volatility. Their risk aversion is seen in their preference for assets with stable attributes, such as known maturities, reliable issuers, and established market conditions. Together, these assumptions collectively establish the foundation for the majority of investor models, which prioritize maximizing returns while minimizing risk (Elton, Gruber, Brown & Goetzmann, 2014).

When faced with two investments that have the same expected return but vary in terms of risk, risk-averse investors would typically choose the option with lower risk. They would only consider a riskier investment if it provides a sufficiently higher return, referred to as the risk premium, which serves as compensation for the added risk. Moreover, it is assumed that investors act rationally, guided by their utility functions, and have complete access to information regarding market changes. Additionally, markets are presumed to function efficiently and without frictions, free of any hindrances such as taxes, transaction fees, or market segmentation. This ensures that prices accurately and comprehensively reflect all available information (Elton et al., 2014).

Given the wide range of asset options and combinations, investment decision-making is highly complex. Investors are faced with an overwhelming array of choices, and while their decisions are primarily based on evaluating the expected rate of return and investment risk, they

rarely focus solely on these factors. Instead, they prioritize the likely outcomes that are most relevant to their goals. Financial advisors frequently help with this process by presenting these options in the form of probability distributions or highlighting the expected payoffs for different alternatives. Finally, these decisions are based on publicly available information on expected returns and risk levels, allowing investors to carefully weigh both factors when selecting assets (Elton et al., 2014; Czerwińska & Kaźmierkiewicz, 2015).

This process is further refined by investor preferences. A key principle is that investors prefer more to less wealth and certainty over risk when expected values are equal. These preferences are represented by utility functions, as shown in Figure 4, which model the trade-offs between risk and return, incorporating a coefficient of risk aversion, that reflects individual tolerance levels (Elton et al., 2014).

Investors risk attitudes vary: Risk-averse individuals avoid fair gambles, risk-neutral investors remain indifferent, and risk-seeking individuals actively pursue higher risks (Bodie, Kane & Marcus, 2011; Elton et al., 2014). Risk-averse investors typically penalize expected returns to account for higher risk, favoring portfolios with positive risk premiums and lower levels of volatility. This strategy results in increased utility scores for safer portfolios. Conversely, less risk-averse investors may accept greater risk for potentially higher returns. The trade-off between risk and return is represented by indifference curves, as illustrated in Figure 5, which depicts the combinations of risk and return that yield equal satisfaction.

Ultimately, investors assess individual asset risks in relation to overall portfolio variability, aligning their choices with their risk tolerance. Highly risk-averse investors tend to allocate a larger portion of their portfolio to risk-free assets, whereas those with lower risk aversion favor riskier assets to maximize returns. These risk preferences directly influence portfolio allocations, and the trade-offs investors are willing to accept between risk and return, shaping their overall investment strategies. (Bodie, Kane & Marcus, 2011; Escobar-Anel & Jiao, 2024).

Building on these fundamental assumptions and criteria, the following section will delve into portfolio analysis, examining the practical application of these theoretical concepts in the construction and evaluation of investment portfolios.

2.1.1.2. Portfolio Analysis and Optimization: Risky and Risk-less Assets

Portfolio theory is a fundamental concept in the field of finance, which emphasizes the importance of selecting financial instruments based on both their individual characteristics and the relationships between them. Those relationships, specifically their direction and strength, play a crucial role in determining portfolio performance (Ertugrul, 2024).

As defined in the academic literature, portfolio management refers to the construction of well-diversified investment portfolios (Ertugrul, 2024). A portfolio, in financial terms, is an investment basket of various securities, though it is also defined more broadly in the literature as a collection of assets, including both real assets (e.g., a car, house) and financial assets (e.g., stocks, bonds) (Elton et al., 2014; Ertugrul, 2024). In today's world, nearly everyone owns a portfolio of assets, underlining the relevance of effective portfolio management (Elton et al., 2014).

Portfolio theory can be divided into two main perspectives: TPT and Modern Portfolio Theory (MPT). TPT emphasizes diversifying assets to minimize risk but lacks quantitative methods, relying instead on subjective judgment. Its limitations became evident due to the lack of mathematical analysis, leading to the development of MPT (Bodie, Kane & Marcus, 2011; Ertugrul, 2024).

The shift to MPT is largely attributed to Harry Markowitz, whose 1952 article *'Portfolio Selection'* published in the Journal of Finance, revolutionized investment strategy (Markowitz, 1952). Markowitz introduced the mean-variance theorem, which addresses the limitations of traditional models by applying mathematical methods to optimize portfolio performance. His model defines optimal portfolios as those that maximize returns while minimizing risk, considering both individual asset returns and their correlations. The theory offers an explanation for the optimal investment choice of investors, under the assumption of rational choices and risk aversion, as previously explained in section 2.1.1.1. This marked a significant departure from traditional models that merely diversified assets without detailed analysis of their relationships (Lean, Ang & Smyth, 2015; Roncalli, 2022; Ertugrul, 2024).

Central to Markowitz's approach is the introduction of the efficient frontier – a curve that visualizes optimal risk-return combinations for different portfolios. Portfolios on this frontier are either those that achieve the maximum return for a given level of risk or those that

minimize risk for a given level of return (Bodie, Kane & Marcus, 2011; Elton et al., 2014; Roncalli, 2022).

Markowitz's work, which earned him the Nobel Prize in 1990, revolutionized the non-linear optimization problem of portfolio selection into a quadratic one using the mean-variance utility function, as defined in financial theory. The definition of MPT focuses on using statistical methods to quantitatively evaluate portfolios, where risk is calculated as variance and return as expected value (Ertugrul, 2024).

The literature defines MPT as a framework that maximizes expected returns while minimizing risk through diversification. Markowitz's model, known as Mean-Variance Optimization (MVO), continues to serve as a foundational approach within finance (Elton et al., 2014: Roncalli, 2022; Ertugrul, 2024). Before further examining this model, it is necessary to briefly review essential concepts that underpin the theory.

The general components of the portfolio process include (Bodie, Kane & Marcus, 2011; Elton et al., 2014):

- μ_P: the (expected) return of the portfolio
- σ_P^2: the risk of the portfolio

The return r of an asset is formally defined as the relative change in its value within a certain time period.[1] Let P_0 represent the stock price at the beginning of the period, whereas P_1 represent the price of the stock at the end of the period.

The stock's return is computed using the following formula:

$$r = \frac{P_1 - P_0}{P_0} \qquad \text{(Eq. 1)}$$

Equation 1 quantifies the return by expressing it as a percentage change in the price of the stock throughout the specified period.

[1] r is commonly used to denote the return for a single period or a specific time interval, such as daily or monthly returns. In certain cases, r is used to denote continuous returns.

In a portfolio composed of multiple assets, the actual return is determined by considering the weight w of each asset. The actual return of the portfolio R_P is calculated as follows:

$$R_P = w_1 \cdot R_1 + w_2 \cdot R_2 + \cdots + w_n \cdot R_n \quad \text{(Eq. 2)}$$

Hence, the actual return of a portfolio is the sum of the weighted returns of its assets. Each asset's return is multiplied by its respective weight within the portfolio, reflecting its contribution to the overall performance.

In contrast, the expected return of a security refers to the profit or loss anticipated by the investor based on historical returns. The expected return is computed by multiplying each possible outcome by its probability and then summing these products:

$$Expected\ Return = \sum_{i=1}^{n} (P_i \cdot R_i) \quad \text{(Eq. 3)}$$

where P_i represents the probability of outcome i and R_i denotes the corresponding return.

This distinction underlines the difference between actual portfolio performance and forecasted performance derived from probabilistic models, emphasizing the importance of both metrics in the process of making investment decisions.

Given the sum of the asset weights $\sum_{i=1}^{n} w_i = 1$, the expected return of a portfolio can be expressed in a linear combination of the expected returns of the individual assets:

$$\mu_p = E(\sum_{i=1}^{n} w_i \cdot R_i) \quad \text{(Eq. 4)}$$

where μ_P represents the expected portfolio return, w_i denotes the weight of each asset, and R_i is the expected return of asset i.

When $w_i \geq 0$ for all assets, μ_p can be interpreted as a weighted average of the expected returns of the assets within the portfolio.

Risk is a central concept in portfolio management, as it encompasses the uncertainty associated with future returns. In this context, risk refers to the fact that investors face a distribution of possible outcomes rather than a single predictable return for any given asset (Bodie, Kane & Marcus, 2011; Elton et al., 2014; Czerwińska & Kaźmierkiewicz, 2015). Markowitz revolutionized the financial theory by defining risk in terms of variance, a measure that quantifies the dispersion of an asset's possible returns around its expected return (Elton et al., 2014).

The variance of an asset's return (σ_i^2) is mathematically represented as follows:

$$\sigma_i^2 = Var(R_i) = \frac{1}{N}\sum_{k=1}^{N}(R_{i,k} - \mu_i)^2 \quad \text{(Eq. 5)}$$

where $R_{i,k}$ represents the individual returns of asset i, μ_i is the mean return, and N is the number of observations (Elton et al., 2014). In practice, variance is often represented by the standard deviation (σ), which is simply the square root of the variance (Bodie, Kane & Marcus, 2011).

$$\sigma_i = \sqrt{Var(R_i)} = \sqrt{\sigma_i^2} \quad \text{(Eq. 6)}$$

The standard deviation is crucial for understanding the volatility of an asset's returns; higher values indicate greater volatility and thus higher risk (Bodie, Kane & Marcus, 2011; Elton et al., 2014; Dorfleitner, Halbritter & Nguyen, 2015; Liu, Nemoto & Lu, 2023).

Markowitz's portfolio theory underlines that a portfolio's risk is more complex than the sum of its components risks. Considering uncertainties, a commonly used measure for portfolio risk is the variance, representing the dispersion of outcomes from the mean (Bodie, Kane & Marcus, 2011). The formula for the portfolio variance is more intricate than that of returns, with two primary parts. The first part involves the sum of the variances of the individual asset returns, weighted by the squared proportions of each asset in the portfolio. The second part represents the covariance, captured through a double summation of the products of asset weights and covariances:

$$\sigma_p^2 = \sum_{i=1}^{N} w_i^2\,\sigma_i^2 + \sum_{i=1}^{N}\sum_{j=1, j\neq i}^{N} w_i\,w_j Cov(R_i, R_j) \quad \text{(Eq. 7)}$$

When considering two risky assets, the variance of the portfolio is determined by summing the weighted variances of the two assets, along with the weighted covariance between them:

$$\sigma_p^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2Cov(R_1, R_2) \quad \text{(Eq. 8)}$$

where w_1 and w_2 are the portfolios weights of the two assets, σ_1^2 and σ_2^2 are their variances, and $Cov(R_1, R_2)$ is the covariance of their returns. This underscores the significance of the covariance in assessing the overall portfolio risk, since it measures the directional link between the returns of two assets (Bodie, Kane & Marcus, 2011; Elton et al., 2014; Ertugrul, 2024).

The covariance is defined as follows:

$$Cov(R_i, R_j) = E\big[(R_i - \mu_i) \cdot (R_j - \mu_j)\big] \quad \text{(Eq. 9)}$$

where μ_i and μ_j are the mean returns of assets i and j, respectively. The covariance has key properties, such as $Cov(i,j) = Cov(j,i)\ and\ Cov(i,i) = Var(i)$. The significance of the covariance lies in its ability to indicate the level of diversification within a portfolio. By utilizing historical data, the covariance, variance and standard deviation may be systematically arranged into a matrix of variance and covariance (Eq. 10). This matrix serves as a crucial instrument for effectively controlling portfolio risk in a portfolio consisting of n assets:

$$\Sigma = \begin{pmatrix} \sigma_{11} & \sigma_{12} & \cdots & \sigma_{1n} \\ \sigma_{21} & \sigma_{22} & \cdots & \sigma_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{n1} & \sigma_{n2} & \cdots & \sigma_{nn} \end{pmatrix} \quad \text{(Eq. 10)}$$

where $\sigma_{ij} = Cov(R_i, R_j) = E\left[(R_i - \mu_i) \cdot (R_j - \mu_j)\right]$

In numerous cases, the covariance is standardized using the correlation coefficient (ρ_{ij}), which is formally defined as the covariance between two assets divided by the product of their standard deviations:

$$\rho_{ij} = \frac{Cov(R_i, R_j)}{\sigma_i\sigma_j} \quad \text{(Eq. 11)}$$

The correlation coefficient (ρ_{ij}) ranges between -1 and 1, with the value indicating the degree to which the returns of the two assets move together, as shown in Figure 1. Depending on the value of ρ_{ij}, three situations may arise:

- $\rho_{ij} = 1$: Perfect positive correlation, where returns move in the same direction.
- $\rho_{ij} = -1$: Perfect negative correlation, where returns move in opposite directions.
- $\rho_{ij} = 0$: No correlation, meaning the returns are unrelated.

The correlation between assets directly affects the overall variance of the portfolio. When assets are perfectly positively correlated, there is no diversification benefit due to the mirroring effect of changes in one asset on the other. Conversely, lower or negative correlations enhance diversification. When $\rho_{ij} = -1$, the portfolio's risk is minimized (Bodie, Kane & Marcus, 2011; Ertugrul, 2024).

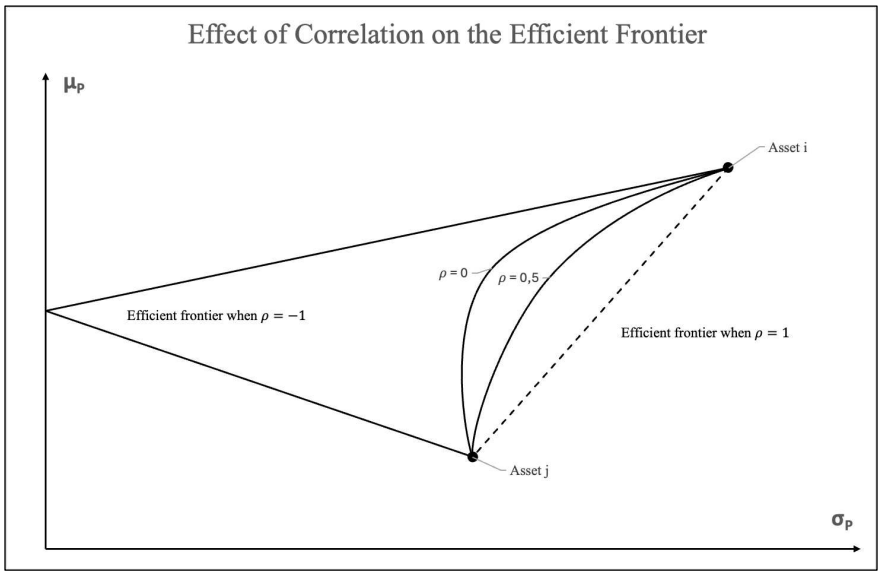

Figure 1: Effect of Correlation on the Efficient Frontier

Correlation plays a significant role in portfolio diversification, with the purpose of including assets with low or negative correlations to reduce the overall portfolio risk. This concept is central to the Markowitz MVO Model, developed by Harry Markowitz in 1952 and based on the risk-return criterion (Markowitz, 1952). According to this criterion, portfolios are optimized by maximizing expected return for a given level of risk or minimizing risk for a given level of expected return (Ertugrul, 2024).

The optimal portfolio is typically selected based on the so-called risk-return tradeoff, where assets with higher expected returns ($\mu_A > \mu_B$) and ($\sigma_A < \sigma_B$) lower risk are preferred. This theory, commonly referred to as Markowitz's MVO Model, is the basis of modern portfolio theory (Markowitz, 1952).

The effectiveness of diversification is highlighted in cases where the correlation coefficient is (ρ_{ij}) less than 1. When $\rho_{ij} < 1$, the portfolio's standard deviation is lower than the weighted average of the standard deviations of the individual assets, illustrating the positive impact of diversification on portfolio risk (Bodie, Kane & Marcus, 2011). The portfolio variance (Eq. 7), when expressed in terms of the correlation coefficient, becomes:

$$\sigma_p^2 = \sum_{i=1}^{N} w_i^2 \sigma_i^2 + \sum_{i=1}^{N} \sum_{j=1, j \neq i}^{N} w_i \, w_j \rho_{ij} \sigma_i \sigma_j \qquad \text{(Eq. 12)}$$

The principle of diversification, stated by the saying ***"Don't put all your eggs in one basket,"*** predates modern finance theory (Bodie, Kane & Marcus, 2011). In 1952, Markowitz formalized this principle in his model of portfolio selection. The diversification reduces risk by combining assets that respond differently to the same economic event, although it cannot completely eliminate risk. The specific choice of assets in a portfolio depends on diversification strategies that consider not just individual asset variances but also covariances and correlations among assets (Markowitz, 1952; Elton et al., 2014).

Furthermore, international diversification can improve portfolio performance by leveraging low correlations between markets. The correlations between international markets are generally lower than those within a single country, resulting in additional risk-reduction benefits (Elton et al., 2014). By including international assets into a portfolio, investors can increase diversification while lowering the overall volatility. In particular, when $\rho_{ij} < 1$, the portfolio standard deviation is less than the weighted average of the standard deviations of the underlying assets, which underscores the diversification effect.

However, even with diversification, Markowitz argues that risk cannot be completely eliminated (Markowitz, 1952). Only non-systematic or firm specific risk can be minimized through careful asset selection and diversification. Yet, systemic risk, driven by broad market factors, remains inevitable.

The optimal portfolio typically consists of a risk-free asset and a diversified portfolio of risky assets. Tobin shows that among all optimized portfolios, one portfolio dominates when a risk-free asset is available, leading to the concept of the tangency portfolio (Roncalli, 2022). This is consistent with the assumption that investors are generally risk-averse and require a positive risk premium to justify holding risky assets over risk-free alternatives (Bodie, Kane & Marcus, 2011). The standard deviation of such a portfolio depends on the proportion invested in the risky asset and reflects the volatility introduced by that component:

$$\sigma_p = w\sigma_{risky} \quad \text{(Eq. 13)}$$

where w is the proportion invested in the risky asset and σ_{risky} is its standard deviation (Bodie, Kane & Marcus, 2011).

Effective risk management in portfolio theory necessitates a thorough understanding of the relationships between variance, standard deviation, covariance, and correlation. By strategically combining assets with favorable covariance and correlation characteristics, investors can achieve the optimal balance between risk minimization and return maximization. This reinforces the relevance of diversification as a crucial strategy in the management of portfolio risk, emphasizing its essential importance within the framework of MPT (Bodie, Kane & Marcus, 2011).

The MVO framework plays a crucial role in establishing the optimal allocation of assets that maximizes expected return while maintaining a given level of risk (Markowitz, 1952). As depicted earlier, the initial step is the selection of securities that are intended to be part of the portfolio. Subsequently, the mean return (μ_i) and variance (σ_i^2) are computed for each asset (Elton et al., 2014). These inputs serve as the basis for solving the MVO problem, which seeks to determine the best possible portfolio based on investor's risk preferences (Markowitz, 1952; Elton et. al., 2014).

The optimization problem can mathematically be expressed as follows:

$$Minimize: \sigma_p^2 = \sum_{i=1}^{n} \sum_{i=j}^{n} w_i w_j \sigma_{ij} \quad \text{(Eq. 14)}$$

subject to:

$$\sum_{i=1}^{n} w_i = 1 \quad \text{(Eq. 15)}$$

Here, w_i represents the weight of asset i in the portfolio. In cases where short-selling is not allowed, an additional constraint is imposed to ensure that all asset weights are non-negative ($w_i \geq 0 \forall i$) (Elton et al., 2014). The primary objective is to maximize the portfolio's expected return (μ_p) while minimizing its associated risk (σ_p^2).

The first significant step in this process is to locate the efficient frontier, a concept first proposed by Markowitz in 1956. The efficient frontier represents the set of portfolios that provide the highest expected return for a given level of risk (Elton et al., 2024). Mathematically, the efficient frontier is derived by optimizing portfolio weights across varying risk levels.

$$\mu_p = \sum_{i=1}^{n} w_i \mu_i = \mu \quad \text{(Eq. 16)}$$

Graphically, the efficient frontier appears as a curve in the risk-return space, as shown in Figure 2, where the x-axis represents the risk (standard deviation), and the y-axis represents the expected return. The curve depicts the trade-off between risk and return, offering a visual representation of all possible portfolios. Portfolios that lie below the frontier are inefficient (Portfolio B), as they offer lower returns for the same level of risk, while those above the frontier are efficient (Portfolio A) (Elton et al., 2014).

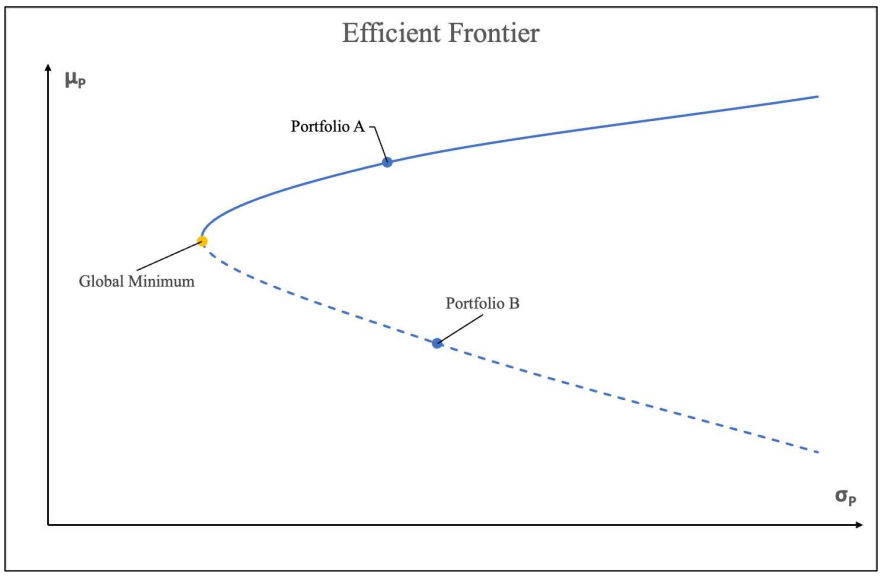

Figure 2: Efficient Frontier

The efficient frontier is concave, reflecting the risk-return trade-off inherent in portfolio construction (Elton et al., 2014). Among the portfolios on this curve, the global minimum variance portfolio stands out since it represents the portfolio with the lowest possible risk. Positioned at the leftmost point of the frontier, it is especially appealing to highly risk-averse investors (Elton et al., 2014).

The formula used to calculate the weights of this portfolio is as follows:

$$w_i = \frac{\sigma_j^2 - \sigma_{ij}}{\sigma_i^2 + \sigma_j^2 - 2\sigma_{ij}} \qquad \text{(Eq. 17)}$$

$$w_j = 1 - w_i \qquad \text{(Eq. 18)}$$

Asset weights within a portfolio can be either positive or negative, depending on the preference of an investor. A positive weight indicates a long position, in which an investor purchases an asset with the anticipation of benefiting from an increase in its value over time. Conversely, a negative weight represents a short position, where an investor sells an asset that they do not own, essentially borrowing it to sell it immediately with the intention of repurchasing it later at a lower price. Short selling is a key tool in portfolio management, allowing investors to capitalize on anticipated price declines (Elton et al., 2014). Allowing short selling effectively removes the non-negativity constraint on asset weights, enabling the construction of portfolios

with higher expected returns, which simultaneously also increases the risk. This modification broadens the efficient frontier, creating new opportunities for investors willing to take on additional risk (Bodie, Kane & Marcus, 2011).

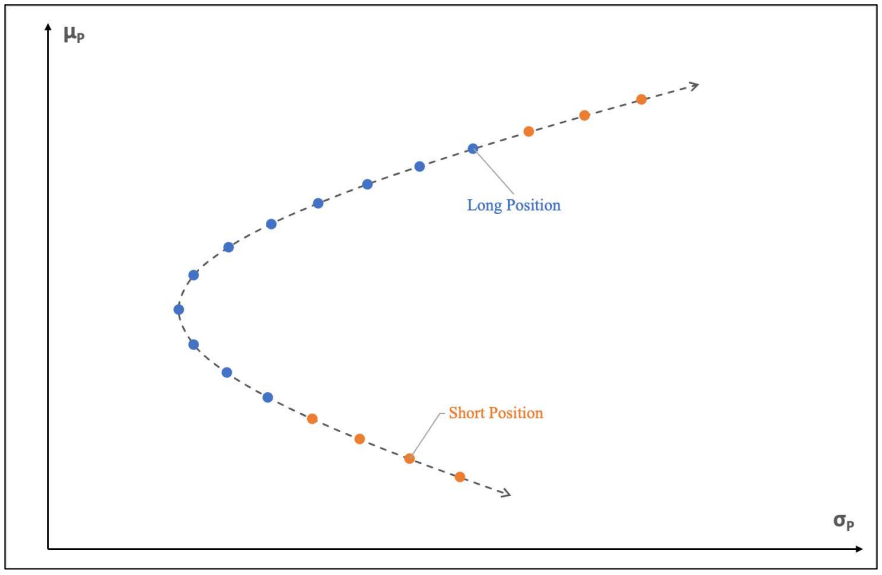

Figure 3: Efficient Frontier when Short-Selling is allowed

As illustrated in the Figure 3, the introduction of short-selling extends the efficient frontier beyond the traditional curve, thereby enabling the construction of portfolios with higher expected returns compared to those possible under a long-only constraint. This enhanced flexibility, however, comes with additional complexities, such as borrowing costs and the potential for substantial losses if market movements diverge from investor expectations. The figure further emphasizes that, in the absence of short-selling, the most efficient portfolios at the upper end and the least efficient ones at the lower end of the curve would be constrained or completely excluded (Bodie, Kane & Marcus, 2011).

Nonetheless, integrating short positions involves rigorous risk management due to the related complexities, which must be carefully considered (Bodie, Kane & Marcus, 2011).

While the efficient frontier provides a set of optimal portfolios, the actual selection of a portfolio depends on the investor's individual risk-return preferences. These preferences are captured by the utility function, which quantifies the trade-off between risk and return based on the investor's risk aversion (Elton et al., 2014). Utility functions are often represented graphically as indifference curves in the risk-return space, as illustrated in the next two Figures (Bodie, Kane & Marcus, 2011). Each indifference curve shows combinations of risk and return

that yield the same level of satisfaction to the investor. Higher curves indicate higher utility levels, and rational investors strive for the highest curve possible (Bodie, Kane & Marcus, 2011; Elton et al., 2014).

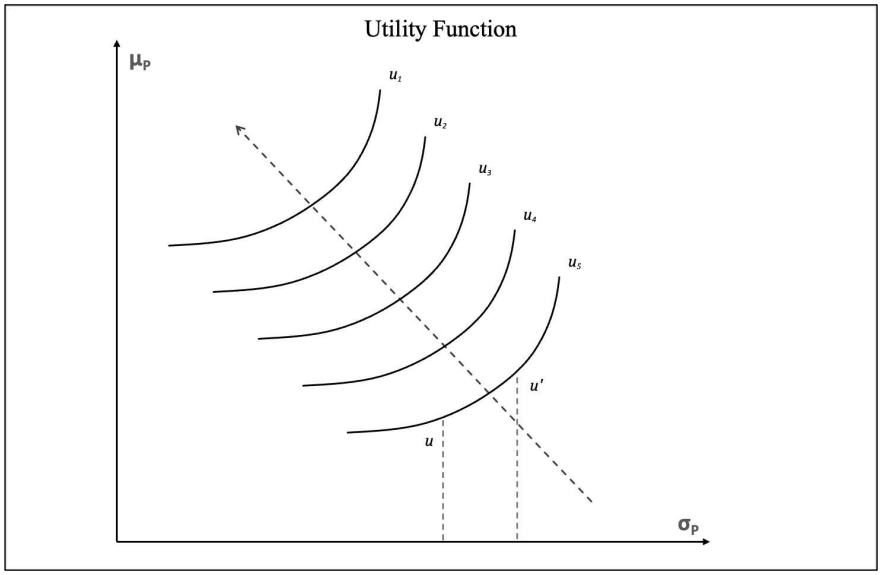

Figure 4: Utility Function

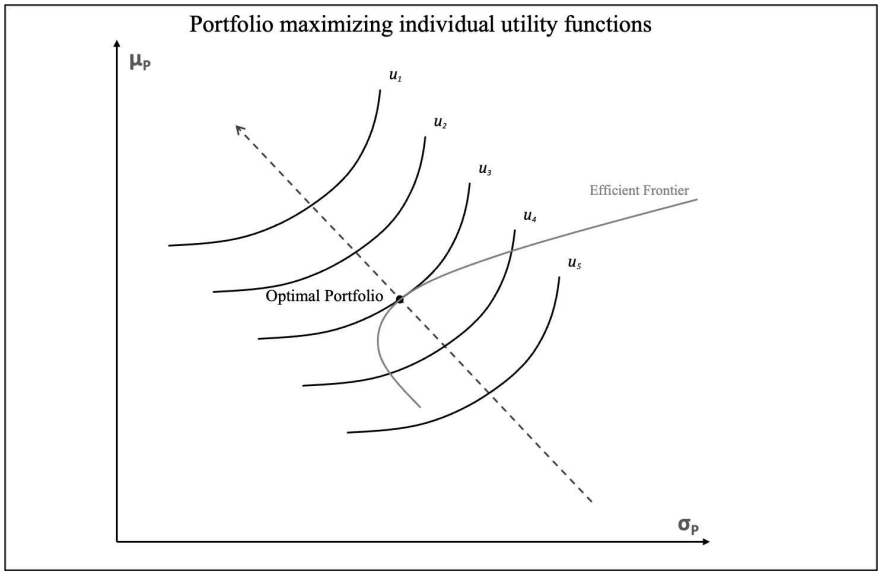

Figure 5: Portfolio maximizing individual utility function

The optimal portfolio, as shown in Figure 5, is found at the point of tangency between the highest attainable indifference curve and the efficient frontier (Elton et al., 2014).

Mathematically, the utility function $U(\mu_p, \sigma_p)$ can be expressed as follows:

$$U = \mu_p - \frac{1}{2} A \sigma_p^2 \quad \text{(Eq. 19)}$$

where A is the investor's risk aversion coefficient.

The point of tangency corresponds to the portfolio that offers the best balance of risk and return given to the investor's preferences (Bodie, Kane & Marcus, 2011).

When risk-free assets, such as Treasury Bills, are introduced into the analysis, the efficient frontier takes on a different shape (Bodie, Kane & Marcus, 2011). Instead of a curve, the frontier becomes a straight line, known as the Capital Market Line (CML), as depicted in Figure 6 (Bodie, Kane & Marcus, 2011). The CML extends from the risk-free rate on the y-axis and is tangent to the original efficient frontier at a specific portfolio known as the market portfolio M (Bodie, Kane & Marcus, 2011). The market portfolio M is composed of the optimal portfolio of all available risky assets that should be held by all investors (Bodie, Kane & Marcus, 2011).

According to Tobin's separation principle, the investment decision is split into two parts: First, identifying the optimal risky portfolio M, and second, determining the appropriate mix of M and the risk-free asset based on the investor's risk tolerance. Portfolios to the left of M on the CML combine risky and risk-free assets, catering to more conservative investors. In contrast, portfolios to the right involve borrowing at the risk-free rate to invest more heavily in risky assets, suitable for more aggressive investors. This dual approach illustrates how portfolio selection and asset allocation are managed separately, following the separation property (Bodie, Kane & Marcus, 2011).

The expected return of any portfolio on the CML can be calculated as follows:

$$\mu_p = \mu_f + \frac{\sigma_p}{\sigma_M} (\mu_M - \mu_f) \quad \text{(Eq. 20)}$$

where μ_f is the risk-free rate, μ_M is the return on the market portfolio, and σ_M is the standard deviation of the market portfolio (Elton et al., 2014).

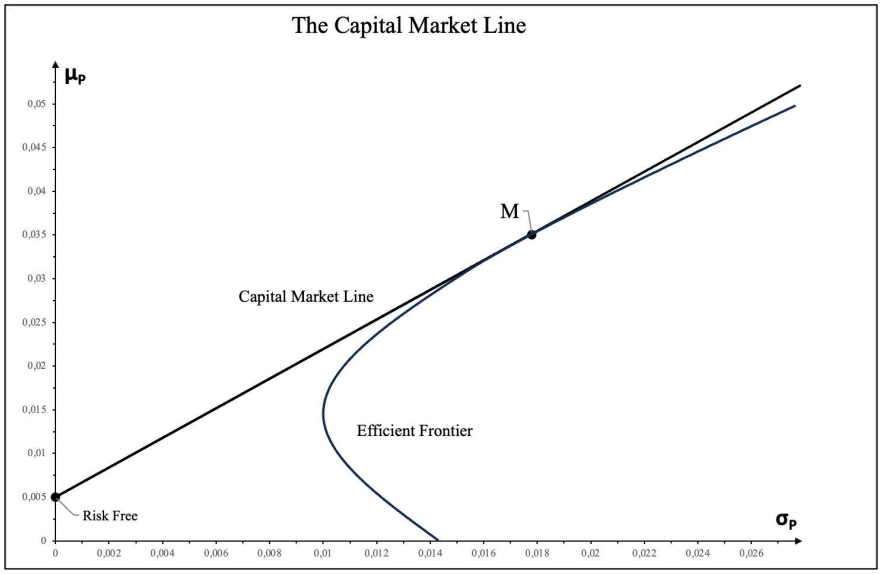

Figure 6: The CML

Additionally, when short-selling is allowed, the efficient frontier expands, removing the upper and lower bounds that would otherwise limit the possible portfolios (Bodie, Kane & Marcus, 2011). This flexibility allows for the construction of portfolios that can achieve higher returns, albeit with increased risk (Elton et al., 2014). The expanded efficient frontier consequently provides a broader range of investment opportunities, that benefits a variety of investor profiles with different levels of risk tolerance.

Incorporating short-positions enables investors to explore strategies with the potential to increase returns, but at the expense of taking on higher levels of risk. Understanding the impact of both long and short positions is crucial for optimizing portfolios under varying market conditions and individual risk preferences.

Overall, the MVO framework, combined with the efficient frontier and utility functions, offers a comprehensive approach for the strategic selection of optimal portfolios. By considering an investor's risk preferences and market conditions, these tools facilitate the systematic construction and evaluation of portfolios, ensuring alignment with the investor's financial objectives and risk tolerance.

Performance Measures

As portfolio management strategies become increasingly sophisticated, the use of reliable performance measures becomes critical for accurately analyzing their effectiveness (Bodie, Kane & Marcus, 2011). Metrics like the SR, Treynor Ratio, and Jensen's Alpha provide an advanced assessment of risk-adjusted returns, allowing theoretically optimized portfolios to be empirically evaluated and benchmarked against performance standards.

In this setting, systematic evaluation of portfolio performance emerges as an essential component of portfolio management. Given the interdependence of risk and return in the portfolio analysis, an effective evaluation must carefully balance these two variables. A straightforward initial approach involves comparing a portfolio's returns against a relevant benchmark with similar risk characteristics, typically represented by a market index or a collection of comparable funds. While this direct comparison offers basic insights, it is often insufficient for capturing the full complexity of performance evaluation. As a result, more sophisticated performance measures have emerged that combine both risk and return into a single metric, allowing for a more comprehensive assessment through risk-adjusted performance measures (Elton et al., 2014).

One of the foundational performance measures is the SR, also known as the excess return to variability measure (Elton et al., 2014). Introduced by William Sharpe, it was among the first metrics used in portfolio evaluation. It remains especially relevant for investors selecting mutual funds where a significant amount of their capital is allocated (Bodie, Kane & Marcus, 2011; Elton et al., 2014).

The SR is defined as follows (Pedersen, Fitzgibbons & Pomorski, 2021):

$$Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p} \qquad \text{(Eq. 21)}$$

where R_p is the portfolio return, R_f is the risk-free rate, and σ_p is the standard deviation of the portfolio's excess returns. A higher SR indicates a more favorable trade-off between risk and return, making the portfolio more attractive (Ertugrul, 2024).

The SR is not only important for measuring portfolio efficiency in terms of risk-adjusted returns, but also represents the slope of the capital allocation line in mean-variance analysis. This graphical interpretation further emphasizes that a higher SR reflects a more efficient portfolio (Bodie, Kane & Marcus, 2011; Elton et al., 2014).

One of the key strengths of the SR is its applicability to evaluating entire portfolios rather than individual components (Bodie, Kane & Marcus, 2011). However, it is not without limitations: The SR can be intentionally increased, as many performance measures can be manipulated using information-less trading strategies that do not necessarily reflect superior information or investment expertise (Elton et al., 2014). This issue emphasizes the significance of cautious interpretation when relying entirely on this measure.

Other performance measures, unlike the SR, focus on different risk dimensions. For example, the Treynor Ratio adjusts for systematic risk, measured by beta, and is more appropriate when evaluating a single manager within a broader investment strategy (Ertugrul, 2024).

The Treynor Ratio is determined as follows:

$$Treynor\ Ratio\ = \frac{R_p - R_f}{\beta_p} \qquad \text{(Eq. 22)}$$

where β_p represents the portfolio's beta, a measure of systematic risk.

Jensen's Alpha, another widely recognized metric, measures the portfolio's excess return relative to what is predicted by the CAPM, considering the portfolio's beta and the market's average return (Bodie, Kane & Marcus, 2011; Dai, 2022).

Jensen's Alpha is defined as follows:

$$\alpha_p = R_p - \left[R_f + \beta_p \cdot (R_m - R_f)\right] \qquad \text{(Eq. 23)}$$

where α_p is Jensen's Alpha and R_m is the market return.

A positive alpha suggests overperformance, while a negative alpha indicates underperformance (Lean, Ang & Smyth, 2015). As previously stated, the value of alpha assesses the

attractiveness of stocks. Specifically, if $\alpha < 0$, the portfolio underperforms; if $\alpha = 0$, the portfolio is priced fairly; and if $\alpha > 0$, the portfolio overperforms, indicating potential mispricing and offering investors a positive extra return since the realized return exceeds predictions. While Jensen's Alpha is useful for evaluating portfolio performance, it is insufficient to comprehensively rank portfolios because it does not account for residual risk, a critical factor in portfolio evaluation. This limitation contrasts with the SR, which considers the overall portfolio efficiency (Bodie, Kane & Marcus, 2011).

Jensen's Alpha provides valuable insights by directly comparing a portfolio's realized return to its expected return as predicted by the CAPM. This measure is particularly useful for assessing a manager's skill, as it shows whether returns above the market's expectations are achieved (Lean, Ang & Smyth, 2015; Dai, 2022). Despite its utility, Jensen's Alpha has limitations: It focuses exclusively on systematic risk and does not consider residual risk, which can be crucial for a holistic portfolio evaluation.

Sharpe also introduced the Index Model, which offers insights into portfolio diversification and risk reduction. This model is instrumental in understanding how different risk-adjusted performance measures apply in specific scenarios. For instance, the SR is best suited for evaluating the overall performance of an investment fund, but the Treynor Ratio or Jensen's Alpha are more appropriate for assessing sub-portfolios within a larger fund. These distinctions are particularly important in actively managed portfolios, where fluctuating means and variances complicate performance evaluation. For example, attempting to time the market might result in fluctuating betas, which obscure a manager's actual performance (Bodie, Kane & Marcus, 2011).

Risk-adjusted performance measures are essential tools for portfolio evaluation and ranking based on their risk-return profiles. While the SR remains a widely recognized metric, other measures like the Jensen's Alpha and Information Ratio provide complementary insights. The Information Ratio, for example, compares a portfolio's excess return against a benchmark while considering tracking error volatility, offering a nuanced perspective on performance relative to a benchmark (Bodie, Kane & Marcus, 2011).

The Information Ratio is expressed as follows:

$$Information\ Ratio = \frac{\alpha}{Tracking\ Error} \quad \text{(Eq. 24)}$$

where α is the portfolio's alpha and the tracking error is the standard deviation of the portfolio's excess returns relative to the benchmark.

In closing, while the SR remains a fundamental tool in performance evaluation, a comprehensive understanding of the context and limitations of other risk-adjusted performance measures, such as Jensen's Alpha, is essential for accurately assessing portfolio efficiency and managerial expertise.

2.1.1.3. Critical Challenges and Issues in Portfolio Management

As previously stated, Markowitz's MPT is an integral concept in finance, introducing a systematic framework for understanding the trade-off between risk and return while serving as the foundation for diversification strategies (Markowitz, 1952). Despite its long-term significance, the model has limits since it is based on simplified assumptions that frequently fail to capture the complexity of real-world financial markets. These constraints highlight the need for more advanced techniques, such as SIM, to solve these deficiencies (Curtis, 2004; Bodie, Kane & Marcus, 2011; Elton et al, 2014). Beyond that, the growing incorporation of sustainability and ESG factors into investment strategies emphasizes the significance of models that go beyond traditional risk-return optimization (Billio et al., 2015; Ballate, 2018; Li et al., 2022; Muck & Schmidl, 2024).

While Markowitz's model was influential in shaping the portfolio theory, its practical application raises several key concerns. One noteworthy difficulty is over-diversification**,** which occurs when an excessive number of assets dilutes potential returns while providing minimal additional risk reduction. Real-world factors like transaction costs and taxes complicate matters even more, as the model fails to account for them adequately.

In addition, the model is built on assumptions about market efficiency and rational investor behavior that, while theoretically sound, do not reflect actual market dynamics. Behavioral biases, herd behavior, and market anomalies frequently drive financial markets in ways that deviate from the purely rational decision-making assumed in MPT. Moreover, the

assumption of unrestricted access to information is rarely true, as information asymmetries and insider knowledge influence market outcomes (Curtis, 2004).

The model's depiction of the relationship between risk and return also faces limitations. Empirical evidence reveals that low-volatility portfolios can sometimes outperform high-volatility ones, contradicting MPT's expectations. Crucially, the model's focus on standard deviation – as a measure of risk – ignores significant systematic risks, such as global crises, which cannot be diversified away. The COVID-19 pandemic, for example, demonstrates how unexpected systematic shocks can have a significant impact even on well-diversified portfolios (Broadstock, Chan, Cheng & Wang, 2021; Díaz, Esparcia & López, 2022; Li et al., 2022).

MPT is also highly input-sensitive, relying heavily on estimates of returns, variances, and covariances derived from historical data, which may not reliably predict future market conditions. This single-period approach also ignores the dynamic, multi-period decision-making, which is critical in real-world investing. The assumption of a linear risk-return relationship further restricts the model, as real markets often exhibit non-linear dynamics, particularly under stress (Curtis, 2004; Bodie, Kane & Marcus, 2011).

Another practical difficulty is the computational complexity associated with MPT. Constructing optimal portfolios needs frequent recalculations of correlations, efficient frontiers, and asset weights, which can be time-consuming and impracticable, especially in volatile markets (Bodie, Kane & Marcus, 2011). In addition to that, the focus on maximizing risk-adjusted returns (e.g., the SR) as the sole objective overlooks other important investor considerations, such as liquidity demands, ethical criteria, and ESG aspects, all of which are becoming increasingly relevant in today's investment environment (Roncalli, 2022).

In the light of these restrictions, a shift toward more adaptable models is critical. SIM simplify analysis by focusing on systematic risk factors, such as market indices, while reducing the computational burden (Elton et al., 2014). They also provide better alignment with the increased emphasis on ESG criteria, enabling for more comprehensive portfolio management that reflects modern sustainability considerations.

Recent events, like the COVID-19 pandemic and the war in Ukraine have highlighted the limitations of traditional models for dealing with unforeseen systematic shocks. These crises demonstrate that relying exclusively on historical data and traditional risk measures is

inadequate in today's complex and turbulent markets (Pederson, Fitzgibbons & Pomorski, 2021; Broadstock et al., 2021; Li et al., 2022; Díaz, Esparcia & López, 2022; Kick & Rottmann, 2022).

To sum up, while MPT remains a useful theoretical foundation, changing market conditions and the growing relevance of sustainability necessitate models that can account for both financial and non-financial factors. SIM represent a natural progression, offering a more practical and integrated framework for addressing the challenges of modern investment strategies (Curtis, 2004; Elton et al., 2014).

2.1.2. Single Index Models and Risk Analysis

The SIM establishes a fundamental and efficient framework for portfolio analysis by simplifying the relationship between an asset's returns and the overall market movements. The core premise of SIMs is that the returns of individual securities are mostly determined by a single factor – typically a market index. By focusing exclusively on market risk as the primary source of covariance among securities, SIMs significantly reduce the complexity associated with estimating the covariance structure. As noted by Elton et al. (2014), this decrease in complexity is beneficial since it allows portfolio managers to focus on the most relevant component – market behavior – while ignoring other impacts, such as industry-specific risks.

In this model, the return R_i of a security i is represented as follows:

$$R_i = \alpha_i + \beta_i R_m + e_i \qquad \text{(Eq. 25)}$$

where α_i represents the security's alpha, capturing returns that are independent of market movements, β_i denotes the security's sensitivity to market returns (market beta), R_m is the return of the market index and e_i is the error term, accounting for idiosyncratic or firm-specific risk.

Although this model sacrifices some accuracy by eliminating non-market influences, it remains a very useful tool in situations where simplicity and operational efficiency are paramount. The reduction in the number of variables makes SIMs particularly advantageous in environments where swift and effective risk assessments are necessary. Despite its limitations, SIMs strike a balance between simplicity and the amount of precision required in portfolio management by focusing on the most important element driving asset returns – the market risk (Elton et al., 2014).

2.1.2.1. Theoretical Foundations of Capital Market Models

Market Equilibrium and the CAPM

Market equilibrium is a central concept in the capital market theory, providing the groundwork for understanding how prices are set in financial markets. In an equilibrium state, asset prices reflect all available information while balancing supply and demand. Sharpe (1964), Lintner (1965), and Mossin (1966) independently developed the CAPM which extends this notion by establishing a linear relationship between systematic risk and expected returns. It builds on the theoretical foundation of market equilibrium by asserting that, in a perfectly competitive market with no frictions, the tangency portfolio – the optimal combination of risky assets – coincides with the market portfolio. This alignment is crucial because it demonstrates the efficiency of markets in pricing risk (Elton et al., 2014; Roncalli, 2022).

According to the CAPM, the expected return $E(R_i)$ of a security is determined as follows:

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f) \qquad \text{(Eq. 26)}$$

where R_f is the risk-free rate, β_i is the beta of the security and $E(R_m)$ is the expected market return.

Roncalli (2022) highlights the profound significance of the CAPM in understanding how markets price assets under the assumptions of market efficiency and rational investor behavior. He further explains that the CAPM is particularly effective for analyzing alpha generation when real-world variables like transaction costs, leverage constraints, or other market frictions – cause deviations from the model's ideal assumptions. These discrepancies help to clarify why certain assets may consistently outperform or underperform the CAPMs predictions.

The CAPM: Structure and Application

The CAPM provides a method for estimating the expected return of assets based on their beta, which measures the asset's sensitivity to market movements. This relationship is based on numerous key assumptions, including perfect competition, no transaction costs or taxes, and rational investors acting within a frictionless market (Bodie, Kane & Marcus, 2011).

The CAPM posits that investors are rational mean-variance optimizers who share homogeneous expectations and consider only a single investment horizon (Bodie, Kane & Marcus, 2011). Despite its simplified assumptions, the CAPM is still extensively used because it provides a straightforward benchmark for asset pricing and portfolio performance evaluation. At its core, the CAPM suggests that in an efficient market, investors can obtain optimal portfolios by holding a combination of the risk-free asset and the market portfolio, thereby positioning themselves along the CML.

The two-fund theorem, a foundational principle underlying the CAPM, states that all investors may construct their optimal portfolio with only two funds: A risk-free asset and a risky market portfolio. Adjusting the balance of these two assets allows investors to align their portfolios with their specific risk preferences, ensuring they are positioned along the efficient frontier represented by the CML. Roncalli (2022) further highlights that all portfolios lying on the CML share the same SR, implying that they are efficient regardless of the specific level of risk taken on by the investor.

Underlying Assumptions and Extensions of the CAPM

As previously mentioned, the CAPM is based on several key assumptions (Bodie, Kane & Marcus, 2011). These conditions allow the model to predict a linear relationship between systematic risk and expected return, with beta serving as the central measure.

However, empirical research reveals limitations in this traditional framework. For instance, Ross (1976) developed the Arbitrage Pricing Theory (APT), which accounts for multiple risk factors beyond market risk. Furthermore, multi-factor models, such as the Fama-French three-factor model, further expand on the CAPM by considering size and value factors, addressing some of the original model's shortcomings (Bodie, Kane & Marcus, 2011).

The Fama-French model extends on the CAPM equation as follows:

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f) + s_i \cdot SMB + h_i \cdot HML \qquad \text{(Eq. 27)}$$

where s_i represents the sensitivity to the size factor (SMB: small minus big), and h_i represents the sensitivity to the value factor (HML: high minus low).

While these extended models provide more in-depth insights into asset pricing, they also increase complexity (Bodie, Kane & Marcus, 2011; Elton et al., 2014). Therefore, this thesis focuses primarily on the traditional portfolio models, as exploring multi-factor models lies beyond the scope of this analysis.

2.1.2.2. Risk Concepts in Capital Market Theory

Systematic Risk vs. Firm-Specific Risk: Understanding Risk in Financial Markets

In financial markets, risk is generally categorized into systematic risk and firm-specific (idiosyncratic) risk. Systematic risk, also known as market risk, is non-diversifiable and stems from macroeconomic factors like inflation, interest rates, and currency fluctuations. This type of risk affects all securities across the market and is the primary focus of models like the CAPM. In contrast, firm-specific risk is diversifiable and pertains to risks specific to individual companies or sectors. The CAPM operates under the assumption that investors are only compensated for bearing systematic risk, as firm-specific risk may be effectively mitigated through diversification strategies (Bodie, Kane & Marcus, 2011).

The total risk σ_i^2 of a security can be broken down as follows:

$$\sigma_i^2 = \beta_i^2 \sigma_m^2 + \sigma_e^2 \qquad \text{(Eq. 28)}$$

where σ_i^2 represents the total variance of the security, $\beta_i^2 \sigma_m^2$ quantifies the systematic risk component due to market-wide factors, and σ_e^2 represents the unsystematic risk specific to the individual security.

Systematic Risk: Definition and Implications

Systematic risk refers to the portion of total risk that cannot be diversified away because it impacts the entire market. Within the CAPM framework, systematic risk is measured by beta, which quantifies a security's sensitivity to overall market movements. Portfolios that lie along the CML maintain a consistent SR, demonstrating that they maximize returns for each unit of risk (Roncalli, 2022). This highlights the critical role of systematic risk in determining expected returns, as investors are compensated only for risks affecting the market as a whole.

Differentiating Systematic Risk and Firm-Specific Risk

The distinction between systematic and idiosyncratic risk is fundamental to MPT. While systematic risk is inherent and unavoidable, firm-specific risk can be eliminated by diversifying across a sufficiently broad and varied portfolio. This principle is central to the SIM, which simplifies portfolio analysis by assuming that all stock's covariance is caused by a single market factor (Elton et al., 2014). As investors diversify portfolios, the impact of firm-specific events is minimized, leaving systematic risk as the primary influence. This insight is a core premise of the CAPM, which assumes that in an efficient market, all investors hold the same market portfolio, effectively eliminating unsystematic risk through diversification. The market portfolio is optimally diversified, reflecting the efficient market hypothesis and the notion that all relevant sources of systematic risk are included.

Beta as a Measure of Systematic Risk

Beta plays a pivotal role in the CAPM, as it is the key metric that quantifies a security's sensitivity to overall market movements. It is calculated using the following formula:

$$\beta_i = \frac{Cov(R_i, R_m)}{\sigma_m^2} \qquad \text{(Eq. 29)}$$

where $Cov(R_i, R_m)$ is the covariance between the returns of the security (R_i) and the returns of the market (R_m), and σ_m^2 is the variance of the market returns.

This formula quantifies how much a security's price is likely to move in response to market fluctuations. A beta greater than 1 indicates that the security is more volatile than the

market, indicating higher risk and potentially higher returns. Conversely, a beta less than 1 suggests that the security is less sensitive to market movements, making the investment more stable and defensive (Elton et al., 2014).

Research by Blume (1970) and Levy (1971) demonstrated that while individual stock betas can vary over time due to changes in firm fundamentals, the beta of well-diversified portfolios remains stable, making it a reliable predictor of future performance. Although historical betas are prone to estimation error, they are still commonly utilized in risk management and portfolio optimization. As portfolios diversify, the impact of idiosyncratic risk diminishes, leaving beta as the primary factor in determining expected returns (Elton et al., 2014).

Elton et al. (2014) state that historical betas are particularly effective for predicting future betas in diversified portfolios, making them essential tools in portfolio optimization. Despite potential estimation errors, beta remains a fundamental metric for assessing market risk and is used extensively in portfolio construction and risk management strategies.

Risk Reduction Strategies and the Role of Diversification

In portfolio theory, effective risk management is built on the principles of diversification, portfolio optimization, and strategic asset selection. By targeting assets with lower beta values, investors can mitigate systematic risk while still achieving favorable returns. The CML serves as a key reference for identifying optimal portfolios, representing the set of portfolios that offer the highest SR, thereby maximizing the return per unit of risk. Roncalli (2022) emphasizes that portfolios positioned along the CML maintain the same SR, underscoring their efficiency across varying risk levels.

The integration of the CML and the SR creates a robust framework for constructing portfolios that maximize returns relative to risk, directing investors toward the most efficient allocation strategies.

2.1.2.3. Portfolio Theory and Market Efficiency

Revisiting the Efficient Frontier

The efficient frontier has already been discussed in previous sections but is briefly reviewed in. this section due to its importance in SIM. The efficient frontier represents the set of portfolios offering the highest expected return for a given level of risk. Investors strive to position their portfolios on this frontier to achieve an optimal risk-return balance. In the CAPM framework, the tangency portfolio, which lies at the intersection of the efficient frontier and the CML, represents the optimal combination of risky assets. This portfolio maximizes the SR, making it the preferred choice for investors seeking the best possible trade-off between risk and return (Bodie, Kane & Marcus, 2011). The SIM incorporates the concept of the efficient frontier, which assumes that market risk is the dominant factor influencing asset returns. By focusing on this factor, SIMs allow for more straightforward calculations while still enabling effective portfolio management.

The Market Portfolio and Asset Pricing

The market portfolio is a cornerstone of MPT and the CAPM. It comprises all risky assets, weighted according to their market values, representing the optimal portfolio that investors should hold in equilibrium (Elton et al., 2014). The CAPM assumes that all investors hold this market portfolio and adjust their overall risk exposure by combining it with a risk-free asset. This idea is based on the two-mutual fund theorem, claiming that any investor can construct an optimal portfolio by holding a combination of a market fund and a risk-free asset.

The assumption, that all investors hold the market portfolio, allows for the derivation of key relationships, such as the CML and the Security Market Line (SML). Both of them are central to asset pricing within the CAPM framework. The SML illustrates the link between beta and expected return and is expressed by the equation 30:

$$E(R_i) = R_f + \beta_i \cdot (E(R_m) - R_f) \qquad \text{(Eq. 30)}$$

where $E(R_i)$ represents the expected return of the asset, R_f is the risk-free rate, β_i is the asset's beta, and $E(R_m)$ is the expected market return.

The SML is particularly effective in determining whether individual assets are fairly priced. An asset positioned above the SML is considered undervalued, offering higher returns than expected for its level of risk. Conversely, an asset below the SML is considered overpriced.

As highlighted by Elton et al. (2014), the composition of the market portfolio has the following key characteristics:

1. All investors hold a portfolio of risky assets in proportions that reflect the market portfolio.
2. The market portfolio includes all traded assets, typically represented by stocks.
3. Each stock's proportion in the market portfolio is determined by its market value relative to the total market value of all stocks.

Investor Behavior and Market Realities

Although the CAPM assumes rational investors who focus solely on systematic risk, real-world investor behavior often diverges from these assumptions. For instance, Horn (2023) notes that various non-market factors increasingly influence investment decisions, leading to the inclusion of idiosyncratic risks that the CAPM has previously deemed irrelevant. This shift is particularly noticeable among institutional investors, who may favor portfolios with lower beta values due to the associated lower cost of capital (Giese, Lee, Melas, Nagy & Nishikawa, 2019). Despite the influence of these additional factors, beta remains a key metric for fully diversified portfolios, as emphasized by Bello (2005). Dai (2022) further stresses the importance of accurately interpreting beta, especially when assessing high-beta stocks that are more sensitive to market fluctuations and thereby carrying higher risks.

2.1.2.4. Capital Market Line and Security Market Line

The CML: Concepts and Applications

The CML represents the risk-return trade-off for efficient portfolios, connecting the risk-free asset with the market portfolio, as previously discussed in detail. Portfolios that lie on this line offer the optimal combinations of risk and return, characterized by having the highest possible SR (Roncalli, 2022).

The CML is expressed by the following equation:

$$E(R_p) = R_f + \frac{E(R_m) - R_f}{\sigma_m}\sigma_p \qquad \text{(Eq. 31)}$$

where $E(R_p)$ is the expected return of the portfolio, σ_p is the standard deviation of the portfolio and σ_m is the standard deviation of the market portfolio.

Equation 30 demonstrates that the expected return of a portfolio increases linearly with risk, as measured by the portfolio's standard deviation σ_p, aligning with the investor's risk tolerance.

The CML is a straight line that tangents to the efficient frontier, dominating all other potential straight lines and risky portfolios. Portfolios positioned on the CML share the same SR, highlighting their efficiency in balancing risk and return. As well as illustrating the optimal set of portfolios allowing investors to achieve the maximum expected return for a given level of risk, making it a key tool in portfolio optimization.

The SML: Interpretation and Use

The SML graphically represents the relationship between expected returns and beta for individual assets, extending the principles of the CML to account for systematic risk. It serves as a vital benchmark for assessing whether a security is undervalued or overvalued based on its beta. Securities positioned above the SML indicate higher than expected returns, implying potential undervaluation, whereas those below suggest possible overvaluation (Elton et al., 2014). It is widely utilized in performance evaluation and capital budgeting, guiding investment

decisions and helping to determine whether assets are appropriately priced according to their risk. Its slope corresponds to the market portfolio's risk premium, providing a clear visual representation of the expected return for any given level of systematic risk (Bodie, Kane & Marcus, 2011).

Distinctions and Implications of the CML and SML

While both the CML and SML are integral to the CAPM, they serve distinct purposes. The CML focuses on portfolio performance by considering total risk – the standard deviation, whereas the SML examines individual asset performance through beta. Together, they offer a comprehensive view of risk-return dynamics in capital markets, illustrating how systematic risk impacts both portfolio management and individual asset pricing. This dual perspective is crucial for investors and portfolio managers who seek to optimize their investment strategies while maintaining a clear understanding of how risk and return are interrelated (Bodie, Kane & Marcus, 2011).

2.1.2.5. Conclusion and Outlook

The models studied, serve as fundamental tools for assessing the link between risk and return in financial markets. They both underscore the importance of market risk while offering practical frameworks for portfolio management. Despite their simplifying assumptions, they remain highly relevant due to their efficiency and widespread applicability in diverse investment contexts.

The discussion highlights that while the CAPM extends the principles of the SIM by introducing a more comprehensive theoretical structure, both models are ultimately designed to facilitate effective management of systematic risk. A solid grasp of these concepts is vital for informed portfolio construction and risk assessment, offering a robust foundation for strategic decision-making in capital markets.

2.1.3. Traditional Index Calculation Methods

The calculation methodologies of major financial indices are essential for evaluating the market performance, serving as critical benchmarks that guide investment strategies and financial analysis. Financial assets can be acquired either directly through instruments such as derivatives, money market securities, and capital market instruments, or indirectly via mutual funds that act as intermediaries. Among capital market instruments like stocks and fixed-income securities, various indices are utilized to measure performance. Notable examples include the Dow Jones Industrial Average (DJIA) in the U.S., the Nikkei Average in Tokyo (Nikkei 225 Index, 2024), and the FTSE in London (FTSE 100 Index, 2024). These indices are primarily categorized into three types: price-weighted, market-value-weighted, and equally weighted indices (Bodie, Kane & Marcus, 2011).

Price-Weighted Indices: The Case of the DJIA

The DJIA, one of the oldest and most widely recognized indices, is a price-weighted measure that tracks 30 significant U.S. stocks (Refinitiv, 2024; Yahoo Finance, 2024). In a price-weighted index, each stock's influence is directly proportional to its share price, which means that higher-priced stocks have a greater weight in determining the index's overall performance. Despite its historical significance, the DJIA's narrow scope, limited to only 30 firms, restricts its ability to represent the broader market accurately. A similar approach is employed in Japan's Nikkei 225 index (Nikkei 225 Index, 2024), which is similarly price-weighted (Bodie, Kane & Marcus, 2011; Refinitiv, 2024; Yahoo Finance, 2024).

The calculation formula for a price-weighted index is as follows:

$$Price - Weighted\ Index = \frac{\sum_{i=1}^{n} P_i}{D} \qquad \text{(Eq. 32)}$$

where P_i represents the price of each stock, and D is the divisor adjusted to account for stock splits and dividends.

Market-Value-Weighted Indices: A Broader Market Perspective

In contrast, market-value-weighted indices, such as the Standard & Poor's 500 (S&P 500), offer a broader market coverage by including 500 firms and weighting each stock based on its market capitalization (Refinitiv, 2024; Yahoo Finance, 2024). This methodology provides a more comprehensive market perspective, as companies with larger market values have a greater impact on index performance.

The equation for a market-value-weighted index is given by:

$$Market - Value - Weighted\ Index = \frac{\sum_{i=1}^{n}(P_i \cdot Q_i)}{\sum_{i=1}^{n}(P_i^0 \cdot Q_i^0)} \qquad \text{(Eq. 33)}$$

where P_i and Q_i represent the current price and quantify of each stock, respectively, and P_i^0 and Q_i^0 are the corresponding prices and quantities at the based period.

Market-value-weighted indices are usually viewed as superior indicators of overall market trends because they reflect the aggregate value of the companies included. Internationally, the MSCI indices, which track over 50 countries and regions, employ a similar methodology, making them important benchmarks in global financial markets (Bodie, Kane & Marcus, 2011; MSCI Index, 2024).

Equally Weighted Indices: An Alternative Approach

Equally weighted indices present an alternative approach by assigning equal weight to each stock's return, regardless of its price or market value. This method reflects an investment strategy in which an equal allocation is made to each stock.

The formula for an equally weighted index is as follows:

$$Equally\ Weighted\ Index = \frac{1}{n}\sum_{i=1}^{n} R_i \qquad \text{(Eq. 34)}$$

where R_i is the return of each stock.

While this approach offers unique insights into market dynamics, it requires regular rebalancing, distinguishing it from more conventional buy-and-hold strategies associated with price- and market-value-weighted indices (Bodie, Kane & Marcus, 2011; Elton et al., 2014).

Due to the specific characteristics and advantages of equally weighted indices, this method will be adopted in the calculations conducted throughout this master's thesis, providing a distinct lens through which market performance is assessed.

The Importance of International and Foreign Indices

The globalization of financial markets has led to the development of numerous foreign and international indices, reflecting the growing importance of non-U.S. markets. Prominent examples include Japan's Nikkei 225, a price-weighted index representing the largest stocks on the Tokyo Stock Exchange, and the Nikkei 300, which is value-weighted (Nikkei 225 Index, 2024). In Europe, the FTSE – pronounced "footsie" – tracks 100 major companies listed on the London Stock Exchange and is value-weighted (FTSE 100 Index, 2024), while the DAX index serves as Germany's premier stock index (DAX Index, 2024). The expansion of market-value-weighted indices in non-U.S. markets, such as those computed by MSCI, further emphasizes the increasing role of international benchmarks in global finance (MSCI Index, 2024; Bodie, Kane & Marcus, 2011).

Investment Strategies and Accessibility: Index Funds and ETFs

For investors, these indices are accessible through various investment vehicles, with index funds being among the most popular. Index funds aim to replicate the performance of a chosen index by holding shares in proportion to their representation within that index. For instance, the Vanguard 500 Index Fund mirrors the S&P 500 by investing in stocks based on their market capitalization (Vanguard, 2024). Index funds are widely favored for their low-cost, passive investment strategy, offering broad market exposure without the need for extensive security analysis. Alternatively, exchange-traded funds (ETFs) provide further flexibility. ETFs, like the SPDR, tracking the S&P 500, and the DIA, tracking the DJIA, combine the diversification benefits of index funds with the liquidity and trading convenience of individual stocks. ETFs allow investors to tailor their portfolios according to specific investment objectives and risk profiles, offering exposure to various asset classes and sectors (Bodie, Kane & Marcus, 2011).

Active vs. Passive Management: The Role of Mutual Funds

While mutual funds offer professionally managed and diversified portfolios, they often incur management fees and expenses that can reduce returns, making passive strategies via index funds more attractive. Over the past 25 years, actively managed equity mutual funds have consistently showed lower performance compared to passive index funds like the S&P 500, primarily due to the higher costs and inefficiencies associated with active management. Although some funds consistently achieve strong returns, many fail to sustain performance over extended periods. On top of this, mutual funds limit investors' control over the timing of capital gains realizations, which can further impact overall returns (Bodie, Kane & Marcus, 2011; Urban & Wójcik, 2019; Yahoo Finance, 2024).

Stock market indices play a vital role in assessing financial markets, from the price-weighted DJIA to the market-value-weighted S&P 500 and international benchmarks such as the Nikkei, FTSE, and DAX (Nikkei 225 Index, 2024; FTSE 100 Index, 2024; DAX Index, 2024). These indices provide investors with a range of methodologies to track market performance, enabling strategic decisions that align with specific financial objectives. The rise of index funds and ETFs has democratized access to these benchmarks, offering greater flexibility and tailored investment options. As global markets continue to evolve, both traditional and emerging indices will remain critical in guiding investment decisions and shaping portfolio management strategies across diverse sectors and regions.

In this context, the equally weighted approach offers a particularly valuable perspective and will serve as the foundation for the analyses conducted in this thesis.

2.1.4. The Shifting Role of Companies in Economic Development

The traditional role of companies in economic development has long centered on maximizing shareholder value, a theory profoundly based in Milton Friedman's influential perspective that a company's primary responsibility is to maximize shareholder returns within legal and ethical boundaries. For decades, financial textbooks and established models such as the MPT and the CAPM have reinforced this viewpoint, emphasizing shareholder value as the core objective of corporate activity (Rennebog, Ter Horst & Zhang, 2008; Urban & Wójcik, 2019; Billio et al., 2021). In this traditional framework, social and environmental goals were frequently considered as secondary or irrelevant, typically perceived as potential burdens that could diminish profitability due to increased costs (Billio et al., 2021).

Yet, significant challenges have emerged as companies are increasingly expected to balance wealth creation with broader societal purposes. While it is generally observed that financial investments tend to generate higher returns, empirical evidence indicates a significant inclination for non-financial enterprises entering financial markets, driven by their immediate profit-oriented objectives (Li et al., 2023). This transition raises concerns about the long-term sustainability of such practices, particularly in light of societal demands and the necessity for stable industrial growth. As a result, the traditional shareholder-centric paradigm is being seriously reconsidered.

Over the past two decades, this profit-maximization approach has faced significant criticism, particularly since the positive impact of ESG factors on profitability has become increasingly evident (Diez-Cañamero, Bishara, Otegi-Olaso, Minguez & Fernández, 2020). The once-dominant belief that financial decisions should exclusively aim at maximizing shareholder wealth is gradually giving way to a broader recognition that integrating ESG considerations can improve long-term financial stability and corporate reputation (Billio et al., 2021). This change signifies an increasing acknowledgment, as noted by Paul-Itua (n.d.), of the interdependence between business and society, wherein corporations are no longer merely obligated to prioritize financial gains, but are also required to make substantial contributions to the general well-being of society.

Innovations remain a crucial component in an ever-changing environment, propelling both economic success and the extension of corporate responsibility. Historically, innovation has been a major driver of economic development and industrial restructuring. Today, it plays

a crucial role in fostering sustainable growth, as companies seek not only to strengthen their market positions but also to provide environmental and societal benefits. Still, such innovation cannot thrive without strong financial support, highlighting the importance of capital markets in maintaining industry stability and long-term prosperity (Li et al., 2023). Yet, contradictions persist in the financial sector, since short-term profit-driven decisions frequently clash with the long-term interests of future generations, resulting in outcomes that may generate immediate gains but undermine sustainable development over time (Ballate, 2018).

The movement in corporate purpose indicates a larger transition away from a purely shareholder-focused model and towards one in which firms are increasingly expected to address global challenges such as climate change, inequality, and social justice (Diez-Cañamero et al., 2020). Companies are increasingly shifting from a traditional reactive stance to a more proactive role, deliberately prioritizing beneficial social and environmental impacts through their activities (Diez-Cañamero et al., 2020). This trend, as highlighted by Ballate (2018), is reflected in the rapid growth of sustainable assets under management, indicating that sustainable investing is still in its early stages but has the potential for substantial growth. As sustainable finance gains momentum, the industry should prepare for considerable change from traditional to sustainable investing strategies in the future decades.

While traditional finance has prioritized shareholder value, evolving societal expectations are forcing a transition towards sustainable finance. This development focuses on creating shared value for all stakeholders. Given that the following chapters provide a detailed analysis of the integration of ESG factors, it is evident that these are no longer purely ethical considerations but have evolved into strategic imperatives for achieving long-term success. This transformation ensures that economic growth is harmonized with environmental sustainability and social equity, signifying a fundamental shift in corporate finance. Moreover, this shift must be assessed in the context of economic crises, where the resilience and adaptability of ESG-driven strategies are rigorously tested, underscoring their importance not only in stable periods but also in times of economic uncertainty (Urban & Wójcik, 2019).

2.2. Sustainable Finance

In recent years, sustainable finance has experienced considerable evolution (Berg, Köbel & Rigbon, 2022), accompanied by a growing body of literature that extensively explores the integration of sustainability and ESG factors into investment strategies (Kick & Rottmann, 2022).

This chapter provides a comprehensive theoretical analysis and synthesis of the current body of literature on sustainable investing practices. It begins by outlining the historical development of responsible investing and exploring the ethical considerations that shape the role of businesses in society. Key concepts in sustainable finance are subsequently discussed, followed by an in-depth review of the regulatory frameworks, reporting standards, and global ESG initiatives shaping the sector. The chapter also examines the significance of ESG ratings in modern finance, analyzing their influence on portfolio performance. Lastly, it assesses the resilience of sustainability strategies during economic crises, analyzing their robustness and adaptability in the face of economic challenges.

2.2.1. Background and Historical Evolution of Responsible Investing

Origins of Ethical Investment

The concept of ethical investment is not novel; it has been part of financial history for millennia. Ethical investment, rooted in religious and moral principles, stretches back to the 16th century and has evolved to encourage investments that avoid to harm society and the environment (Charlo, Moya & Muñoz, 2017; Lean & Pizzutilo, 2021). Early examples include religious groups excluding investments in industries like tobacco, alcohol, and gambling, providing the groundwork for what would later become sustainable finance (Renneboog, Ter Horst & Zhang, 2008; Urban & Wójcik, 2019).

History of Sustainable Finance

Sustainable finance, in its modern form, is relatively new but has grown into a significant component within the financial sector. Originally spurred by activism from ethically motivated investors and civil society, sustainable finance began gaining momentum in the latter half of the 20th century (Renneboog, Ter Horst & Zhang, 2008). The concept gained further traction following the Brundtland Commission's 1987 report, which articulated the need for

development that meets present needs without compromising the ability of future generations to meet their own needs (Urban & Wójcik, 2019; Diez-Cañamero et al., 2020). This seminal definition of sustainability paved the way for integrating ESG factors into financial decision-making.

Presently, sustainable finance is a thriving industry, driven not only by ethically oriented investors but also by mainstream financial institutions seeking profitability. Despite its impressive expansion, the sector remains a niche market that needs greater transparency, standardization, and incentives to address global challenges and long-term societal goals effectively (Ballate, 2018).

History of Responsible Finance and Ethical Investment

The rise of responsible investing has been shaped by several key developments. In recent decades, the integration of ESG criteria into investment strategies has become increasingly common, with approaches now combining traditional financial techniques and ESG considerations (Billio et al., 2021). The introduction of sustainability indices has also played a significant role in enabling investors to track price trends of socially responsible companies, similar to traditional market indices (Escrig-Olmedo, Muñoz-Torres & Fernández-Izquierdo, 2010).

The European Commission (EC) has defined sustainable finance as the integration of ESG factors into financial decision-making processes with the goal of achieving long-term investments in sustainable economic activities and projects. This definition underscores the importance of addressing environmental issues like climate change, social concerns such as inequality and inclusiveness, and governance practices that promote responsible management (Roncalli, 2022).

Another definition of sustainable investing originates from the Swiss Sustainable Finance (SSF) titling it as *"an investment approach that actively integrates ESG factors into the selection and management of investments,"* emphasizing its dual focus on financial returns and societal impact (Ballate, 2018). Sustainable investing is no longer viewed as just a trend for millennials, but rather as a crucial discipline integral to addressing global challenges. It must be integrated into the financial system in order to reflect the real economy and assure the future generations' well-being (Ballate, 2018).

How Sustainable Finance Differs from Traditional Finance

Sustainable finance differs in its initial approach from traditional finance, primarily through its focus on ESG factors alongside financial returns. Traditional finance, with its exclusive focus on increasing shareholder value, frequently overlooks social and environmental implications (Ballate, 2018). In contrast, sustainable finance seeks to achieve both financial and non-financial goals, reflecting a broader responsibility to stakeholders and society (Dai, 2022; Lin & Swain, 2024).

The growing popularity of sustainable investments underscores the industry's transition. The rapid increase in assets managed under sustainable investment strategies signals a shift toward approaches that balance financial performance with social and environmental accountability (Ballate, 2018). While the principles of due diligence and reliance on robust financial data remain essential in both sustainable and traditional investing, the distinction is the emphasis on long-term impact and inter-generational equity (Ballate, 2018).

The evolution of responsible investing represents a substantial shift in finance, driven by ethical considerations and the awareness that sustainability can improve long-term financial performance. As the field evolves, it progressively incorporates factors beyond short-term profits, in order to promote a more sustainable and equitable future for all stakeholders involved (Kick & Rottmann, 2022).

The following section will examine the expanding connection between business and society, focusing on the increasing expectation for businesses to address societal challenges and how this trend aligns with responsible investing principles.

2.2.2. The Role of Business in Society: Ethical Considerations and Responsibilities

Should Companies Be Socially Responsible?

The question of corporate responsibility has long divided academics and practitioners. As previously discussed, Milton Friedman's well-known stance emphasizes that the principal responsibility of a business is to maximize shareholder profits within legal and ethical limits, arguing that engaging in social causes detracts from this goal (Diez-Cañamero et al., 2020). However, modern perspectives increasingly disagree with this statement. Paul-Itua (n.d.) asserts that corporations should contribute to societal goals, but only in ways that are consistent with their core business activity. Such an approach not only supports a more humanitarian society, but also creates a favorable environment for business operations. Corporations are encouraged to support government efforts in sectors like education and healthcare, thereby improving societal well-being while increasing their own productivity (Paul-Itua, n.d.).

Growing Awareness among Managers and Stakeholders

In recent decades, there has been a notable shift in how managers and stakeholders perceive corporate responsibility. Freeman's Stakeholder Theory, introduced in 1986, broadened the traditional view by arguing for the inclusion of all groups affected by corporate decisions. As per Diez-Cañamero et al. (2020) companies that address the interests of a broad range of stakeholders can generate shared value, leading to improved financial outcomes and societal benefits. This alignment between corporate and societal interests is also evident in the rise of sustainable investing, driven largely by younger generations who prioritize companies addressing environmental and social challenges. Despite challenges in education and standardization within sustainable finance, the demand for responsible investment strategies continues to grow (Ballate, 2018).

The Interdependence of Business and Society

The interdependence between business and society is increasingly recognized as fundamental to long-term corporate success. Companies rely on stable and healthy societies to sustain markets and ensure growth, whereas society relies on businesses to generate wealth and create employment (Paul-Itua, n.d.). Separating the two may yield short-term benefits but is detrimental in the long run.

As Billio et al. (2021) argue, integrating societal goals into corporate strategies fosters sustainability, development, and competitiveness. Businesses are thus compelled to balance profitability with societal impact, understanding that their long-term survival is inextricably linked to the well-being of the communities in which they operate.

The developing idea of corporate responsibility stresses the critical interdependence between business and society. As companies increasingly integrate social and environmental factors into their strategies, it becomes crucial to establish clear definitions and frameworks for key concepts in sustainable finance, which will be discussed in greater detail in the following chapters.

2.2.3. Defining Key Concepts in Sustainable Finance

Building upon a foundational definition of sustainability provided by Van Holt & Whelan (2021) which describes sustainable business practices as those that *"(1) at minimum do not harm people or the planet and at best create value for stakeholders, and (2) focus on improving sustainability performance in the areas in which the company or brand has a material environmental or social impact"* (Atz, van Holt, Liu & Bruno, 2023), it is clear that both minimizing negative impacts and actively enhancing sustainability in key areas like operations, value chains, and customer relations are essential.

In the light of this, it is vital to first define and examine the key concepts of sustainability to effectively assess their potential impact on portfolio performance in the subsequent chapters.

CSR:

In recent years, Corporate Social Responsibility (CSR) has evolved into a central pillar of sustainable finance, indicating the integration of ESG factors into corporate strategies and operations. Liang & Renneboog (2020) define CSR as the integration of ESG considerations that go beyond traditional compliance, emphasizing sustainable, responsible, and impact-focused investing. This shift has elevated CSR from a peripheral concept into a mainstream business activity, encompassing initiatives like environmental protection, workforce diversity, and employee welfare (Liang & Renneboog, 2020). The interchangeable use of the terms 'CSR' and 'ESG' underscores the growing recognition of responsible corporate practices in achieving long-term societal benefits.

The increasing use of CSR is driven by conceptual frameworks and growing societal concerns about environmental and social issues, prompting companies to integrate CSR into their operations. These initiatives aim to ensure sustainable practices that maximize societal benefits while minimizing negative impacts, thereby safeguarding the needs of future generations (Diez-Cañamero et al., 2020). As CSR evolves, it becomes essential to align business activities with broader societal objectives, cementing its position as a core element in strategies focused on sustainable development.

Despite its growing popularity, CSR remains a term open to various interpretations. Traditionally, CSR has been seen as voluntary corporate engagement that exceeds legal and market

obligations (Atz et al., 2023). This voluntary nature is central to CSR's role as a self-regulation mechanism, in which companies address social issues proactively, independent of governmental mandates (Van Holt & Whelan, 2021).

Definitions of CSR vary in scope, ranging from a narrow view of 'sacrificing profits in the social interest' to a broader perspective consistent with value maximization (Liang & Renneboog, 2020). The narrower view focuses on meeting non-financial preferences of stakeholders like investors and employees, whereas the broader approach aligns CSR with strategic goals, positioning it as an essential component of sustainable corporate growth (Diez-Cañamero et al., 2020).

The vagueness in defining CSR and associated terms such as ESG creates challenges, as noted by Van Holt and Whelan (2021). This definition goes beyond minimizing negative impacts; it stresses the need for organizations to actively improve sustainability performance within areas of tangible relevance, whether in operations, supply chains, or customer relations (Van Holt & Whelan, 2021). CSR incorporation into corporate strategies is increasingly seen as a strategic tool for balancing profit with societal and environmental concerns (Charlo, Moya & Muñoz, 2017). This is consistent with the Triple Bottom Line (TBL) philosophy, which underlines the importance of social, environmental, and financial outcomes in shaping business operations.

The theoretical foundations of CSR can be traced back to Howard Bowen's seminal work *"Social Responsibilities of the Businessman"* (1953). Regarded as the 'father of CSR,' Bowen emphasized the alignment of business decisions with societal objectives, driven by the 'social conscience' of business leaders (Diez-Cañamero et al., 2020; Roncalli, 2022). His work laid the groundwork for modern CSR by stressing its role in fostering both social justice and economic growth.

Building on Bowen's ideas, Frederick (1960) expanded CSR to include meeting societal expectations beyond business interests, while McGuire (1963) and Walton (1982) pointed out that CSR encompasses responsibilities beyond legal obligations and plays a crucial role in the business-society relationship. Freeman's Stakeholder Theory further refined the notion by focusing on managing diverse stakeholder interests as a key to sustainable business. His stakeholder map provides a framework for integrating CSR into strategic goals, balancing profitability with societal impact (Diez-Cañamero et al., 2020).

Early conceptualizations, such as Steiner (1971), stated the alignment of economic goals with societal objectives, promoting CSR as a balance between social interest and enlightened self-interest. Steiner's view suggests that long-term business success is strongly linked to beneficial society contributions (Paul-Itua, n.d.).

In recent years, CSR has increasingly become a top priority for both policymakers and the public. The growing demand for corporate responsibility reflects a transition from perceiving CSR as voluntary and ethical to seeing it as a strategic necessity in today's global environment (Renneboog, Ter Horst & Zhang, 2008).

Several international organizations have contributed to standardizing CSR definitions. The EC defines CSR as integrating social and environmental concerns into business operations beyond legal requirements (European Commission, 2001). The International Organization for Standardization (ISO) emphasizes ethical and transparent operations aligned with sustainable development principles (ISO, 2010). The World Business Council for Sustainable Development (WBCSD) focuses on collaborative efforts between businesses and stakeholders for sustainable economic development (Holmes & Watts, 2000).

These standardized definitions demonstrate CSR's evolution from a voluntary initiative to a strategic framework required for integrating sustainability into corporate operations, reflecting its role as a key factor in achieving long-term business and societal goals.

The literature identifies four main approaches to why companies adopt CSR: the Regulatory, Descriptive, Instrumental, and Strategic Approaches. The Regulatory Approach focuses on ethical obligations, whereas the Descriptive Approach emphasises CSR's role in aligning business practices with societal norms. The Instrumental Approach views CSR as a tool for competitive advantage, such as improving brand image. The Strategic Approach integrates elements from the other approaches, seeing CSR as a way to create shared value by aligning ethical goals with business objectives (Diez-Cañamero et al., 2020).

Empirical studies further support the concrete benefits of CSR for companies and stakeholders. Sen, Bhattacharya & Korschun (2006) demonstrated that CSR activities not only boost customer purchases but also enhance 'CSR associations, attitudes, and identification,' leading stakeholders to invest personal resources. Similarly, Servaes & Tamayo (2013) found a positive link between increased customer awareness and CSR initiatives, while Edmans (2011)

connected higher employee productivity and satisfaction to effective CSR practices. These findings underscore the strategic value of CSR as a tool for enhancing stakeholder engagement and overall business performance.

CSR has evolved from a voluntary initiative to a strategic approach that aligns business practices with societal welfare and environmental sustainability. This shift underscores the importance of balancing profit with social and environmental responsibilities. As CSR becomes more integral to business strategy, it forms the foundation for Sustainable and Responsible Investing (SRI), which incorporates CSR principles into investment decisions, allowing investors to support companies that are committed to ethical conduct and sustainability.

SRI:

Over the past two decades, SRI has gathered increasing interest from individual and institutional investors, as well as scholars, by emphasizing ethical values, environmental protection, social development, and sound governance practices (Revelli & Viviani, 2015). While SRI has been in existence since the 1920s, it has recently evolved from a niche investment strategy into a mainstream concern, with a substantial global impact (Billio et al., 2021). Historical origins of SRI can be traced back to religious movements of the early 19th-century. Its broader popularity expanded from the 1980s onwards, particularly in Europe and North America (Berry & Junkus, 2013). Early adopters such as Belgium, Italy, Sweden, and the UK led the charge by requiring pension funds to disclose their levels of socially responsible investments (Lean, Ang & Smyth, 2015).

Despite its growth, a consistent definition of SRI remains elusive, often varying depending on the investment vehicles and personal values integrated into decision-making (Berry & Junkus, 2013). Though, at its core, SRI involves integrating personal ethics and societal concerns with financial decision-making, striving to balance profitability with social and environmental impact. Unlike earlier forms of ethical investing based on religious beliefs, modern SRI is driven by broader social convictions, reflecting individual and collective responsibility towards societal well-being (Escrig-Olmedo, Muñoz-Torres & Fernández-Izquierdo, 2010).

External pressures have significantly shaped the evolution of SRI, including regulatory changes, demands from institutional investors, and advocacy by NGOs and the media, which have collectively fueled its expansion (Eurosif, 2008). By the end of 2012, global SRI funds

reached $13.6 trillion, with Europe accounting for two-thirds of these assets (Lean, Ang & Smyth, 2015). Europe and North America together managed 96% of global SRI funds, showing the region-specific concentration of this investment strategy.

In Europe specifically, the SRI market, while still in its early stages, has been growing rapidly. By 2005, SRI assets in Europe totaled $1.4 trillion, representing 10-15% of European funds under management. During the same period, the number of SRI mutual funds increased significantly, with the US seeing a rise from 55 to 201 funds, while Europe experienced an even larger jump from 54 to 375 funds. Among European countries, the Netherlands and the UK hold the highest percentage of SRI mutual funds, reflecting strong regional leadership in this area (Renneboog, Ter Horst & Zhang, 2008).

In practice, SRI strategies involve establishing socially responsible criteria, followed by selecting companies that adhere to these principles, thereby supporting social and environmental development (Lean & Pizzutilo, 2021). Investors often approach SRI with the philosophy of 'doing well while doing good,' blending financial goals with ethical considerations (Hamilton, Joe & Statman, 1993). In addition to that, the rapid rise of the SRI industry has aroused widespread academic interest, particularly in determining whether non-financial criteria influence investor decisions and how they benefit from these investments (Renneboog, Ter Horst & Zhang, 2008).

Modern SRI emerged from social campaigns in the 1960s, gaining significant momentum in the 1980s, when investors protested apartheid in South Africa and environmental disasters heightened awareness of industrial impacts. This growing social awareness, combined with favorable regulatory environments, has solidified SRI as an essential asset class with a promising future. As Western governments continue to introduce regulations to encourage SRI, it is expected that this investment strategy will maintain its growth trajectory, becoming increasingly integral to portfolio management globally (Renneboog, Ter Horst & Zhang, 2008).

SRI has evolved into a sophisticated approach that combines ESG considerations and financial performance, aligning economic returns with societal and environmental objectives (Dorfleitner, Halbritter & Nguyen, 2015). Unlike traditional investment strategies, SRI prioritizes ESG criteria, reflecting a shift towards sustainable portfolio management. As ESG factors increasingly drive investment decisions, they have become central to the growth of SRI, setting the stage for further exploration.

ESG:

Sustainable finance is widely acknowledged as an important framework for integrating financial decision-making with ESG factors. ESG has emerged as a central pillar in sustainable finance, offering a structured approach for assessing the long-term sustainability and societal impact of investments. High ESG performance is often regarded as a source of competitive advantage, particularly as ESG-focused investments tend to demonstrate resilience and asymmetric benefits in periods of social or economic turbulence (Atz et al., 2023).

Moreover, ESG practices and disclosures have evolved into vital instruments of corporate accountability. They signify a voluntary yet strategic commitment to broader non-financial objectives, aligning businesses with the principles of sustainable development. These practices not only enhance the transparency and credibility of firms but also generate value for investors, stakeholders, and society at large (Khaled, Ali & Mohamed, 2021). As a result, firms that prioritize ESG considerations signal their alignment with global sustainability goals while addressing the increasing demand for responsible corporate behavior.

The concept of ESG was initially introduced in the 2004 report, *"Who Cares Wins: Connecting Financial Markets to a Changing World,"* which sought to connect financial markets with the growing need for global sustainability (Roncalli, 2022). Over time, ESG has become integral to modern investment and financing practices, driven by regulatory interventions and the establishment of accounting standards tailored to ESG risks. During the past two decades, ESG factors have not only shaped portfolio construction but also redefined risk management, with climate change recognized as a paramount risk. Simultaneously, social pressures and governance-related risks, such as reputational damage from corporate controversies, have underscored the need for proactive management of ESG factors (Roncalli, 2022).

ESG represents a cornerstone in the broader field of sustainable finance, serving as both a strategic framework for investors and a critical accountability measure for corporations. This brief overview provides a foundational understanding of ESG, which will be expanded upon in subsequent sections to explain its implications and significance within sustainable finance strategies.

2.2.4. Regulatory Landscape, Reporting Standards, and Global ESG Initiatives

Regulatory Framework in the EU

The EU has established itself as a leader in sustainable finance, supported by a robust regulatory framework. Over the past decades, various European countries have introduced forward-thinking regulations that integrate ESG factors into financial markets. For instance, Germany's Renewable Energy Act (1991) offered tax incentives for wind energy investments, while the Netherlands' 'Green Savings and Investment Plan' (1995) provided tax deductions for green projects. Additionally, Belgium's 'Vandebroucke' law (2001) required pension funds to disclose their ESG considerations, highlighting the growing importance of sustainability in financial reporting. The increasing focus on sustainability has pushed France to require listed companies to include social and environmental information in their annual reports, a mandate that has significantly influenced corporate behavior across Europe (Renneboog, Ter Horst & Zhang, 2008). This regulatory backdrop underlines Europe's leadership in advancing sustainable investments, marked by a strong emphasis on integrating ESG factors into investment policies.

At the EU level, the European Climate Law sets an ambitious target for climate neutrality by 2050, reinforcing Europe's leadership in sustainable finance. European fund managers have become increasingly adept at measuring the social and environmental impacts of their investment strategies, reflecting the broader continental commitment to advancing a green and socially inclusive economy (Bermejo Climent, Figuerola-Ferretti Garrigues, Paraskevopoulos & Santos, 2021).

Global Sustainability Initiatives and Standards

On the global stage, several key frameworks and initiatives have shaped the trajectory of responsible investment. The United Nations Principles for Responsible Investment (UN PRI), launched in 2005, has been instrumental in encouraging financial institutions to incorporate ESG factors into their investment decisions (Diez-Cañamero et al., 2020). Europe stands out as a leader once again in this regard, with 53% of all PRI signatories as of April 2013, making it the region with the most signatories (Lean, Ang & Smyth, 2015). Nowadays, the PRI includes over 1,400 signatories from more than 50 countries, representing over $80 trillion in assets (Urban & Wójcik, 2019; Bermejo Climent et al., 2021). Despite widespread adoption,

full integration of ESG criteria remains unequal, with mainstream investors remaining hesitant to fully embrace sustainable investment practices (Friede, Busch & Bassen, 2015).

Another significant milestone was the introduction of the 17 Sustainable Development Goals (SDGs) in 2015 as part of the 2030 Agenda for Sustainable Development. These goals expand on the earlier Millennium Development Goals (MDGs) and address a broad range of issues, including climate change, inequality, and sustainable innovation. The SDGs provide 169 targets and 230 indicators, offering a structured framework to monitor global progress toward sustainability (Diez-Cañamero et al., 2020; Roncalli, 2022). Supporting frameworks such as the UN Global Compact and the SDG Compass provide practical tools for companies to align their strategies with these objectives (Khaled, Ali & Mohamed, 2021).

Key Sustainability Reporting Frameworks and Standards

The increasing regulatory demands and global initiatives have given rise to numerous reporting frameworks that standardize how organizations disclose their ESG performance. Among the most recognized are the Global Reporting Initiative (GRI) and the Task Force on Climate-Related Financial Disclosures (TCFD). The GRI provides comprehensive guidelines for reporting on economic, environmental, and social impacts, while the TCFD focuses on the financial risks associated with climate change (Urban & Wójcik, 2019; Roncalli, 2022).

More recently, the International Sustainability Standards Board (ISSB) established new benchmarks for sustainability reporting. The ISSB standards, which are integrated into the broader International Financial Reporting Standards (IFRS) framework, have quickly become the global standard for sustainability disclosures (Roncalli, 2022). These frameworks are crucial for organizations to measure and report their ESG performance in line with global objectives like the SDGs. Despite these frameworks' availability, businesses often face challenges in applying broad sustainability goals into quantitative company achievements (Diez-Cañamero et al., 2020; Roncalli, 2022).

The evolving regulatory landscape in Europe, together with global initiatives and reporting frameworks, reflects the increasing recognition of sustainability as a core component of financial decision-making. As regulatory standards and global frameworks continue to develop, aligning financial markets with sustainability goals will be crucial in driving meaningful progress towards a more sustainable global economy (Urban & Wójcik, 2019).

2.2.5. The Significance of ESG Ratings in Modern Finance

2.2.5.1. Definition and Conceptualization of ESG

In the previous chapter, the key concepts and terminology related to sustainable finance, particularly in the context of ESG, were introduced. Building on this foundation, this chapter delves into the three core dimensions of ESG, providing a detailed examination of their components and implications.

ESG is a comprehensive framework encompassing a wide range of financial strategies, including sustainable investing, SRI, impact investing, green investing, value-based investing, and TBL investing (Escobar-Anel & Jiao, 2024). Although these strategies differ in approach, they share the common goal of promoting sustainability while enhancing company and portfolio performance for stakeholder benefit. The growing trend among institutional investors to integrate ESG criteria into investment decision-making and portfolio management underscores the increasing relevance of these factors in global finance. The COVID-19 pandemic has further highlighted the importance of ESG principles by demonstrating the resilience of companies with strong sustainability practices (Li et al., 2022).

The Three Dimensions of ESG

The ESG framework is built upon three interconnected pillars: **E**, **S**, and **G**, each of which is critical for assessing corporate sustainability and guiding responsible investment decisions.

E: The environmental dimension focuses on assessing a company's impact on the natural environment through:

- Greenhouse gas emissions and carbon management.
- Resource efficiency, including energy, water, and material usage.
- Pollution and waste management strategies.
- Innovation aimed at developing eco-friendly products and sustainable business practices (Liang & Renneboog, 2020).

This dimension also addresses broader environmental challenges such as climate change, deforestation, biodiversity loss, and resource depletion. Companies are evaluated on

their efforts in areas like energy efficiency, waste management, and overall resource stewardship (Billio et al., 2021; Roncalli, 2022).

S: The social dimension evaluates how companies manage relationships with their workforce, customers, and society, focusing on:

- Employment quality, including worker health, safety, and development opportunities.
- Customer satisfaction and product safety.
- Corporate citizenship, including community engagement and social contributions (Liang & Renneboog, 2020).

Additionally, this pillar covers issues like gender equality, human rights, labor standards, and income distribution, all of which directly influence corporate reputation and social impact (Billio et al., 2021).

G: The governance dimension can be divided into two key aspects:

1. Traditional Corporate Governance:
    - Ensures management aligns with shareholders' long-term interests.
    - Includes safeguarding shareholder rights, ensuring board diversity and independence, implementing effective executive compensation policies, and preventing illegal practices such as fraud and bribery (Liang & Renneboog, 2020).

2. CSR-Specific Governance:
    - Emphasizes diversity, equity, and inclusion (DEI) within corporate leadership.
    - Focuses on the representation of minorities and inclusive decision-making processes (Liang & Renneboog, 2020).

Governance is further assessed based on board structure, shareholder rights, executive remuneration, and adherence to legal and ethical standards, all of which are essential for transparent and responsible corporate management (Billio et al., 2021; Roncalli, 2022).

Each pillar addresses different but interconnected aspects of corporate sustainability (Billio et al., 2021). As academics point out, understanding ESG requires a comprehensive

depiction of these dimensions, which collectively serve as the foundation for assessing sustainability and guiding responsible investment practices.

2.2.5.2. The Growing significance of ESG

The integration of ESG principles in financial markets and corporate governance has seen a significant rise, reflecting evolving societal expectations, regulatory developments, and shifting investor priorities. In 2022, the SIF reported that $7.6 trillion in U.S.-domiciled assets now include ESG criteria (Escobar-Anel & Jiao, 2024). This trend demonstrates the growing importance of ESG considerations, as the number of companies disclosing ESG data increased from less than 20 in the early 1990s to approximately 6,000 by 2014. Simultaneously, the asset management industry has undergone a significant transformation, with assets managed by UN PRI signatories expanding from a few hundred billion dollars in 2006 to more than $100 trillion by 2020 (Serafeim & Yoon, 2023).

This rise in ESG's significance is closely linked to increasing awareness of environmental and governance issues, particularly following the global financial crisis and corporate scandals (Billio et al., 2021). Sustainable investments increased by more than 38% between 2016 and 2018, with worldwide investments reaching $22.89 trillion in 2016. Sustainable finance is increasingly recognized as a tool for achieving sustainability by influencing corporate responsibility and ethical practices (Urban & Wójcik, 2019; Billio et al., 2021).

The appeal of ESG investing stems from its ability to balance ethical objectives with enhanced financial performance. By 2019, ESG-focused portfolios in major markets had surpassed $30 trillion, driven by both ethical reasons and the potential for higher returns with lower risk (Broadstock et al., 2021).

The growing integration of ESG criteria into financial markets and corporate governance represents a significant shift. As these principles become more thoroughly ingrained in investment strategies and corporate policies, ESG will play an increasingly important role in shaping the future of global finance.

2.2.5.3. ESG Ratings

Understanding ESG Ratings

ESG ratings are quantitative metrics provided by specialized rating agencies to evaluate a company's integration of ESG principles (Zhang, Hao, Gao, Xia & Zhang, 2024). Initially developed to meet the growing need for SRI, these ratings have now evolved into a critical component of non-financial information that supplements traditional financial analysis (Diez-Cañamero et al., 2020; Liang & Renneboog, 2020). Today, ESG ratings are commonly considered essential tools for evaluating how effectively a company manages risks associated with environmental impact, social responsibility, and corporate governance.

Despite their widespread adoption, ESG ratings face significant criticism concerning their objectivity and impartiality. Although presented as independent evaluations, the methodologies and criteria used by different rating agencies can differ considerably, leading to inconsistencies in results (Serafeim & Yoon, 2023). Such discrepancies raise concerns about the credibility of these ratings and whether they genuinely reflect a company's sustainability performance or merely mirror biases embedded in the data and methodologies applied by the agencies (Escrig-Olmedo et al., 2019).

As Horn (2023) emphasizes, ***"The purpose of ESG ratings is to measure the unmanaged ESG risk of a company."*** Ideally, these ratings should mitigate information asymmetries for stakeholders by offering clearer insights into a company's sustainability practices. Nevertheless, ongoing challenges related to consistency and transparency continue to drive the debate over the reliability and effectiveness of ESG ratings in precisely reflecting corporate sustainability.

What Are ESG Ratings Supposed to Measure?

ESG ratings aim to measure 'ESG quality,' but there is no single agreed-upon definition (Tayan, 2022). Broadly, there are two main views of ESG:

1. Stakeholder Impact: This perspective reflects a company's impact on stakeholders such as employees, suppliers, customers, communities, and the environment. Due to this viewpoint, improving ESG entails reducing harm or improving practices for stakeholders, even if

these initiatives may result in short-term costs incurred by shareholders. The long-term financial impact of such practices is often unclear. This "doing good" approach is common among individual investors.

2. Financial Materiality: This approach views ESG as a set of risks that need to be mitigated through planning and investment. The primary objective is to examine the impact of societal and environmental factors on the company, with the anticipation that mitigating these risks will ultimately provide advantages for both the company and its shareholders in the long run. This view is predominantly adopted by ESG rating providers.

These differing perspectives contribute to the divergence seen in ESG ratings and further complicate efforts to standardize ESG assessments.

The Role of ESG Rating Agencies

ESG rating agencies, such as MSCI, Sustainalytics, and Refinitiv, play a central role in the sustainability ecosystem by providing ratings that influence trillions of dollars in investments (Roncalli, 2022; Serafeim & Yoon, 2023). These agencies utilize proprietary methodologies that consider a broad range of factors, from environmental metrics like carbon emissions to governance issues such as board diversity (Escrig-Olmedo et al., 2019). Their primary objective is to deliver comprehensive assessments of companies' ESG risks and opportunities, offering investors actionable insights. Nevertheless, the lack of a universally accepted standard results in substantial disparities in the measurement and reporting of ESG performance (Tayan, 2022; Horn, 2023).

Several studies highlight that key players in the ESG rating market include major agencies like Refinitiv, MSCI, and Bloomberg, which the OECD identifies as leading providers (Dorfleitner, Halbritter & Nguyen, 2015; Tayan, 2022; Muck & Schmidl, 2024). These agencies employ methodologies involving hundreds of metrics that are weighted to produce an aggregate rating. However, recent evidence indicates substantial divergence in these ratings, sparking criticism regarding their reliability and usefulness (Chatterji, Durand, Levine & Touboul, 2016; Serafeim & Yoon, 2023).

Well-known rating agencies place significant emphasis on developing indicators that reflect corporate social and environmental responsibility (Li et al., 2023). Typically, ESG

agencies consider a wide array of factors, including company data, social initiatives, corporate governance, environmental performance, and relationships with stakeholders (Escrig-Olmedo, Muñoz-Torres & Fernández-Izquierdo, 2010). The services provided by these agencies have evolved throughout time. Historically, U.S. credit rating agencies like Moody's and S&P were pivotal in capital market growth by providing ratings for government bonds and financial instruments in the mid-20th century.

The origins of ESG ratings date back to the 1980s. The establishment of the first agency, EIRIS, in London in 1983 marked the beginning of ESG ratings in Europe (Berg, Köbel & Riggbon, 2022). In the United States, KLD was founded in 1990, initially catering to specialized investors like faith-based organizations. Over the past decade, the market for ESG ratings has expanded significantly, reflecting the growing demand for sustainable investment strategies. ESG ratings have become indispensable in guiding investment decisions, driving the parallel growth of sustainable finance.

What Are Quantified ESG Ratings?

Quantified ESG ratings reduce complex and multidimensional data to measure indices that reflect a company's overall ESG performance (Zhang et al., 2024). These ratings are based on a broad range of data sources, including company disclosures, third-party reports, and proprietary research, creating a structured index system aimed at quantifying corporate sustainability (Liang & Renneboog, 2020). Investors rely on these ratings to analyze a company's alignment with ESG principles and to anticipate market reactions to changes in ESG performance, allowing for better informed investment decisions (Zhang et al., 2024).

In theory, ESG ratings are intended to increase market transparency and provide a more complete picture of a company's risk profile. But, their practical application is often hampered by large discrepancies in how different providers calculate and interpret ESG metrics (Berg, Kölbel, & Rigbon, 2022). Moreover, these ratings are integral to non-financial reporting, providing an extra layer of analysis for investors trying to align their portfolios with sustainable practices. (Escrig-Olmedo, Muñoz-Torres & Fernández-Izquierdo, 2010).

ESG Ratings: A Compass without Direction

Despite the widespread adoption of ESG ratings, they have been consistently criticized for lacking objectivity and impartiality. Although these ratings are presented as independent assessments, significant variations exist in the methodologies and criteria used by different agencies, resulting in inconsistent and often conflicting outcomes (Serafeim & Yoon, 2023). For instance, Chatterji et al. (2016) document considerable disagreement across firms' social ratings, while Berg, Köbel & Rigbon (2019) point out that these divergences stem from differences in how raters measure, define, and weigh ESG criteria. Furthermore, Christensen, Hail & Leuz (2022) suggest that ESG ratings tend to diverge more as companies disclose more information, indicating that the understanding and application of ESG metrics are still in the early stages of development.

Gibson, Krueger & Schmidt (2019) provide further evidence of these discrepancies by highlighting that the average correlation between ESG scores from six major providers for S&P 500 firms is less than 0.5. They also note that the geographical location of data providers affects their perspectives: Raters in civil law countries tend to focus more on labor issues and social protection, while those in common law countries emphasize investor protection and governance. Kotsantonis & Serafeim (2019) stress that inconsistencies arise not only from varying definitions and criteria but also from differences in how rating providers report data, define peer groups, and impute missing ESG information. As a result, stakeholders face significant challenges when attempting to rely on ESG ratings for consistent analysis. Windolph (2011) identifies six key obstacles to transparent and objective ratings: lack of standardization, credibility issues, inherent biases, trade-offs, lack of transparency, and lack of independence (Billio et al.,2021). Billio et al. (2021) add that the absence of common standards often renders the assessment of a company's sustainability challenging and, in some cases, 'unratable.'

Methodological challenges play a critical role in exacerbating these issues, particularly due to the diverse criteria and methodologies employed by various agencies. For example, while MSCI evaluates 37 key ESG indicators, FTSE Russell assesses over 300, illustrating the vast differences in scope (Billio et al., 2021). Such disparities create confusion for investors who rely on these ratings for decision-making. Additionally, biases in data collection further complicate the reliability of ESG ratings. Larger companies with greater resources often receive better ratings due to more comprehensive reporting and effective reputation management (Liang & Renneboog, 2020). Companies located in regions with more stringent reporting

requirements may also score higher, irrespective of their actual sustainability practices (Escrig-Olmedo et al., 2019). Moreover, a 'halo effect' can occur, where strong performance in one ESG category leads to inflated ratings in others, even when the company's performance in those areas is weaker (Berg, Köbel & Riggbon, 2022). This bias distorts the overall evaluation and results in ratings that do not accurately reflect a company's true ESG performance.

The literature underscores that the divergence in ESG ratings raises fundamental concerns regarding their utility. This inconsistency across agencies undermine the reliability and validity of ESG ratings as instruments for assessing sustainability. Although ESG ratings have the potential to enhance transparency and offer investors valuable insights, their effectiveness is significantly compromised by methodological inconsistencies, biases in data collection, and varying approaches across rating agencies. Addressing these challenges is crucial for ESG ratings to serve as credible and reliable indicators of corporate sustainability.

Methodological Variations and Divergences: Navigating Inconsistent ESG Ratings

The variation in ESG ratings is principally caused by discrepancies in how rating agencies measure, define, and weight ESG criteria, which can be classified into three key areas: measurement, scope, and weight (Berg, Köbel & Rigbon, 2022).

Measurement divergence is the most significant driver, accounting for 56% of the range between ESG ratings (Berg, Köbel & Rigbon, 2022). This divergence occurs because different agencies use distinct indicators to evaluate the same ESG attributes. For instance, one agency might assess labor practices by examining workforce turnover, while another focuses on labor-related legal disputes (Escrig-Olmedo et al., 2019). Such discrepancies complicate cross-agency comparisons and undermine the credibility of ESG ratings, making it difficult for stakeholders to assess a company's actual performance (Chatterji et al., 2016). This disparity, is previously mentioned, is further accentuated by the 'halo effect,' which arises when high scores in one ESG category lead to inflated scores in others from the same rater, distorting the total assessment (Berg, Köbel & Rigbon, 2022).

Scope divergence is responsible for 38% of the inconsistencies and arises when rating agencies include different attributes in their ESG assessments. Some agencies may place more emphasis on environmental factors like carbon emissions, while others prioritize social issues such as community relations (Berg, Köbel & Rigbon, 2022). This variation in focus leads to

fragmented and even inconsistent assessments of a company's ESG performance (Escrig-Olmedo, Muñoz-Torres & Fernández-Izquierdo, 2010). The various viewpoints on what should be measured represent valid differences in user preferences, but they also underscore the difficulty of developing a uniform ESG rating system that serves all stakeholders.

Weight divergence, albeit accounting for only 6% of overall rating disparities, is nonetheless an important factor. It occurs when agencies assign different levels of importance to various ESG components. For example, one provider may prioritize governance metrics, while another focuses more on environmental factors (Berg, Köbel & Rigbon, 2022). Aligning these weighting schemes could reduce discrepancies, but it does not fully address the broader issues stemming from measurement and scope divergence (Roncalli, 2022).

The core of the issue lies in how ESG ratings are constructed. Measurement disparities are the primary cause of divergence since they arise from fundamental disagreements about the underlying data, rather than from conflicting definitions or preferences. (Berg, Köbel & Rigbon, 2022). While various perspectives on which ESG categories are relevant can be considered as valid and even desirable, given the diverse needs of users, measurement divergence is problematic when ESG ratings are intended to be based on objective, verifiable observations. This inconsistency raises serious concerns regarding the credibility and comparability of ESG ratings from various providers.

Implications of Divergent ESG Ratings

The inconsistency in ESG ratings has significant consequences:

- **Investment Decisions:** Divergent ratings create uncertainty for investors, potentially leading to misallocations of capital (Zhang et al., 2024). This variability makes it difficult to distinguish between truly sustainable organizations and those who benefit from favorable, but potentially false, ratings. (Roncalli, 2022). Furthermore, ESG ratings are increasingly used in portfolio construction and trading decisions by investment managers who manage trillions of dollars in assets, influencing financial markets (Serafeim & Yoon, 2023). Given that ESG ratings are often multidimensional and difficult to assess consistently, these issues can lead to substantial challenges in evaluating investment opportunities accurately.

- **Corporate Strategy:** Companies get inconsistent signals regarding their ESG performance, which can reduce their motivation to improve if they cannot determine how their efforts will be reflected in their ratings. (Christensen, Hail & Leuz, 2022). Moreover, inconsistent ratings make it challenging for companies to align with best practices. ESG ratings are also known to have biases; for instance, larger companies may receive better ratings due to more extensive resources for ESG disclosures and reputation management (Liang & Renneboog, 2020).

- **Empirical Research and Policy:** Diverging ratings complicate academic research and policy-making, leading to contradictory findings that hinder consistent insights into the impact of ESG practices (Chatterji et al., 2016; Diez-Cañamero et al., 2020). This fragmentation also complicates regulatory efforts aimed at standardizing ESG reporting. Notably, the divergence in ratings introduces uncertainty into empirical studies, affecting their conclusions and making it difficult to draw robust insights from ESG data.

- **Market Efficiency:** If financial markets cannot reliably assess ESG risks, asset prices may not accurately reflect a company's sustainability efforts, leading to potential mispricing and inefficiencies (Tayan, 2022). The lack of clarity regarding how to assess ESG ratings accurately has also contributed to persistent rater disagreements, which continue to increase over time (Christensen, Hail & Leuz, 2022).

Addressing the Challenges of ESG Rating Divergence

To address the divergence in ESG ratings, several strategies have been proposed (Berg, Köbel & Rigbon, 2022):

- **Multiple Ratings:** Investors can include several ESG ratings to measure 'consensus ESG performance' (Liang & Renneboog, 2017). This approach helps mitigate the effects of individual rating biases by combining different perspectives.

- **Specific Rating:** Another strategy is to use a single ESG rating focused on a specific company characteristic, ensuring that the rating aligns closely with the investor's goals (Berg, Köbel & Rigbon, 2022). This requires a detailed explanation of why that rating is acceptable for the proposed analysis.

- **Sub-categories:** Focusing on specific ESG sub-categories, such as greenhouse gas emissions or labor practices, can help avoid scope and weight divergence, though the risk of measurement divergence remains (Berg, Köbel & Rigbon, 2022). Ideally, this analysis should be based on independently verifiable raw data. When raw data is not available, the processes for generating data should be scrutinized, and non-transparent sources should be approached with caution. Collecting and sharing high-quality ESG data is essential for reducing rating discrepancies and improving the overall reliability of assessments.

Conclusion of ESG ratings

ESG ratings are critical instruments for assessing company sustainability, but their effectiveness is severely limited by numerous methodological problems. The lack of uniform methodologies to measurement, scope, and weighting across rating providers results in differences that impair the reliability and comparability of the ratings (Berg, Köbel & Rigbon, 2022; Avramov, Cheng, Lioui & Tarelli, 2022; Zhang et al., 2024). As the well-known management theory attributed to William Thomson Kelvin states, ***"What is not defined cannot be measured; what is not measured cannot be improved; what is not improved inevitably deteriorates."*** To address these challenges, there is an urgent need for increased transparency, standardization, and greater collaboration among key stakeholders in the ESG landscape, including investors, companies, rating agencies, and regulators.

2.2.5.4. ESG Strategies: Performance Assessment and Practical Implementation

The increasing importance of ESG performance in investment decisions has drawn significant attention from both researchers and practitioners. ESG metrics have become vital for assessing a company's sustainability and ethical impact. As Li et al. (2023) highlight, the systematic analysis of ESG reports and ratings are now essential for effective corporate development and financial management, reflecting the broader consensus that ESG considerations are central to responsible business strategy.

While investment approaches vary depending on investor preferences, ESG strategies consistently converge around seven core methods. Leading sources, such as Roncalli's *"Handbook of Sustainable Finance"* (2022), Boffo & Patalano's OECD study (2020), and the Global Sustainable Investment Alliance's 2022 report, present variations of these approaches with slightly different terminologies but share consistent principles for sustainable investing practices.

The primary ESG strategies can be categorized as follows:

- **Negative/ Exclusionary Screening:** This strategy excludes sectors or companies deemed harmful to society or the environment. According to Liang & Renneboog (2020), it typically avoids industries such as tobacco, alcohol, and weapons. Additional common exclusions include human rights violations, cluster bombs, and animal testing (Ballate, 2018). Exclusions may be driven by clear mandates or financial concerns, such as the risk of value loss due to potential regulations or boycotts (Horlacher & Koutsoukis, 2017). Common exclusion criteria in Europe include controversial weapons, gambling, pornography, nuclear energy, and genetically modified organisms (Eurosif, 2018). While straightforward to implement, Lean, Ang, & Smyth (2015) argue that Negative Screening can lead to less diversified and potentially riskier portfolios. Revelli & Viviani (2015) also note that this approach is more common in the US but often results in limited diversification by excluding entire sectors. Liang & Renneboog (2020) further emphasize that this constraint on portfolio optimization can lead to higher costs and lower returns.

- **Positive/ Best-in-Class Screening:** Positive screening selects companies demonstrating superior ESG performance within their sectors. Berry & Junkus (2013) explain that this approach rewards firms with strong social and environmental practices, encouraging improvement rather than exclusion. Positive screens typically focus on areas such as corporate governance, labor relations, and sustainability (Renneboog, Ter Horst & Zhang, 2008). In contrast to the US, where Negative Screening dominates, European investors often favor this Best-in-Class approach (Revelli & Viviani, 2015).

- **ESG Integration:** The ESG integration approach explicitly incorporates ESG risks and opportunities into financial analysis and investment decisions (Wild, 2017). Managing over $10.3 trillion in assets, it is the second-largest sustainable investment strategy (Wild, 2017). Billio et al. (2021) emphasize that this approach is comprehensive, although it relies heavily on qualitative inputs from ESG rating agencies. By systematically embedding ESG factors into traditional financial analysis, this strategy allows investors to assess both risks and opportunities related to ESG issues (Ballate, 2018; Billio et al., 2021; Horn, 2023).

- **Sustainability Themed Investing:** This strategy focuses on specific sustainability themes, such as clean energy, pollution reduction, or sustainable agriculture. Investors target industries or companies directly contributing to these themes, aligning financial goals with long-term environmental and social objectives (Ballate, 2018; Billio et al., 2021).

- **Impact/ Community Investing:** Impact investing seeks both financial returns and measurable social or environmental outcomes (Ballate, 2018; Billio et al., 2021). Roncalli (2022) notes that this strategy typically targets projects such as social housing or renewable energy, focusing on high-impact outcomes that would not be possible without targeted capital.

- **Corporate Engagement and Shareholder Activism:** This approach involves using shareholder influence to drive corporate change. Through direct dialogue or shareholder proposals, investors aim to enhance company practices regarding ESG issues, promoting greater transparency and accountability (Ballate, 2018; Billio et al., 2021).

- **Norm-Based Screening:** Norm-based screening focuses on investing in companies that meet internationally recognized ethical standards. This strategy can exclude firms, even if they meet basic ESG criteria, if they operate in controversial sectors such as weapons or tobacco (Billio et al., 2021; Roncalli, 2022).

While these strategies provide several options for sustainable investing, they also present obstacles and complexities (Dorfleitner, Halbritter & Nguyen, 2015; Billio et al., 2021). Investors, as noted by Berry & Junkus (2013), often assess a corporation's social responsibility based on its overall behavior rather than through rigid exclusions. They tend to favor a balanced approach that evaluates firms based on a nuanced assessment of their SR profiles rather than simply eliminating companies based on specific products or practices. This perspective suggests that the traditionally screened 'bad' products may not always be the worst in investors' eyes, as they often prioritize positive actions over avoidance. Yet, many SRI funds continue to prioritize exclusionary approaches, which may limit the broader appeal and expansion of sustainable investing.

As ESG investing grows, with global assets surpassing $30 trillion in 2018 (GSIA, 2018), these strategies become increasingly important for aligning portfolios with ethical and sustainability objectives. On the other hand, as Horn (2023) points out, careful attention is essential when implementing these strategies, particularly in terms of trade-offs in risk management and portfolio diversification. Each strategy has distinct benefits and limitations, emphasizing the need of aligning investing decisions with both financial goals and ethical ideals.

2.2.5.5. Comparative Analysis: ESG vs. Credit Rating

When comparing ESG ratings with traditional credit ratings, distinct differences and key similarities emerge, influencing how investors and stakeholders assess companies. According to Billio et al. (2021), credit ratings are based on well-defined and standardized metrics, such as creditworthiness, while ESG measurements are characterized by ambiguity due to the absence of consistent definitions, uniform reporting standards, and shared criteria across ESG components and rating providers. Credit rating agencies have long-established methodologies for evaluating a company's ability to meet its financial obligations, whereas ESG ratings are relatively new and lack comparable standardization.

Escrig-Olmedo, Muñoz-Torres, & Fernández-Izquierdo (2010) underscore the role of ESG rating agencies as intermediaries between stakeholders and companies, a role that has expanded as financial markets have evolved and regulations surrounding E, S and G disclosures have increased. Unlike traditional credit rating agencies, which focus primarily on financial health and stability, ESG rating agencies apply unique methodologies, often relying on complex questionnaires and public data analysis. The criteria used by these agencies are frequently integrated into prestigious sustainability indices, signaling a company's commitment to ESG principles.

Berg, Köbel, & Rigbon (2022) highlight that while both ESG and credit ratings serve to screen companies, they fundamentally differ in their underlying definitions, reporting standards, and financial models. Creditworthiness is clearly defined as the probability of default, whereas ESG performance remains an abstract, value-driven concept that varies between agencies. Financial reporting standards have matured over time, leading to high consistency among credit ratings, with a correlation of 99% between agencies. As outlined earlier, ESG ratings exhibit significant discrepancies due to differing and often voluntary reporting standards, resulting in inconsistent assessments across providers.

Additionally, the financial models underpinning these ratings differ. ESG rating agencies are typically funded by investors seeking insights into sustainability, which mitigates concerns around biased ratings that can arise in the credit rating industry, where companies often pay for their own evaluations – a practice that may lead to rating shopping (Berg, Köbel, & Rigbon, 2022).

Further Roncalli (2022) discusses the mathematical frameworks behind scoring models in both credit and ESG contexts, noting that while structural similarities exist – such as concepts of materiality and risk – these models differ in their execution. Credit scoring employs a supervised model designed to predict short-term default probability using historical data, while ESG scoring is typically unsupervised, with the score itself serving as a measure of sustainability. ESG scoring on the other hand, faces substantial challenges, such as the absence of a clear response variable, leading to reliance on rule-based methods rather than calibrated models. This, in turn, creates issues related to performance evaluation, score consistency, and back testing, rendering ESG scores less robust than traditional credit scores.

While both ESG and credit ratings are indispensable tools for company assessment, they differ fundamentally in principles, methodologies, and frameworks. ESG ratings remain fragmented and less standardized, reflecting the evolving and complex nature of sustainability assessments compared to the established practices in credit risk evaluation.

These differences have profound implications for transparency and information asymmetry in financial markets. Credit ratings benefit from well-established standards, reducing information gaps and offering consistent assessments. Conversely, the lack of standardization in ESG ratings often leads to confusion, increasing information asymmetry and limiting their utility in investment decision-making. Research by Czerwińska & Kaźmierkiewicz (2015) underscores the significant information gap in ESG reporting, particularly in markets such as Poland, where non-financial data reporting remains inconsistent. This asymmetry affects capital market participants – investors, portfolio managers, and issuers – by reducing transparency and increasing forecasting errors in risk-return profiles. Across Europe, information asymmetry varies, with no uniform, comprehensive, and systematic assessment of ESG-related risks across public companies.

Furthermore, as highlighted by Horn (2023), increased ESG transparency enhances firm value by mitigating reputational risk, reducing information asymmetry, lowering agency costs, and easing capital constraints. Despite these benefits, regulatory frameworks have yet to fully integrate financial sustainability. As Urban & Wójcik (2019) point out, there is a significant regulatory deficit in addressing the systemic risks posed by climate change, signaling an urgent need for comprehensive financial regulations.

Looking ahead, ESG rating agencies could enhance transparency and consistency by adopting best practices from credit rating methodologies, such as standardized reporting, refined evaluation frameworks, and data-driven approaches. Aligning closer to the structured frameworks of credit ratings could transform ESG assessments into more reliable and transparent tools, better suited to the demands of sustainable finance and responsible investing, ultimately fostering greater market confidence and reducing information asymmetry.

2.2.6. Evaluating the Influence of Sustainability on Portfolios

After establishing the theoretical foundations of this thesis, this section will examine various studies and their findings on the impact of sustainability on portfolio performance.

The integration of sustainability into investment portfolios has become a focal point for both academics and practitioners, particularly in terms of understanding its effects on portfolio risk, return, and diversification. This section explores the impact of ESG factors, CSR, and SRI on financial performance, presenting various findings and research results.

The Impact of ESG Strategies on Portfolios

Czerwińska & Kaźmierkiewicz (2015) emphasize the significant impact of ESG factors on portfolio risk. Their research demonstrates that enhanced transparency in disclosing non-financial ESG data by public companies leads to lower return rate volatility, thereby reducing overall portfolio risk. Companies with higher ESG ratings tend to exhibit less volatility and more accurate forecasting, highlighting the stabilizing effect of ESG factors on portfolio performance. They also point out that while ESG criteria can reduce risk, their impact on portfolio efficiency varies, with some studies revealing negative effects resulting from exclusion of specific stocks (Chong, Her & Phillips, 2006), and others finding positive outcomes from ESG-based selection strategies (Statman, 2006).

Further supporting this positive relationship, Giese et al. (2019) found that ESG information positively improves company valuations and performance by lowering systematic risk, which leads to reduced capital costs and higher valuations. Their study, using MSCI ESG data, shows that improvements in ESG ratings correlate with better financial outcomes, particularly through reduced idiosyncratic risk and increased profitability.

Pedersen, Fitzgibbons & Pomorski (2021) also emphasize the financial benefits of ESG integration, demonstrating that portfolios including ESG information could achieve a 12% higher SR compared to those ignoring ESG factors. But they warn that excessively high ESG scores may somewhat diminish the SR, implying that a balanced approach to ESG integration is crucial for optimizing financial performance.

A seminal contribution by Friede, Busch & Bassen (2015) offers a comprehensive overview of the relationship between ESG and financial performance. Their meta-analysis of over 2,200 empirical studies found that nearly 90% of the cases showed a non-negative relationship between ESG criteria and financial performance, with the majority reporting positive results. This suggests that *"investing in ESG pays financially"* (Friede, Busch & Bassen, 2015). The consistency of these findings over time indicates that the financial benefits of ESG integration are both stable and enduring. Atz et al. (2023) extended this analysis by reviewing nearly 1,200 primary papers and 27 meta-reviews published between 2015 and 2020. Their findings confirmed earlier conclusions, demonstrating that ESG strategies generally do not lead to inferior financial performance compared to traditional investment strategies. They also identified a substantial positive correlation between broader sustainability practices and financial performance, further validating the financial viability of ESG integration.

Several studies specifically examining ESG portfolio performance reinforce the financial advantages of ESG integration. Kempf & Osthoff (2007) found that strategies involving the purchase of highly socially responsible stocks, and the sale of less socially responsible stocks yielded significant abnormal returns, which remained robust even after accounting for transaction costs. Similarly, Statman & Glushkov (2009) observed that socially responsible investors generally achieved better returns than conventional investors, while noting that the systematic exclusion of certain 'sin stocks' could potentially penalize returns.

The Impact of CSR Strategies on Portfolios

CSR's impact on firm performance and its connection to economic returns is well-documented. Zhichuan Li et al. (2019) provided key insights by creating a value-weighted portfolio based on the '100 Best CSR Companies in the World' and analyzing the effects of CSR activities on stock market performance. Their study found that companies actively engaged in CSR initiatives, particularly those focused on external communities, workplace environments, and management practices, achieved significant abnormal returns. They concluded that CSR activities are positively correlated with financial performance, and when CSR is embedded as a long-term strategic approach, it can yield sustained benefits for shareholders.

Liang & Renneboog (2020) conducted further research on CSR, revealing considerable differences in CSR performance across different countries. Their study found that firms in common law countries, such as those in the Anglo-American and Commonwealth regions, generally

have lower ESG scores. In contrast, firms in civil law countries, particularly Scandinavian companies, tend to have higher ESG scores, with German-type civil law firms excelling in environmental performance and French-type civil law firms leading in social engagement. These findings underscore the importance of regional and legal contexts in shaping CSR practices and their impact on financial outcomes.

The Impact of SRI Strategies on Portfolios

Revelli & Viviani (2015) conducted an extensive study to assess the financial performance of SRI portfolios relative to conventional investments. Their findings indicate that incorporating CSR and ethical considerations into portfolio management does not result in significant differences in financial performance when compared to conventional investments. This study, based on 20 years of data, reflects the mixed results often found in SRI performance studies, where the relationship between ethical investing and financial returns can vary widely depending on the methodologies and markets analyzed.

In a related study, Bello (2005) examined the effects of ethical and moral screening on portfolio diversification and performance. His research found no significant differences between socially responsible and conventional mutual funds in terms of asset characteristics, diversification, and overall investment performance. This is consistent with earlier studies, such as those by Hamilton, Joe, & Statman (1993) and Sauer (1997), which found that social screens do not significantly impact investment performance or increase investor risk.

Research on the diversification effects of SRI funds has produced mixed results. Jones, van der Laan, Frost & Loftus (2008) and Renneboog, Ter Horst & Zhang (2008) suggest that SRI portfolios may underperform relative to conventional portfolios due to reduced diversification. Other studies, such as those by Gil-Bazo, Ruiz-Verdú & Santos (2010) and Climent & Soriano (2011), argue that SRI funds perform on par with conventional portfolios, pointing out that the effects of SRI on diversification and performance are not uniformly negative and may depend on specific fund management strategies and market conditions.

In summary, while the integration of ESG, CSR, and SRI factors into investment portfolios is generally associated with positive or at least non-negative financial outcomes, the relationship is complex and influenced by various factors, including market conditions, management strategies, and the specific criteria used. The ongoing debate in the literature reflects the

multifaceted nature of sustainable investing, where potential benefits must be carefully weighed against the associated risks and trade-offs.

2.2.7. Resilience of Sustainability Strategies during Crises

The resilience of ESG strategies in times of crises has received considerable attention, particularly in the light of the COVID-19 outbreak and the ongoing Russia-Ukraine conflict. The COVID-19 pandemic underscores the global economy's vulnerability (Díaz, Esparecia & López, 2022), providing a unique opportunity to evaluate whether investor's view ESG performance as a predictor of future stock performance or as a tool for risk mitigation (Broadstock et al., 2021). Following the analysis of studies conducted in stable periods, this chapter investigates the performance of sustainability-focused investment strategies in times of economic turmoil.

The Impact of Sustainability Strategies during COVID-19

Evidence on ESG strategies throughout the pandemic reveals mixed results, but it also emphasizes a significant shift in investment strategies (Zhang et al., 2024), with a growing emphasis on sustainability.

Zhang et al. (2024) observed that the crisis led to increased trading activity in companies with strong ESG ratings, especially in regions severely hit by the pandemic. This shift underscored the importance of ESG ratings in enhancing stock liquidity and attracting investment under crises conditions.

Li et al. (2023) noted that many companies responded to the pandemic by taking on greater social responsibilities, which in turn bolstered their reputations. Similarly, Engelhardt, Ekkenga & Posch (2021) found that European firms with high Refinitiv ESG scores experienced higher abnormal returns throughout the pandemic, driven largely by the social component of ESG (Kick & Rottmann, 2022). These findings align with Albuquerque, Koskinen, Yang & Zhang (2020), who reported that U.S. firms with strong Refinitiv E and S ratings also fared better in the first quarter of 2020, reinforcing the notion that robust ESG performance can act as a buffer amid financial crises. Further supporting this, Li et al. (2022) found that ESG performance was positively associated with cumulative abnormal returns over the course the pandemic in China. This suggests that ESG factors played a critical role in mitigating downside risks and were perceived by investors as a signal of future returns and effective risk management in times of crises (Li et al., 2022).

Positive evidence supporting the resilience of ESG strategies over the pandemic includes findings from Broadstock et al. (2021), who reported that high ESG portfolios in China outperformed low ESG portfolios, significantly reducing financial risk throughout the pandemic. Likewise, Ferriani & Natoli (2020) observed that funds with low ESG risk scores attracted positive inflows during the market collapse, while higher-risk ESG funds experienced selloffs, with low-risk funds ultimately performing better. Singh (2020) also demonstrated that risk-averse investors sought refuge in CSR portfolios in the course of the crisis.

Studies by Bermejo Climent et al. (2021) and Billio et al. (2021) further highlight the increasing importance of ESG investing, especially in times of crises. Nofsinger & Varma (2014) also found that socially responsible mutual funds outperformed in periods of market downturns, further supporting the notion that ESG-focused strategies, particularly those emphasizing shareholder advocacy and ESG issues, can provide superior risk-adjusted returns in challenging times.

On the flipside, Lean & Pizzutilo (2021) warn that the risk-return profiles of socially responsible investments can vary significantly between crisis and non-crisis periods, implying that the benefits of ESG strategies may be more context-dependent.

Despite these positive findings, some studies present a more nuanced picture. Bae, El Ghoul, Gong & Guedhami (2021) found no significant impact of CSR on stock returns during the crash, using data from 1,750 U.S. firms. Comparably, Pástor & Vorsatz (2020) noted that while investors favored funds with high sustainability ratings, the performance results were inconclusive. Pavlova & de Boyrie (2021) found that higher sustainability ratings did not protect ETFs from losses in the 2020 crash, although these funds did not underperform compared to the market.

The COVID-19 pandemic is increasingly seen as a turning point for responsible business practices, with investors placing greater scrutiny on CEOs' efforts to protect broader ecosystems (Dai, 2022). This shift has unleashed a growing demand for accountability in corporate sustainability. While the pandemic led to negative shocks in stock prices for some products and firms, studies consistently show that ESG performance is positively linked to cumulative abnormal returns, even in the face of contrary expectations from some scholars (Li et al., 2022).

Numerous studies indicate that sustainability strategies can sustain a positive or neutral impact, even in the face of unpredictable crises. When comparing these findings to those from more stable periods, significant differences are not always apparent, indicating that further investigation is required. It is noteworthy that, despite expectations of potentially negative outcomes amid crises, most studies have shown results that are either positive or not worse than in normal times, particularly in comparison to the COVID-19 crisis. This demonstrates that sustainability has had a favorable influence on markets and portfolios, even in challenging times.

The Impact of Sustainability Strategies during the Russia-Ukraine Conflict

In contrast to the extensive research on ESG strategies throughout the COVID-19 pandemic, studies analyzing the impact of the Russia-Ukraine conflict on ESG investments are still relatively limited due to the ongoing nature of the conflict. Tensions had been escalating since the annexation of Crimea in 2014, with a notable increase in geopolitical strain following the publication of Putin's article *"On the Historical Unity of Russians and Ukrainians"* in July 2021. Despite these rising tensions, the year 2021 was largely perceived as 'normal' by the financial markets. By January 2022, leading stock indices like MSCI World, Dow Jones, and the DAX had reached new all-time highs, indicating that investors had not anticipated the impending conflict (Kick & Rottmann, 2022).

Kick & Rottmann (2022) found that, while ESG scores, particularly in the ecological dimension of Refinitiv's ESG rating, had some influence on cumulative abnormal returns in the early stages of the conflict, the overall effects were economically insignificant. This suggests that ESG ratings may not provide significant protection against unforeseen geopolitical events like the Russia-Ukraine war.

Given that this conflict is still ongoing, empirical evidence on ESG performance remains limited. Consequently, this thesis will primarily focus on the impact of ESG strategies during the COVID-19 pandemic, where more extensive data is available, with further exploration in the subsequent data analysis. Future research will be necessary to fully understand the role of ESG investments in the context of the Russia-Ukraine conflict and other geopolitical crises.

3. Development of the Central Research Questions

To effectively transition from the theoretical framework to the practical analysis in this thesis, it is essential to articulate central and critical research questions. These questions will guide the interpretation and evaluation of previously collected data and calculations.

Given the increasing emphasizing on crises and sustainability in current research, as discussed in the preceding chapters, the following research questions have been developed:

1. Do Sustainability-focused strategies outperform Traditional strategies?

2. Within the context of the two crises and across the three sub-periods analyzed, do Sustainability-focused strategies demonstrate superior performance compared to Traditional strategies?

3. Do ESG ratings impose constraints on diversification that could potentially limit investment performance?

These questions will be thoroughly explored and addressed in the subsequent sections, providing a rigorous interpretation of the empirical data.

4. Data and Methodology

To build upon the theoretical foundation established in the previous sections, which included a comprehensive literature review and the development of critical research questions, this chapter outlines the methodology employed to empirically test the proposed theories.

The chapter focuses on the process of data collection and portfolio construction. The dataset for this analysis was sourced from Refinitiv, a well-known provider of sustainability data, ensuring the robustness and depth needed for a thorough evaluation. This dataset facilitated the implementation and comparison of various investment strategies. Critical aspects of the methodology, such as the selection of the data source, the analysis period, and the identification of relevant markets and companies, are discussed, as they underpin the portfolio construction process. Furthermore, the steps involved in constructing and calculating the portfolios are explained, allowing for a meaningful comparison of their performance in addressing the research questions.

The primary objective of this analysis is to provide empirical insights that directly respond to the developed research questions, thereby supporting the discussions and conclusions presented in subsequent chapters.

4.1. Data Collection

4.1.1. Data Source Selection and Database Overview

The data employed in this study was acquired via LSEG Workspace, a platform managed by LSEG Data & Analytics, which underpins the entirety of this analysis. Globally acknowledged as one of the largest and most authoritative data providers, LSEG operates under the well-recognized name Refinitiv. Assessing the Refinitiv database, a widely used resource in academic research (Garcia, Mendes-Da-Silva & Orsato, 2017; Uyar, Karaman, Kilic, 2020; Khaled, Ali & Mohamed, 2021; Dai, 2022; Lin & Swain, 2024; Muck & Schmidl, 2024), provides a solid and dependable basis for obtaining ESG ratings, which are crucial for the assessment of corporate sustainability performance.

Refinitiv has established itself as a leading provider of ESG data, extensively utilized in both academic research and practical applications because of its transparency and

comprehensive coverage, which spans over 70% of global market capitalization (Wang, Wang & Yan, 2024; Tayan, 2022). The Refinitiv ESG scores are based on a rigorous methodology that evaluates over 400 company-level ESG measures. Of these, 178 key indicators are systematically organized into ten categories, which are further divided into three primary pillars: E, S, and G (Khaled, Ali & Mohamed, 2021). This detailed structure provides a robust framework for assessing corporate sustainability performance, making Refinitiv ESG scores indispensable in sustainable investing and scholarly research, as evidenced by their citation in over 1,200 academic articles by the end of 2020 (Berg, Köbel & Rigbon, 2019; Rajesh, 2020).

While Refinitiv's data-driven approach enhances the transparency and usability of ESG ratings, some studies have identified potential biases, such as a tendency for larger companies to receive higher scores (Drempetic, Klein & Zwergel, 2020; Dobrick, Klein & Zwergel, 2023). Despite these concerns, Refinitiv's ESG scores continue to be widely regarded as a critical resource for evaluating firms' sustainability efforts and are frequently employed as a proxy for corporate sustainability performance in the literature (Muck & Schmidl, 2024).

The empirical analysis conducted in this thesis utilized a diverse array of data obtained from the Refinitiv database. This encompassed companies' historical prices and characteristics, including industry classifications, as well as detailed ESG scores. The data was methodically retrieved from the platform and organized into several Excel files, serving as the fundamental foundation for following computations and thorough data analysis.

4.1.2. Analysis Period

The period selected for this analysis was carefully chosen to balance recency and relevance, providing the necessary data for a robust empirical study while avoiding an overly broad scope that could complicate the analysis. The timeframe had to be sufficiently comprehensive to ensure that the research questions posed in this thesis could be fully addressed.

The six-year period, from January 1, 2018, to December 31, 2023, was found to be both relevant and significant for this study, particularly when considering the notable global events during this time. To facilitate a more detailed analysis and to emphasize potential differences between distinct phases, the sample period has been further divided into three sub-periods. This subdivision is crucial to adequately answering the research questions outlined in this thesis.

The first sub-period, January 1, 2018, to December 31, 2019, represents the pre-pandemic phase, serving as a baseline before the onset of the COVID-19 pandemic. The second sub-period, from January 1, 2020, to December 31, 2021, captures the period of the first and second waves of the pandemic, providing insights into the immediate impacts of this global health crisis. The final sub-period, January 1, 2022, to December 31, 2023, encompasses the recovery phase, which is also marked by the ongoing Russian-Ukrainian conflict.

This segmentation of the sample period into distinct sub-periods is essential for the analysis, enabling a nuanced examination of the different phases and their respective impacts. It provides a methodical approach to understand the complex dynamics that have influenced the research topic, thereby contributing to a comprehensive and insightful thesis.

4.1.3. Selection of Markets and Analysis of Key European Stock Indices

The analysis conducted in this thesis focuses on companies headquartered in the EU, specifically those based in countries using the Euro as their currency. This strategic focus was chosen to ensure consistency in market characteristics and to avoid the complexities associated with including companies from different continents, which could introduce significant variations in market size, macroeconomic environments, and currency exchange rates. As a result, only industrialized countries were chosen, with emerging markets excluded, to maintain an emphasis on developed European economies, while the findings may not be directly transferable to non-European or emerging market scenarios.

Country indices were not directly used in the analysis. Instead, the analysis centered on individual companies, allowing for a more in-depth examination of corporate performance. Funds and ETFs were also excluded to guarantee that the analysis was based on raw data from individual companies, with a focus on historical prices and specific corporate characteristics.

While a broader geographical scope may have been considered, the study ultimately concentrated on companies with headquarters in five European countries: France, Germany, Italy, the Netherlands, and Spain. These countries were chosen due to their similar market sizes, economic significance, and the widespread usage of the Euro, which simplified the analysis by eliminating the need for currency conversion. This approach was intended to facilitate a comprehensive examination of the European market while minimizing the influence of external variables.

The five selected stock indices from these countries - the DAX (Germany), CAC 40 (France), FTSE MIB (Italy), AEX (Netherlands), and IBEX 35 (Spain) - provide essential context for the selection of companies in this study. Although these indices share certain characteristics, such as market capitalization-weighted methodology and sectoral diversity, they also exhibit distinct features that make them unique indicators of their respective national economies (Yahoo Finance, 2024). However, this analysis does not conduct a sectoral comparison among the selected countries, as the wide range of sectors represented by the companies involved, as shown in Table 1, would render such a comparison less meaningful and difficult to interpret.

The DAX, established on July 1, 1988, is Germany's leading stock market index. Consisting of the 40 largest and most liquid companies listed on the Frankfurt Stock Exchange, it serves as a crucial indicator of the German economy. Originally composed of 30 companies, the index was expanded to 40 constituents in 2021 to better capture the economic diversity and complexity of Germany. The DAX is a performance index, meaning it integrates both dividends and price changes into its calculation and is updated every second during trading hours. Encompassing a broad array of sectors, including automotive, technology, finance, and consumer goods, the DAX provides a comprehensive overview of market trends in Germany and across Europe (DAX Index, 2024; Yahoo Finance, 2024; Refinitiv, 2024).

Similarly, the CAC 40, launched on December 31, 1987, is France's foremost stock market index. It monitors the 40 largest companies listed on the Euronext Paris exchange and serves as a critical benchmark for the French economy. The CAC 40 is a price index, excluding dividends from its calculations, and is updated every 15 seconds during trading hours. It spans major sectors such as luxury goods, energy, financial services, telecommunications, and consumer goods, making it a significant reference for investors globally (Yahoo Finance, 2024; Refinitiv, 2024).

The FTSE MIB is Italy's primary stock market index, representing the 40 largest and most liquid companies listed on the Borsa Italiana in Milan. Launched in 2009 as the successor to the MIB 30 index, the FTSE MIB employs a free-float market capitalization-weighted methodology. It spans key sectors such as banking, energy, telecommunications, and manufacturing, and is updated in real-time during trading hours, making it a pivotal indicator of Italy's economic performance (FTSE MIB Index, 2024; Yahoo Finance, 2024; Refinitiv, 2024).

The AEX, established on March 4, 1983, is the principal stock market index in the Netherlands. It includes the 25 largest companies listed on Euronext Amsterdam and operates as a price index, excluding dividends from its calculations. Updated every 15 seconds during trading hours, the AEX encompasses sectors such as technology, financial services, consumer goods, and energy, reflecting the Dutch economy's strong international orientation and innovation-driven nature (Yahoo Finance, 2024; Refinitiv, 2024).

The IBEX 35, Spain's leading stock market index, was established on January 14, 1992, and comprises the 35 most liquid and largest companies listed on the Bolsa de Madrid. This market capitalization-weighted index considers the free-float shares of its constituents and is

updated in real-time during trading hours. The IBEX 35 spans several critical sectors, including banking, telecommunications, energy, and construction, providing valuable insights into broader economic trends within Spain (Yahoo Finance, 2024; Refinitiv, 2024).

By concentrating on these key European markets and their representative indices, the analysis seeks to provide a detailed and nuanced understanding of the economic environment, thereby enabling a precise evaluation of corporate performance across diverse sectors.

4.1.4. Selection of Companies for Analysis

In this analysis, the selection of portfolios was carefully designed to ensure a dataset of adequate size and diversity, allowing for a thorough examination while avoiding the complications associated with excessive data management. The final portfolios were constructed to include a broad range of companies with varying characteristics across different industries, thereby providing a robust foundation for relevant and rigorous analysis.

Market capitalization was employed as the primary criterion for selecting companies, serving as a proxy for performance measurement and as a key evaluative metric. LSEG defines market capitalization as 'the total market value of a company's shares of stock, calculated by multiplying the number of shares by the latest closing price.' This metric offers a standardized and reliable basis for comparing companies across different markets, making it an appropriate choice for this work (Refinitiv, 2024).

For the indices representing France, Germany, Italy, the Netherlands and Spain, market capitalization data were readily accessible through the Refinitiv database. These data were systematically extracted and organized into several Excel worksheets for further analysis.

To ensure consistency and comparability across the portfolios, the selection includes the 20 largest companies by market capitalization from each country, resulting in a dataset of 100 companies, as shown in Table 1. This selection strategy also allowed for flexibility in the event that data for certain companies were unavailable for specific periods, ensuring that each portfolio maintained a consistent number of companies.

Country	Company	Sector
CAC 40 (France)	LVMH Moet Hennessy Louis Vuitton SE	Apparel & Accessories (NEC)
	Hermes International SCA	Handbags & Luggage
	L'Oreal SA	Cosmetics & Perfumes
	TotalEnergies SE	Integrated Oil & Gas
	Airbus SE	Commercial Aircraft Manufacturing
	Schneider Electric SE	Electrical Components & Equipment (NEC)
	Sanofi SA	Pharmaceuticals (NEC)
	L'Air Liquide Societe Anonyme pour l'Etude et l'Exploitation des Procedes George	Commodity Chemicals (NEC)
	EssilorLuxottica SA	Glasses, Spectacles & Contact Lenses
	Safran SA	Aircraft Parts Manufacturing
	Stellantis NV	Automobiles & Multi Utility Vehicles
	AXA SA	Life & Health Insurance (NEC)
	BNP Paribas SA	Banks (NEC)
	Vinci SA	Construction & Engineering (NEC)
	Dassault Systemes SE	Software (NEC)
	Kering SA	Apparel & Accessories Retailers (NEC)
	Credit Agricole SA	Corporate Banks
	Danone SA	Food Processing (NEC)
	Engie SA	Multiline Utilities
	Compagnie de Saint Gobain SA	Construction Supplies & Fixtures (NEC)
DAX (Germany)	SAP	Enterprise Software
	Siemens AG	Electrical Components & Equipment (NEC)
	Airbus SE	Commercial Aircraft Manufacturing
	Deutsche Telekom AG	Integrated Telecommunications Services (NEC)
	Allianz SE	Multiline Insurance & Brokers (NEC)
	Mercedez-Benz Group AG	Auto & Truck Manufacturers (NEC)
	Bayrische Motoren Werke AG	Auto & Truck Manufacturers (NEC)
	Volkswagen AG	Auto & Truck Manufacturers (NEC)
	Merck KGaA	Proprietary & Advanced Pharmaceuticals
	Siemens Healthineers	Advanced Medical Equipment & Technology (NEC)
	Münchener Rückversicherungs Gesellschaft in München AG	Property & Casualty Reinsurance
	Deutsche Post AG	Courier, Postal, Air Freight & Land-based Logistics (NEC)
	BASF SE	Diversified Chemicals
	Infineon Technologies AG	Semiconductors (NEC)
	Daimler Truck Holding	Heavy Machinery & Vehicles (NEC)
	Deutsche Boerse AG	Financial & Commodity Market Operators & Service Providers (NEC)
	Adidas AG	Sports & Outdoor Footwear
	Beiersdorf AG	Personal Products (NEC)
	E ON SE	Multiline Utilities
	Henkel AG & Co KGaA	Adhesive & Epoxy
FTSE MIB (Italy)	Stellantis NV	Auto & Truck Manufacturers
	Ferrari NV	Auto & Truck Manufacturers
	Intesa SanPaolo SPA	Banks
	ENEL SPA	Electric Utilities
	Uni Credit SPA	Banks
	ENI SPA	Integrated Oil & Gas
	STMicroelectronics NV	Semiconductors
	Assicurazioni Generali SPA	Life & Health Insurance
	Tenaris SA	Oil Related Services and Equipment
	Moncler SPA	Apparel & Accessories

	Poste Italiane SPA	Courier, Postal, Air Freight & Land-based Logistics
	Terna Rete Electtrica Nazionale SPA	Electric Utilities
	SNAM SPA	Oil & Gas Transportation Services
	Prysmian SPA	Electrical Components & Equipment
	Leonardo SPA	Aerospace & Defense
	Mediobanca Banca di Credito Finanzario SPA	Banks
	Davide Campari Milano NV	Distillers & Wineries
	Recordati Industria Chimica e Farmaceutica SPA	Pharmaceuticals
	Infrastructture Wireless Italiane SPA	Integrated Telecommunications Services
	Banco BPM	Banks
AXE (Netherlands)	ASML Holding NV	Semiconductor Equipment & Testing (NEC)
	Shell PLC	Integrated Oil & Gas
	Unilever PLC	Personal Products (NEC)
	Prosus NV	Online Services (NEC)
	RELX PLC	IT Services & Consulting (NEC)
	ING Groep NV	Banks (NEC)
	Heineken NV	Brewers (NEC)
	Universal Music Group NV	Music, Music Video Production & Distribution
	Adyen NV	Financial Technology (Fintech) (NEC)
	Wolters Kluwer NV	Professional Information Services (NEC)
	Koninklijke Ahold Delhaize NV	Food Retail & Distribution (NEC)
	Exor NV	Heavy Machinery & Vehicles (NEC)
	ArcelorMittal SA	Iron & Steel (NEC)
	Koninklijke Philips NV	Advanced Medical Equipment & Technology (NEC)
	Koninklijke KPN NV	Integrated Telecommunications Services (NEC)
	NN Group NV	Life Insurance
	BE Semiconductor Industries NV	Semiconductor Machinery Manufacturing
	Akzo Nobel NV	Paints & Coatings
	Aegon Ltd	Life & Health Insurance (NEC)
IBEX 35 (Spain)	Industria de Diseno Textil SA	Apparel & Accessories Retailers
	Iberdrola SA	Electric Utilities
	Banco Santander SA	Banks
	Banco Bilbao Vizcaya Argentaria SA	Banks
	Caixa Bank SA	Banks
	AENA SME SA	Airport Operators & Services
	Amadeus IT Group SA	T Services & Consulting
	Ferrovial SE	Construction & Engineering
	Telefonica SA	Integrated Telecommunications Services
	Naturgy Energy Group SA	Natural Gas Utilities
	Cellnex Telecom SA	Wireless Telecommunications Services
	ArcelorMittal SA	Iron & Steel
	Endesa SA	Electric Utilities
	Repsol SA	Oil & Gas Refining and Marketing
	ACS Actividades de Construccion y Servicios SA	Construction & Engineering
	International Consolidated Airlines Group SA	Airlines
	Redelia Corporacion SA	Electric Utilities
	Banco de Sabadell SA	Banks
	Mapfre SA	Multiline Insurance & Brokers
	Corporacion Acciona Energias Renovables SA	Electric Utilities

Table 1: Companies included in the Dataset (Refinitiv, 2024; Yahoo Finance, 2024)

4.2. Investment Strategy Development

Three distinct investment strategies were developed to address the critical research questions, with an emphasis on whether sustainable investments can yield positive financial outcomes – such as reduced risk or enhanced returns – as well as non-financial benefits, particularly during times of crisis.

Strategy 1: Benchmark Strategy

The first strategy serves as a benchmark, representing a Traditional investment approach. In this strategy, 20 companies were selected based on their market capitalization, as previously explained. This approach employs a conventional equal-weighted investment methodology, constructing a portfolio of the 20 largest companies by market capitalization. This strategy is commonly utilized in financial markets and serves as a benchmark against which the other strategies can be compared.

Strategy 2: Negative Screening Methodology

The second strategy, as stated in chapter 2.2.5.4, applies a sustainable investment approach through a Negative Screening methodology. This strategy excludes companies with ESG scores below a predetermined level from the portfolio. The portfolio is constructed by selecting the five best-performing companies from each country based on their ESG scores, disregarding any related controversies, and excluding all other stocks.

It should be noted that this thesis lacks a comparative analysis with portfolios that consider controversies, which is a limitation of this strategy.

Strategy 3: Best-in-Class Methodology

The third strategy also follows a sustainable investment approach, using a Best-in-Class methodology, as described in chapter 2.2.5.4. This strategy only includes companies in the portfolio with an ESG score of 80 or higher. It focuses on selecting companies that excel not only in financial performance but also in sustainability standards, making it a more selective and rigorous method than the second strategy.

These three strategies collectively provide a comprehensive framework for evaluating the financial and non-financial impacts of Traditional vs. Sustainable investment approaches, with a focus on their performance during crises.

Table 2 provides an overview of the three investment strategies analyzed in this study.

Strategy 1	**Strategy 2**	**Strategy 3**
Traditional Investment Methodology (Benchmark)	ESG Negative Screening Methodology	ESG Best-in-Class Methodology
Equally weighted portfolio	Equally-weighted portfolio	Equally-weighted portfolio (proportional to the ESG score)

Table 2: Investment Strategies

4.3. Data Preparation and Portfolio Construction Methodology

4.3.1. Portfolio Construction

Initial Portfolio Assembly

The portfolio construction process began with the creation of five files, each representing one of the five selected countries. These files detailed the key characteristics of the companies to be included in each portfolio and served as the foundation for constructing the benchmark portfolios. These tables were instrumental in merging the two sustainable investment strategies.

Integration of ESG Scores

Separate tables were also developed for each country to record the ESG scores for the years 2018 to 2023. These scores were obtained from Refinitiv and carefully placed into the respective datasets. The Refinitiv ESG score, which is crucial for the development of sustainable investment strategies, is defined as an aggregate company score derived from self-reported data across the E, S, and G pillars. The scores range from 0 to 100, providing a standardized metric that facilitates data collection and potential comparisons with other ESG data providers (Refinitiv, 2024).

In addition to recording the overall ESG scores, the analysis gathered detailed information on each company's performance across the E, S, and G pillars. However, for the purposes of this study, only the overall ESG scores for each year were included in the final Excel datasets.

- **E Score:** According to LSEG Workspace, this score evaluates a company's impact on natural systems, including air, land, water, and entire ecosystems. It represents the company's ability to mitigate environmental risks and capitalize on environmental opportunities to create long-term shareholder value.

- **S Score:** This score assesses the company's capacity to foster trust and loyalty among its workforce, customers, and society as a whole, reflecting its reputation and the health of its operating license as contributors to long-term value creation.

- **G Score:** The governance pillar measures the robustness of a company's systems and processes to ensure that the board acts in the best interest of long-term shareholder value. It reflects the company's ability to manage rights and responsibilities effectively through incentives, checks, and balances (Refinitiv, 2024).

4.3.2. Data Construction and Refinement

Data Assembly for Portfolio Analysis

Following the compilation of the tables detailing each company's characteristics, the dataset for portfolio construction was assembled. Using LSEG Workspace, historical price data for the 100 selected companies were extracted for the period from 2018 to 2023.

Data Calculation and Refinement

The closing prices of all companies for each trading day were aggregated into a comprehensive dataset. To ensure data accuracy, a thorough cleaning process was conducted, utilizing the Excel 'VLOOKUP' function to identify and resolve inconsistencies. Companies were excluded from the analysis if they lacked complete data for the entire period, had missing data for specific periods, or if their ESG rating was unavailable on Refinitiv. These exclusions are underlined in **red and bold** in Table 1.

As a result of these exclusions, the number of companies included in each country's portfolio was adjusted. This revision resulted in portfolios of 18 stocks each, with the exception of the Netherlands portfolio, which is comprised of 15 stocks.

Subsequently, the dataset including the closing prices of the 87 remaining companies (across the five portfolios) for the period from January 2, 2018, to December 29, 2023, was then utilized to create a new dataset focusing on stock return calculations. This dataset forms the basis for the subsequent financial analysis.

4.3.3. Portfolio Calculation Methodology

Calculation Approach

The calculating methodology for each investment strategy was based on an equally-weighted approach, as detailed in chapter 2.1.3 and summarized in Table 2. Daily portfolio returns were calculated using the 'SUMPRODUCT' function, which multiplies each stock's return by its weight to ensure consistent and accurate calculations across all strategies.

Strategy-Specific Calculations

Strategy 1: Traditional Investment Methodology (Benchmark)

Under the Traditional investment methodology, portfolios for each country were constructed using an equally-weighted approach. In this strategy, the weight assigned to each stock was equal to $\frac{1}{N}$, where N represents the total number of companies in the portfolio - 18 stocks for all countries except the Netherlands, which had 15 stocks.

Strategy 2: Negative Screening Methodology

Similar to Strategy 1, the portfolios under the Negative Screening methodology were constructed using an equally-weighted approach. However, these portfolios were more selective, with only 5 stocks per country.

Strategy 3: Best-in-Class Methodology

Strategy 3 utilized a best-in-class methodology, with weights proportional to the company's ESG scores. The number of companies in each portfolio varied by country, as only those having an ESG score of 80 or higher were selected.

The weighting for each stock was determined using the formula:

$$w_i = \frac{ESG_i}{\sum ESG_i} \qquad \text{(Eq. 35)}$$

where represents the weight of stock w_i, and ESG_i denotes the ESG score of each stock. These weights were recalculated for each sub-period within the analysis timeframe.

Portfolio Return and Risk Analysis

After constructing the portfolios, the average returns were calculated by taking the mean of the daily returns. The associated risk was evaluated by calculating the standard deviation of the returns using the 'STDEV.P' formula.

The SR was then computed to assess risk-adjusted performance. Considering the observation period (2018-2023) and the diversity of companies across five countries, a risk-free rate of 0% was assumed. Thus, the SR was determined by dividing the portfolio return by its corresponding risk.

This methodology was applied consistently across all three strategies and the five country-specific portfolios to ensure a consistent approach to the analysis.

Analysis of Included Stocks in the Portfolios

A detailed examination of the stocks included in the various portfolios reveals significant differences in the number of companies selected across the different countries. Understanding these variations is crucial for assessing cross-country comparability and the extent to which specific companies are repeatedly included across various investment strategies. This information is further described in Table 3, which shows the number of stocks included in each portfolio for the respective strategies across all countries. A key consideration is whether, despite the distinct methodologies, certain companies emerge consistently in multiple portfolios.

Notably, across all countries, the stocks selected for the Best-in-Class and Negative Screening strategies show a consistent overlap. This overlap suggests that certain companies, regardless of the strategy, consistently meet the stringent sustainability criteria, making them prominent selections in both methodologies.

France: The Best-in-Class strategy contained ten companies, only eight fewer than the Traditional portfolio. This figure is relatively lower compared to Germany and Spain, indicating a narrower gap between the Traditional and Sustainable approaches in France.

Germany: In Germany the Best-in-Class strategy includes 13 companies, which is only five fewer than in the Traditional portfolio. This is the highest number of companies included

in the Best-in-Class strategy among all countries analyzed, reflecting the relatively high ESG scores of German companies.

Italy: The Best-in-Class strategy in Italy encompasses eight companies, fewer than those included in the Traditional portfolios of Germany, Spain, and France. This indicates that Italian companies generally have lower ESG scores than their counterparts in these other countries.

Netherlands: In the Netherlands, the Best-in-Class strategy includes six companies, the fewest of any countries analyzed. However, it is important to note that the Traditional portfolio for the Netherlands also includes only 15 companies, compared to 18 in the Traditional portfolios of other countries. Consequently, the Dutch stocks have a higher weighting, which limits its comparability to the other countries.

Spain: he Best-in-Class strategy in Spain includes 11 companies, seven fewer than in the Traditional portfolio. Spanish companies have relatively high ESG scores, second only to Germany, indicating strong sustainability performance.

Country	Traditional Strategy (Strategy 1)	Negative Screening (Strategy 2)	Best-in-Class (Strategy 3)
France	18 stocks	5 stocks	10 stocks
Germany	18 stocks	5 stocks	13 stocks
Italy	18 stocks	5 stocks	8 stocks
Netherlands	15 stocks	5 stocks	6 stocks
Spain	18 stocks	5 stocks	11 stocks

Table 3: Distribution of Stocks across Investment Strategies by Country

Sub-Period Analysis

Following the comprehensive analysis of the entire period from 2018 to 2023, a sub-period analysis was undertaken to further evaluate the variations in return, risk, and SR throughout different timeframes. This sub-period analysis was crucial for gaining a more nuanced understanding of how the portfolios, constructed using three different strategies, responded to varying economic conditions.

The analysis divided the overall period into three specific sub-periods: 2018-2019, 2020-2021, and 2022-2023. Each of these sub-periods represents a distinct economic context, affected by significant historical events such as the COVID-19 pandemic and the Russia-Ukraine conflict. Throughout these sub-periods, each strategy's return, risk, and SR were calculated independently.

This segmented approach allowed for a detailed examination of the portfolios' performance, revealing insights into how they responded to different crises. The primary objective of this analysis was to evaluate the resilience and effectiveness of sustainable investment strategies relative to the Traditional approach in times of economic turmoil. By comparing the outcomes across the sub-periods, the study aimed to determine whether sustainable strategies offered any advantages in terms of stability and performance under adverse conditions – a topic that has also been explored in prior studies, as discussed extensively in chapter 2.2.7.

Comparative Analysis

With these calculations completed, the next step was to compare the performance metrics – return, risk, and SR – of the benchmark portfolio (Strategy 1) to those derived from the two sustainable investment strategies (Strategies 2 and 3). This comparison conducted to assess the effect of sustainable investment practices on portfolio performance. Furthermore, cross-country comparisons were carried out to evaluate whether certain countries exhibited superior performance, particularly in the light of the economic crises that occurred throughout the study period.

It is also worth noting that this thesis focuses exclusively on long-only portfolios, with short-sales excluded from the analysis. This choice was made to simplify the calculation process while simultaneously limiting its scope.

The results were then compared to the initial benchmarks, with a focus on the differences in SR between the various strategies and countries. The detailed evaluation and discussion of these results are provided in the following chapter.

5. Empirical Results Analysis

This chapter aims to evaluate the financial performance of the various investment strategies, with a particular emphasis on sustainable investing. The analysis begins with an assessment of the entire observation period to identify long-term trends, followed by a detailed examination of specifically selected sub-periods relevant for this thesis.

Given the possibility, as suggested by previously discussed studies, that the financial performance of sustainable investments may be relatively lower than from traditional strategies, it is crucial to assess the effectiveness of ESG strategies. To do so, the performance of benchmark portfolios from the five different EU countries is compared to the ESG investment strategies, as detailed in prior chapters. This comparative analysis is critical for evaluating whether ESG strategies can compete with, outperform, or underperform Traditional strategies under varying market conditions.

As noted in chapter 4, in addition to return and risk, the SR was also calculated for each strategy. This widely recognized measure of risk-adjusted performance is essential for an accurate and equitable comparison of the different strategies. Given its significance as a risk-adjusted metric, the SR plays a critical role in assessing the effectiveness of the strategies, particularly in the context of the past years. This period has been marked by economic recession, inflation, crises, wars, and heightened uncertainties, resulting in considerable fluctuations in both risk and returns. Consequently, the SR provides crucial insights into how each strategy has navigated these volatile conditions.

The objective of this analysis is to determine whether sustainable investment strategies can achieve superior financial performance. Based on the results of this empirical analysis, this chapter will investigate whether sustainable investments can lead to positive financial outcomes, considering the different strategies, the number of companies, and their respective weightings. The findings will be discussed further in chapter 5.3., in relation to the critical research questions previously outlined in chapter 3.

5.1. Comprehensive Analysis of the Entire Period Results

First, the individual five EU countries and the three investment strategies will be analyzed for the entire period from 2018 to 2023.

France

	Strategy 1	**Strategy 2**	**Strategy 3**
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
Number of Companies	18	5	10
Weights	Equally-weighted	Equally-weighted	ESG Score proportional
Average Return (Portfolio Return)	0,0436%	0,0258%	0,0365%
Standard deviation (Portfolio Risk)	0,012750	0,013363	0,013680
Sharpe Ratio	0,034187	0,019315	0,026647

Table 4: Investment Strategies France (2018-2023)

A detailed analysis of the overall timeframe (2018-2023) for the French portfolios clearly indicates that the Traditional strategy outclassed the two ESG strategies. It does not only generate a higher return but also exhibits lower risk, resulting in a superior SR.

Additionally, the analysis shows that the Negative Screening strategy lagged across the entire period, as evidenced by its notably lower SR. However, it is important to note that this portfolio consists of only five stocks, significantly fewer than the other two strategies, which may have contributed to its underperformance.

The Best-in-Class approach produces fairly average results ranking almost perfectly in the middle between the Traditional strategy and Negative Screening on the number of companies, return, risk and SR.

Germany

	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
Number of Companies	18	5	13
Weights	Equally-weighted	Equally-weighted	ESG Score proportional
Average Return (Portfolio Return)	0,0303%	0,0182%	0,0295%
Standard deviation (Portfolio Risk)	0,012735	0,015136	0,014068
Sharpe Ratio	0,023805	0,012054	0,020981

Table 5: Investment Strategies Germany (2018-2023)

The results in Germany closely mirror those in France. The Traditional strategy also excelled in this context, while the Negative Screening portfolio once again underachieved. This outcome may be attributed to the fact that, similar to the situation in France, this portfolio includes significantly fewer stocks compared to the other two strategies, which could contribute to its weaker performance. Interestingly, in this case the Best-in-Class approach is fairly close to the Traditional strategy in terms of risk and return.

Italy

	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
Number of Companies	18	5	8
Weights	Equally-weighted	Equally-weighted	ESG Score proportional
Average Return (Portfolio Return)	0,0442%	0,0286%	0,0353%
Standard deviation (Portfolio Risk)	0,012967	0,014101	0,014834
Sharpe Ratio	0,034093	0,020259	0,023789

Table 6: Investment Strategies Italy (2018-2023)

The analysis for Italy similarly indicates that the Traditional portfolio outperforms the others, while the Negative Screening strategy once again exhibits the poorest performance among the three portfolios over the entire timeframe. Additionally, the results for the Traditional portfolio in Italy closely mirror those observed in France.

Netherlands

	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
Number of Companies	15	5	6
Weights	Equally-weighted	Equally-weighted	ESG Score proportional
Average Return (Portfolio Return)	0,0333%	0,0184%	0,0200%
Standard deviation (Portfolio Risk)	0,011753	0,012510	0,013694
Sharpe Ratio	0,028342	0,014689	0,014582

Table 7: Investment Strategies Netherlands (2018-2023)

In comparison to the other four EU countries, the analysis of the Netherlands reveals a notable distinction. Despite the Traditional strategy continuing to outperform the others, it is the Best-in-Class strategy, rather than the Negative Screening, that lags behind in terms of the SR relative to the other portfolios in the Dutch market. This underperformance may be attributed to the fact that the Best-in-Class portfolio in the Netherlands includes considerably fewer stocks compared to the same portfolio in the other countries. Furthermore, due to data limitations highlighted in chapter 4, the Traditional portfolio also includes fewer companies in the Netherlands than in the other selected countries.

Spain

	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
Number of Companies	18	5	11
Weights	Equally-weighted	Equally-weighted	ESG Score proportional
Average Return (Portfolio Return)	0,0213%	0,0188%	0,0178%
Standard deviation (Portfolio Risk)	0,012407	0,018989	0,013392
Sharpe Ratio	0,017170	0,009907	0,013315

Table 8: Investment Strategies Spain (2018-2023)

The analysis of the Spanish market further reinforces the finding that the Traditional portfolio outperforms the other two strategies, with the Negative Screening strategy overall displaying the weakest performance, particularly evident in its relatively low SR. This SR is not only the poorest among the three portfolios in Spain but also the lowest when compared to the other four EU countries. This comparison is robust, as all five EU countries share an identical composition of five stocks within the Negative Screening portfolio.

Summary of the entire period analysis

The analysis of the individual EU countries over the six-year period from 2018 to 2023 demonstrates that the Traditional strategy consistently outperforms both ESG investment strategies. In every country examined, the Traditional portfolio achieves higher returns, lower risk, and, consequently, a superior SR.

When comparing the two ESG strategies, the data reveals that the Negative Screening portfolio consistently produces the weakest results across all countries, except in the Netherlands, where the Best-in-Class portfolio shows an even weaker performance.

A cross-country comparison indicates that the Traditional portfolios from France and Italy deliver the strongest performance, while Spain records the lowest results. This trend is also evident in the Negative Screening strategy.

Although there are minor variations in specific metrics, the results clearly indicate that the Traditional strategy is the most effective portfolio approach over the entire period in all the EU countries analyzed. The consistently strong performance of the French and Italian markets, particularly in Traditional and ESG investments, suggests that these countries may offer more favorable conditions for these strategies.

5.2. Comprehensive Analysis of the Sub-Periods Results

In addition to the in-sample period discussed in chapter 5.1., this study also investigates three distinct sub-periods, as previously outlined.

The primary objective of this analysis is to assess whether ESG investment strategies enhance portfolio performance during periods of crisis – such as those encountered within the observation period – or whether they have a neutral or potentially adverse effect.

To identify meaningful differences or similarities, the analysis begins with an examination of the individual results across the five countries. Additionally, this analysis seeks to identify any significant deviations in findings between the entire observation period and the 2020-2021 timeframe.

To ensure a comprehensive and detailed examination, the individual risk, return, and SR metrics are presented in separate tables for each country.

Results from France

Return	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,0430%	0,0253%	0,0407%
2020 - 2021	0,0528%	0,0102%	0,0518%
2022 - 2023	0,0349%	0,0420%	0,0266%

Table 9: Return of the Sub-Periods France

As illustrated in Table 9, the Traditional strategy generated the highest return in France for all periods except for the 2022-2023 period. In contrast, the Negative Screening strategy yielded the lowest return during this timeframe. Notably, both the Traditional and Best-in-Class strategies exhibited elevated and nearly comparable returns throughout the COVID-19 phase relative to the other two sub-periods.

However, in the 2022-2023 interval, the Negative Screening strategy outperformed the other strategies, delivering the highest return.

Risk	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,008595	0,009145	0,008981
2020 - 2021	0,016472	0,017649	0,018307
2022 - 2023	0,011894	0,011807	0,010255

Table 10: Risk of the Sub-Periods France

Standard deviations varied across the sub-periods. Over the 2020-2021 period, the Traditional portfolio exhibited the lowest risk, while in the 2022-2023 period, the Best-in-Class strategy emerged as the strategy with the lowest risk compared to the others. The table also reveals that the risk for all three strategies increased starting in 2020, as the risk values in the

pre-pandemic phase were consistently much lower. This suggests that the crises have contributed to heightened risk in the French market.

Sharpe Ratio	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,050082	0,027694	0,045282
2020 - 2021	0,032034	0,005756	0,028294
2022 - 2023	0,029336	0,035604	0,025906

Table 11: SR of the Sub-Periods France

Focusing on the SR, the Traditional strategy exhibited the strongest performance for both the 2018-2019 period as well as the COVID-19 phase, which is in line with the findings for the return. Nevertheless, in the 2022-2023 crisis, the Negative Screening strategy achieved the highest SR, mirroring the finding for the return yet again.

In summary, the Traditional strategy delivered the most favorable results in France over the COVID-19 period. In contrast, the Negative Screening outperformed the others in the 2022-2023 period. Notably, the Best-in-Class strategy consistently fell short during these crisis stages.

Comparison to the entire period (2018-2023)

When comparing the results of the sub-periods, particularly throughout the COVID-19 period, across the three investment strategies, notable differences in both risk and return emerge. As shown in Figure 7 and 8, while the returns for both the Traditional and Best-in-Class strategies unexpectedly increased in 2020-2021 compared to the overall period (2018-2023), there was a simultaneous rise in risk across all three strategies in the COVID-19 period.

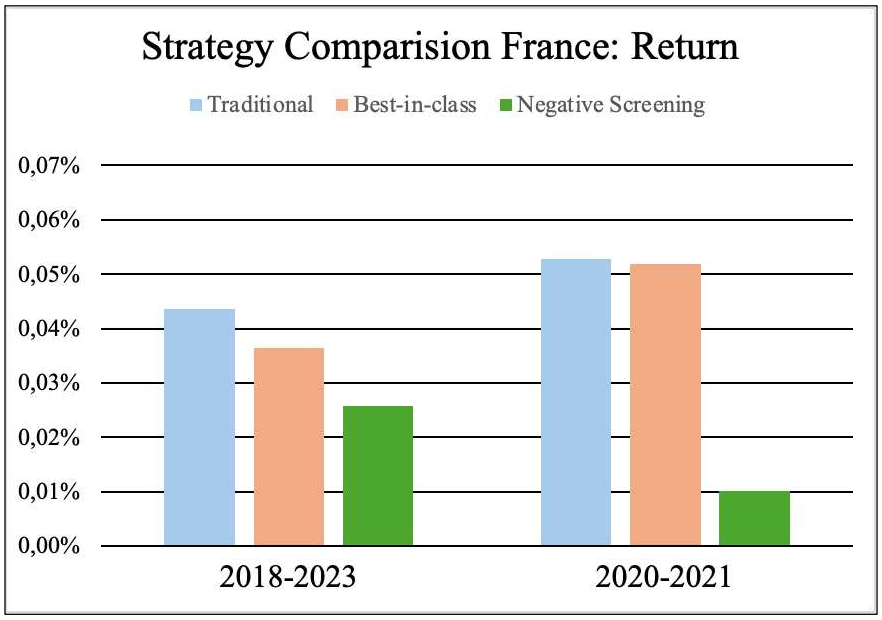

Figure 7: Return Comparison France

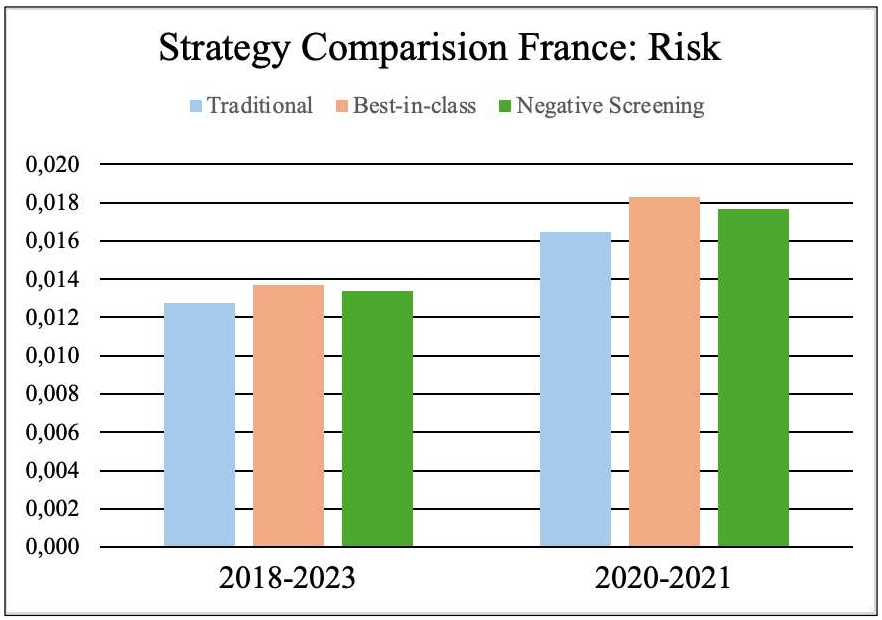

Figure 8: Risk Comparison France

Results from Germany

Return	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,0226%	0,0211%	0,0107%
2020 - 2021	0,0505%	0,0301%	0,0661%
2022 - 2023	0,0178%	0,0036%	0,0058%

Table 12: Return of the Sub-Periods Germany

Throughout the COVID-19 period, as shown in Table 12, the Best-in-Class strategy achieved the highest return, while the Negative Screening strategy recorded the lowest return, consistent with its performance in France. Moreover, compared to the previous period (2018-2019), returns for all strategies increased significantly despite the pandemic.

In contrast, in the 2022-2023 period, the Traditional strategy delivered the highest return, although significantly lower compared to the pandemic period, while the Negative Screening once again recorded the lowest return. In this portfolio, returns also fell well below the levels observed in both the pre-pandemic and COVID-19 periods, highlighting the enormous impact of the Russian war on Germany. Notably, the Negative Screening strategy consistently recorded the lowest returns across crisis periods compared to the other strategies.

Risk	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,008690	0,010869	0,009415
2020 - 2021	0,016446	0,018910	0,017843
2022 - 2023	0,011809	0,014496	0,012376

Table 13: Risk of the Sub-Periods Germany

In terms of risk, the Traditional strategy demonstrated the lowest risk throughout all periods, while the Negative Screening strategy experienced the highest risk in these intervals.

Nevertheless, the results indicate that risk levels have declined across all strategies following the pandemic, suggesting a partial recovery in the German market. However, these values remain significantly higher than those observed in the pre-pandemic period (2018-2019).

Sharpe Ratio	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,026042	0,019391	0,011314
2020 - 2021	0,030698	0,015937	0,037020
2022 - 2023	0,015074	0,002515	0,004668

Table 14: SR of the Sub-Periods Germany

Regarding the SR, the Best-in-Class strategy achieved the highest SR throughout the COVID-19 period, despite presenting a higher risk than the Traditional strategy in this period. In the 2022-2023 timeframe however, the Traditional strategy generated the leading SR.

It is evident that in the post-COVID phase, the SR for all three portfolios declined significantly, reaching a low point compared to the other two sub-periods.

In summary, over the course of the COVID-19 phase, the Best-in-Class strategy delivered the strongest performance in Germany, whereas in the 2022-2023 interval, the Traditional strategy surpassed the others. The Negative Screening strategy consistently underperformed across all crisis's intervals.

Comparison to the entire period (2018-2023)

A clear comparison with the entire period (2018-2023) is also evident in Germany, where the Best-in-Class strategy particularly stands out. As shown in Figure 9 for return and Figure 10 for the SR, the Best-in-Class strategy demonstrates the most significant deviation from the overall period, especially throughout the COVID-19 timeframe, compared to the other strategies.

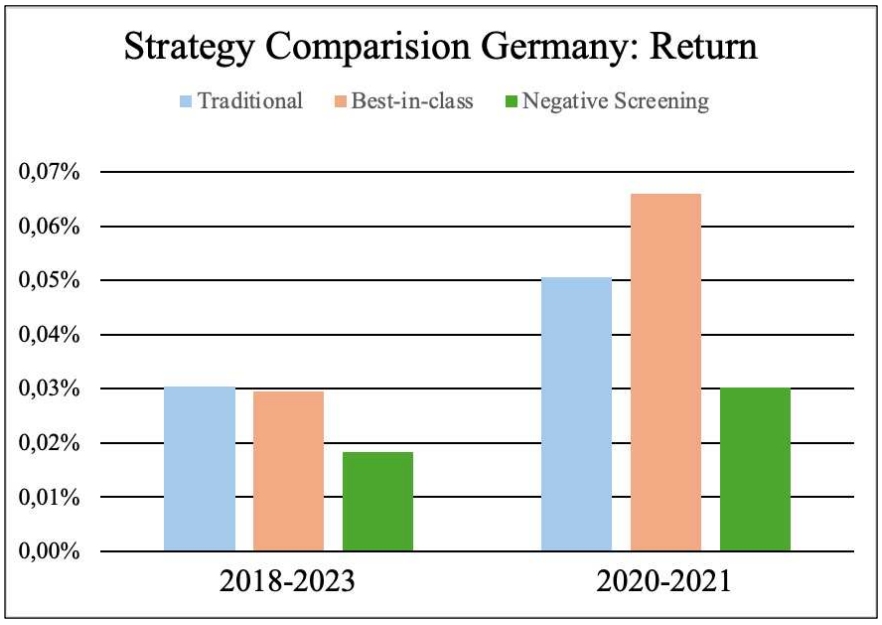

Figure 9: Return Comparison Germany

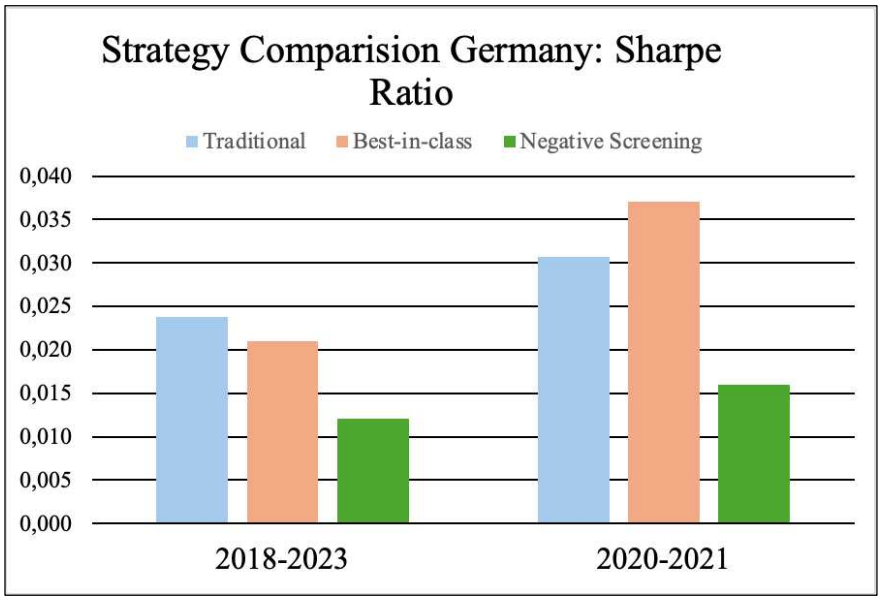

Figure 10: SR Comparison Germany

Results from Italy

Return	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,0358%	0,0263%	0,0223%
2020 - 2021	0,0516%	0,0355%	0,0354%
2022 - 2023	0,0451%	0,0238%	0,0272%

Table 15: Return of the Sub-Periods Italy

In Italy, the Traditional strategy consistently outperforms the other two strategies, delivering the highest return across all three sub-periods.

Similarly, for Italian companies, the returns for all three strategies were most elevated over the pandemic phase and subsequently returned to levels similar to those observed before the pandemic.

Risk	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,009916	0,010965	0,011007
2020 - 2021	0,016428	0,017225	0,019559
2022 - 2023	0,011627	0,013357	0,012522

Table 16: Risk of the Sub-Periods Italy

Notably, the Traditional strategy consistently exhibits the lowest risk across all periods, distinguishing it from the ESG strategies.

In Italy, the COVID-19 period also saw an increase in risk compared to other countries. However, unlike in other regions, the risk did not return to pre-pandemic levels after the pandemic subsided, indicating that the market has not yet fully recovered to its previous state.

Sharpe Ratio	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,036121	0,024007	0,020288
2020 - 2021	0,031436	0,020604	0,018085
2022 2023	0,038748	0,017851	0,021711

Table 17: SR of the Sub-Periods Italy

The Traditional strategy's superiority is further demonstrated by its SR, consistently outperforming both ESG strategies across every sub-period.

As illustrated in Tables 15-17, the Traditional strategy consistently delivers the strongest performance across all three sub-periods in Italy.

Comparison to the entire period (2018-2023)

As clearly demonstrated in the tables above, the Traditional strategy excells in comparison to the other two strategies across all sub-periods in the Italian market. This dominance is further emphasized in the following Figures 11-13, especially when comparing the COVID-19 phase to the entire timeframe.

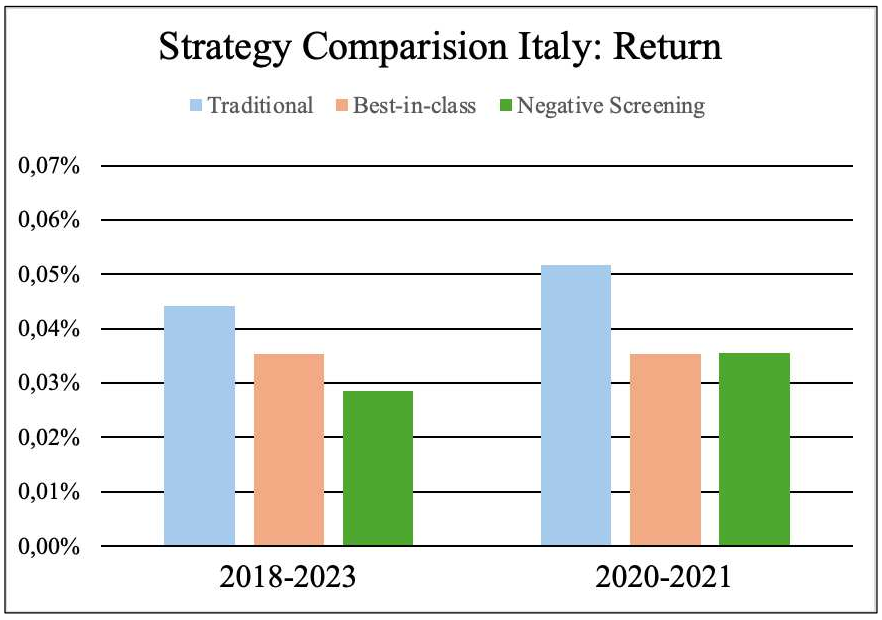

Figure 11: Return Comparison Italy

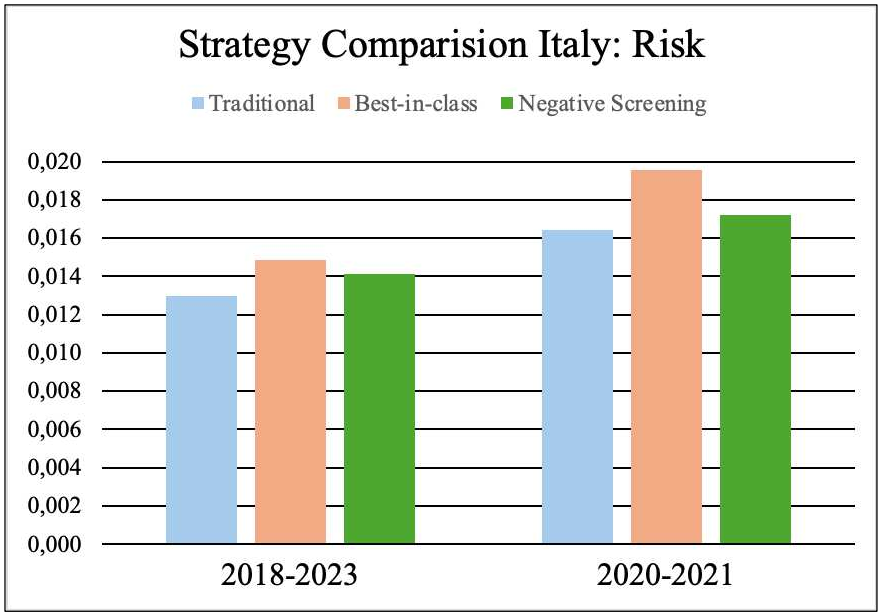

Figure 12: Risk Comparison Italy

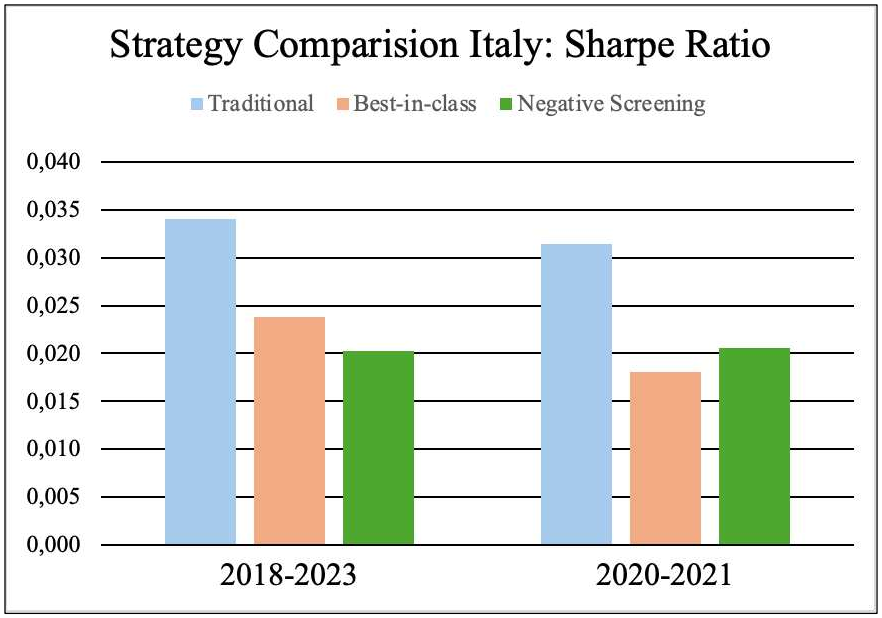

Figure 13: SR Comparison Italy

Results from the Netherlands

Return	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,0063%	0,0142%	0,0117%
2020 - 2021	0,0691%	0,0121%	0,0490%
2022 - 2023	0,0242%	0,0287%	0,0352%

Table 18: Return of the Sub-Periods Netherlands

Throughout the COVID-19 period, the Traditional strategy achieved the highest return, consistent with its performance in Italy, France, and Spain. In contrast, the Negative Screening strategy recorded the lowest return in this period, mirroring its performance in France and Germany. In the 2022-2023 timeframe, the Best-in-Class strategy delivered the highest return.

It is also evident for the Dutch market that across both crisis sub-periods, the returns of the three strategies were comparatively better than in the pre-pandemic phase.

Risk	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,008627	0,008417	0,007921
2020 - 2021	0,015164	0,016977	0,016228
2022 - 2023	0,010447	0,010464	0,010763

Table 19: Risk of the Sub-Periods Netherlands

Throughout both crisis periods (2020-2021 and 2022-2023), the Traditional strategy surpassed the ESG strategies by consistently maintaining the lowest level of risk. In accordance with the previous findings, risk levels rose across both crises and have yet to reach their former levels.

Sharpe Ratio	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,007321	0,016836	0,014766
2020 - 2021	0,045551	0,007150	0,030171
2022 - 2023	0,023192	0,027428	0,032733

Table 20: SR of the Sub-Periods Netherlands

In terms of the SR, the Traditional strategy achieved the highest SR throughout the COVID-19 period, while the Best-in-Class strategy excelled during the 2022-2023 timeframe.

Overall, the SR remained comparatively high across all portfolios throughout the crisis's periods, especially when compared to the baseline values from 2018-2019 in Table 20.

In the Netherlands, the Traditional portfolio delivered the best results amid the COVID-19 period, whereas in the 2022-2023 phase, the Best-in-Class strategy emerged as the top performer.

Comparison to the entire period (2018-2023)

When comparing the results to the COVID-19 phase in the Netherlands, it is clear that the Traditional strategy consistently performed better than the other strategies, particularly in terms of return and SR. This dominance is evident both over the entire period and specifically within the 2020-2021 sub-period, as shown in Figures 14 and 15 for the Netherlands.

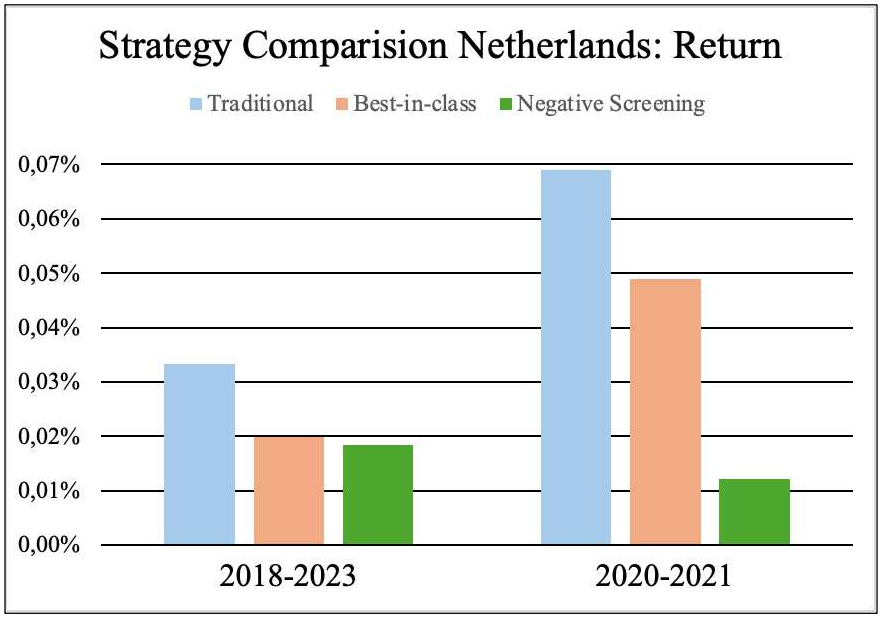

Figure 14: Return Comparison Netherlands

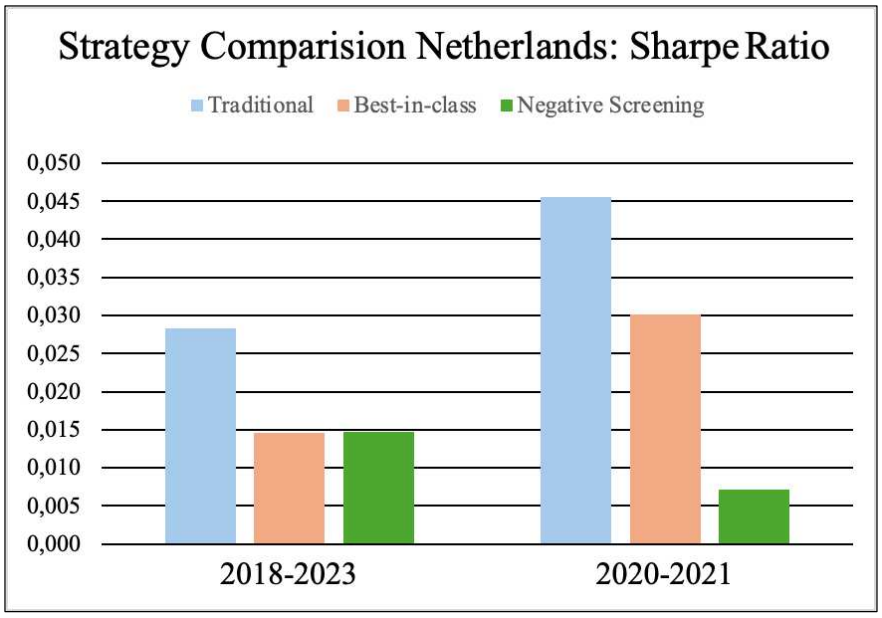

Figure 15: SR Comparison Netherlands

Results from Spain

Return	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,0056%	-0,0303%	0,0048%
2020 - 2021	0,0150%	0,0002%	-0,0020%
2022 - 2023	0,0433%	0,0864%	0,0701%

Table 21: Return of the Sub-Periods Spain

As presented in Table 21, throughout the COVID-19 period in Spain, the Traditional strategy achieved the highest return, while the Best-in-Class strategy experienced a negative return, making it the only strategy across all countries to underperform in this manner. In the 2022-2023 period, the Negative Screening delivered the highest return.

Additionally, it is noteworthy that both ESG strategies exhibited comparatively high returns in the 2022-2023 period, whereas their performance in the other sub-periods was significantly lower, and in some cases, even negative – as previously noted for the Best-in-Class strategy.

Risk	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,007618	0,011673	0,012581
2020 - 2021	0,017202	0,026424	0,026512
2022 - 2023	0,010350	0,015652	0,016343

Table 22: Risk of the Sub-Periods Spain

Across all three sub-periods, the Traditional strategy consistently maintained the lowest risk compared to the ESG strategies, while the Best-in-Class strategy exhibited the highest risk.

Compared to the pre-pandemic period, the portfolios also displayed elevated values in Spain during the crisis periods, indicating a highly strained market.

Sharpe Ratio	Strategy 1	Strategy 2	Strategy 3
	Traditional Strategy (Benchmark)	Negative Screening Methodology	Best-in-Class Methodology
2018 - 2019	0,007312	-0,025934	0,003799
2020 - 2021	0,008715	0,000065	-0,000793
2022 - 2023	0,041833	0,055192	0,042884

Table 23: SR of the Sub-Periods Spain

Regarding the SR, the Traditional strategy recorded the highest value throughout the COVID-19 phase. In stark contrast, the Best-in-Class strategy not only experienced a negative return but also a negative SR, a distinction unique to Spain among the analyzed countries. In the 2022-2023 timeframe, the Negative Screening strategy posted the highest SR.

When comparing the pre-pandemic period with the second crisis sub-period, it is evident that all three portfolios in the Spanish market achieved better SRs than before COVID-19.

In summary, the Best-in-Class strategy performed the worst throughout the COVID-19 phase in Spain. Overall, the Traditional strategy delivered the strongest results compared to the other strategies in the 2020-2021 interval.

Comparison to the entire period (2018-2023)

Analyzing the investment strategies in Spain reveals that both returns, and SR experienced a decline amid the COVID-19 phase compared to the overall period, while risk levels escalated during this timeframe, as illustrated in the accompanying Figures 16-18. Additionally, Figures 16 and 18 indicate that the values for the Negative Screening strategy in 2020-2021 are so minimal that they are not captured in the figures.

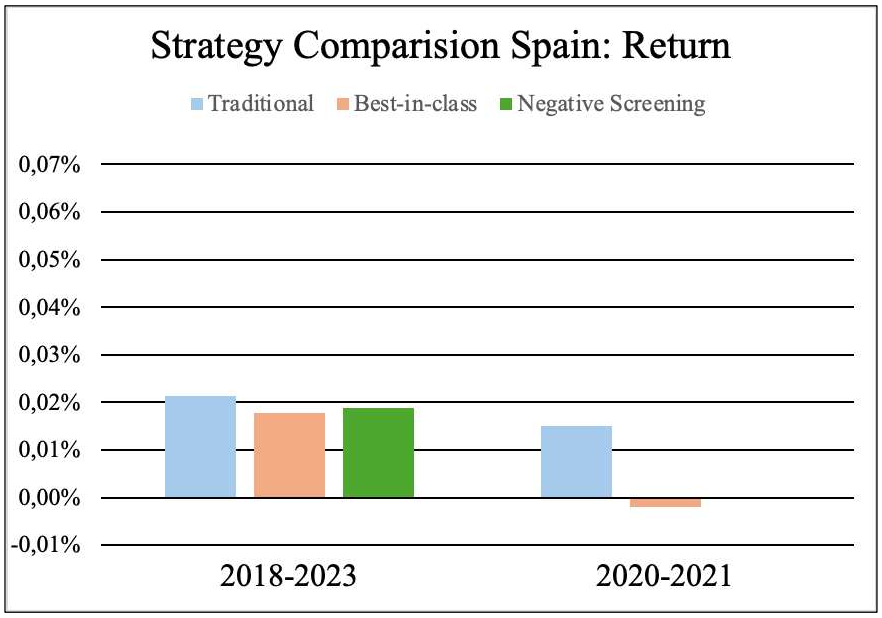

Figure 16: Return Comparison Spain

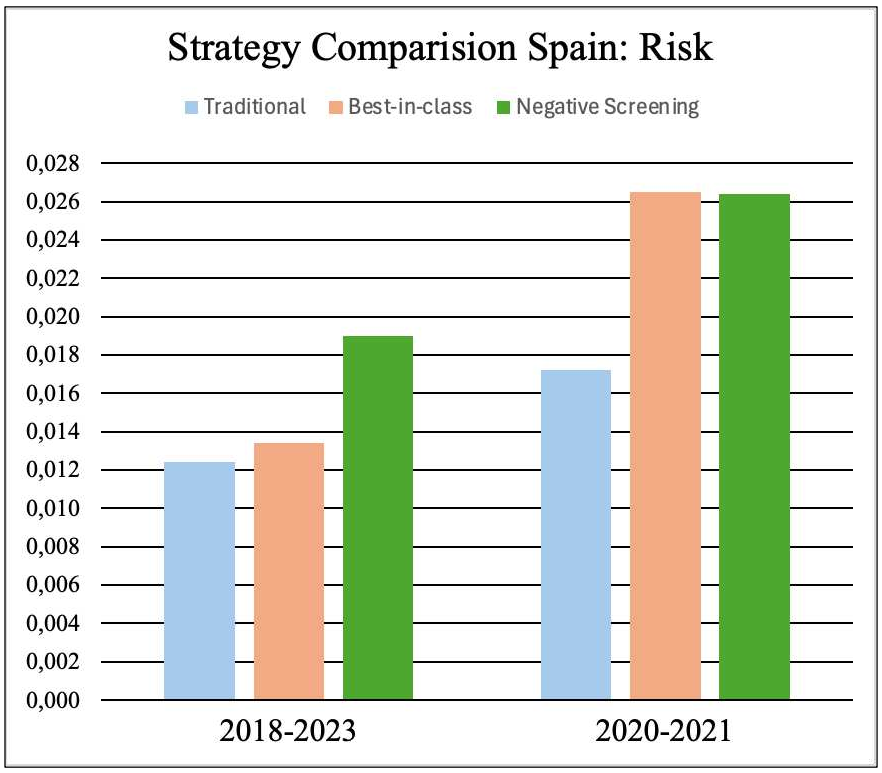

Figure 17: Risk Comparison Spain

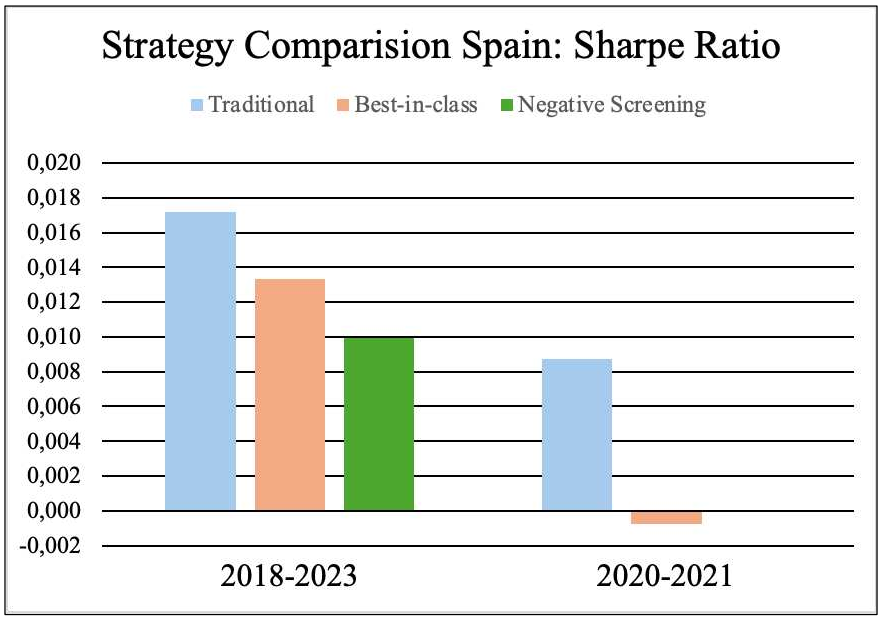

Figure 18: SR Comparison Spain

Summary of the sub-period analysis

The comprehensive analysis of the sub-periods across the five countries reveals several key findings.

Over the COVID-19 phase, the Traditional strategy delivered the strongest performance in France, Italy, the Netherlands, and Spain. The sole exception was Germany, where the Best-in-Class strategy experienced superior performance. It is important to note that the Best-in-Class portfolio in Germany includes a larger number of stocks compared to the other four countries, complicating direct comparison. The higher number of stocks in the German Best-in-Class portfolio may explain the superior performance of the strategy over the course of this period, while the discrepancy in the number of stocks in the portfolios of the other countries could have contributed to their underperformance.

In Italy, the Traditional strategy consistently maintained its superior performance across all three sub-periods, with no ESG portfolio achieving better results throughout the crises. This underscores the robustness of the Traditional strategy in this market.

A consistent pattern is observed in both France and Spain, where the same strategy excelled through both crisis periods. Specifically, the Traditional strategy performed better during the COVID-19 phase in both countries, while the Negative Screening strategy led the way in 2022-2023. The 2022-2023 period produced varied results, with the Traditional strategy showing the best performance in Germany, while the Best-in-Class strategy outperformed in the Netherlands.

The analysis reveals a significant increase in risk levels across all five countries over the COVID-19 period compared to both other sub-periods and the entire period (2018-2023). This suggests that the overall risk was notably higher throughout the COVID-19 crisis for both Traditional and sustainable investment portfolios across these European markets. However, despite this elevated risk, returns did not decline dramatically. In fact, in several cases, particularly within the Traditional and Best-in-Class strategies, returns even improved compared to other sub-periods, likely defying initial expectations. The following Figures 19-23 visually emphasize these findings, illustrating the substantial rise in risk across all five European markets during the crisis, alongside the unexpected resilience or increase in returns for several strategies.

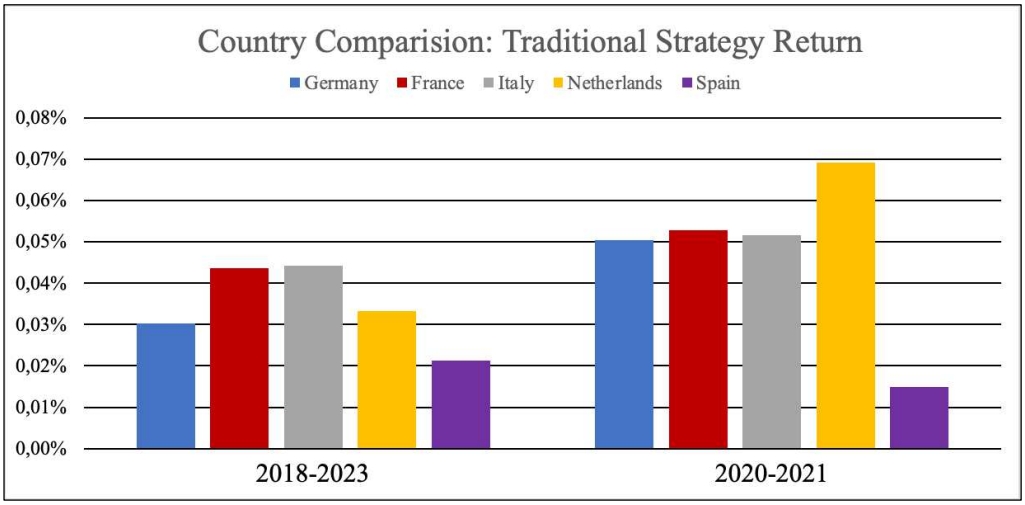

Figure 19: Country Comparison - Traditional Strategy Return

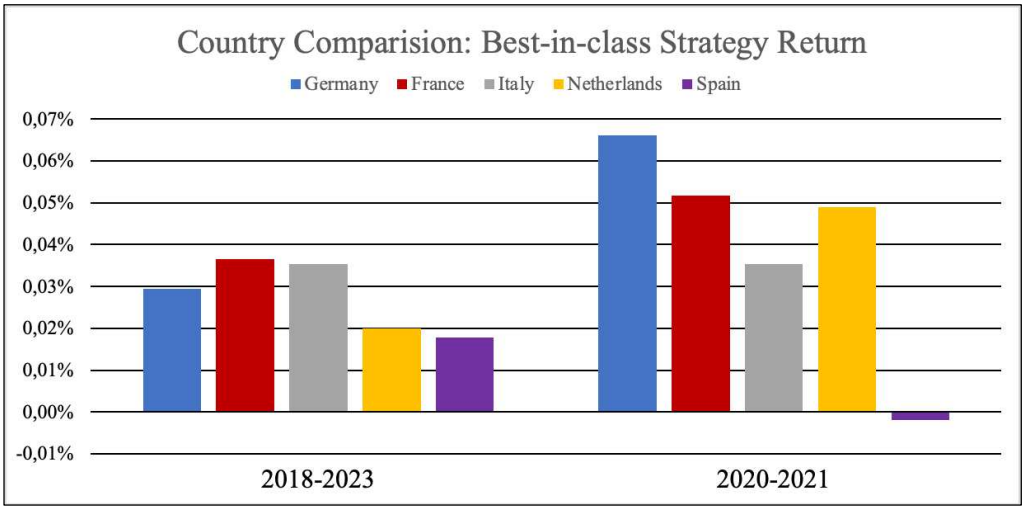

Figure 20: Country Comparison - Best-in-Class Strategy Return

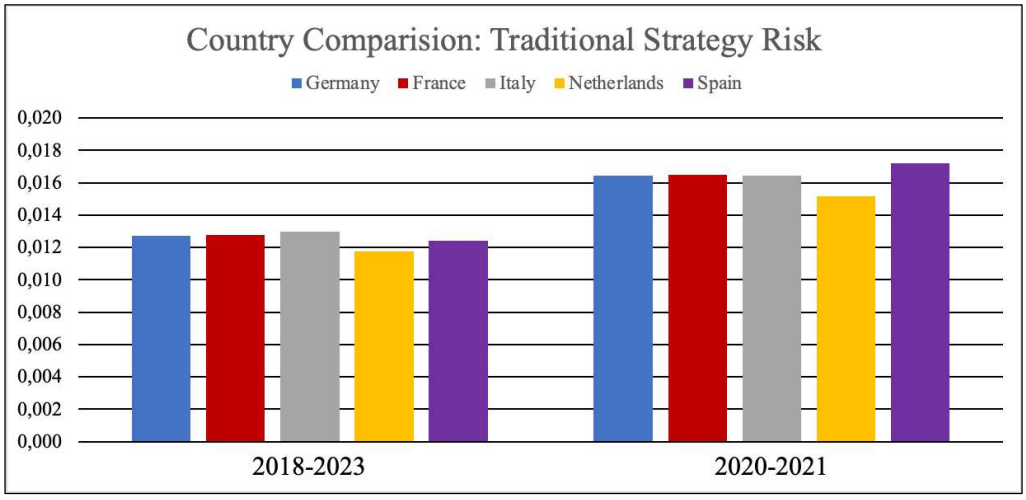

Figure 21: Country Comparison - Traditional Strategy Risk

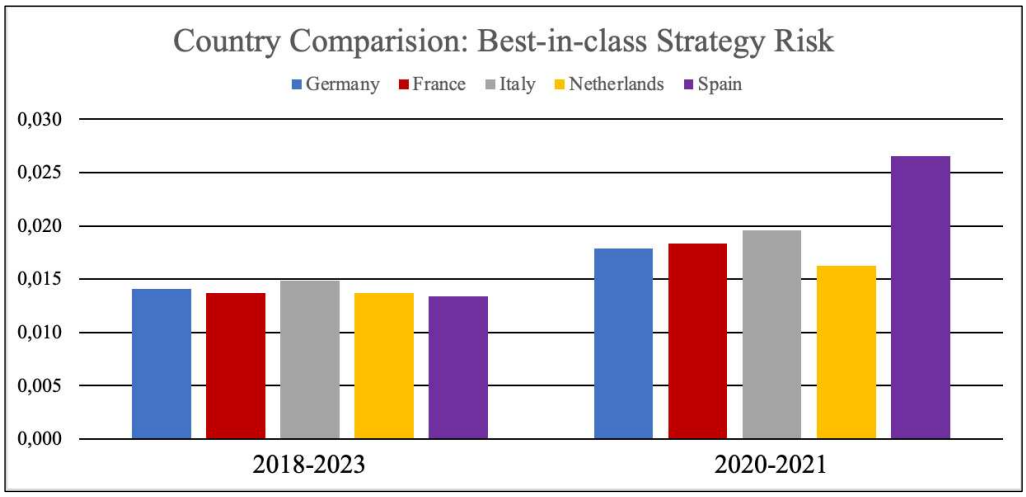

Figure 22: Country Comparison - Best-in-Class Strategy Risk

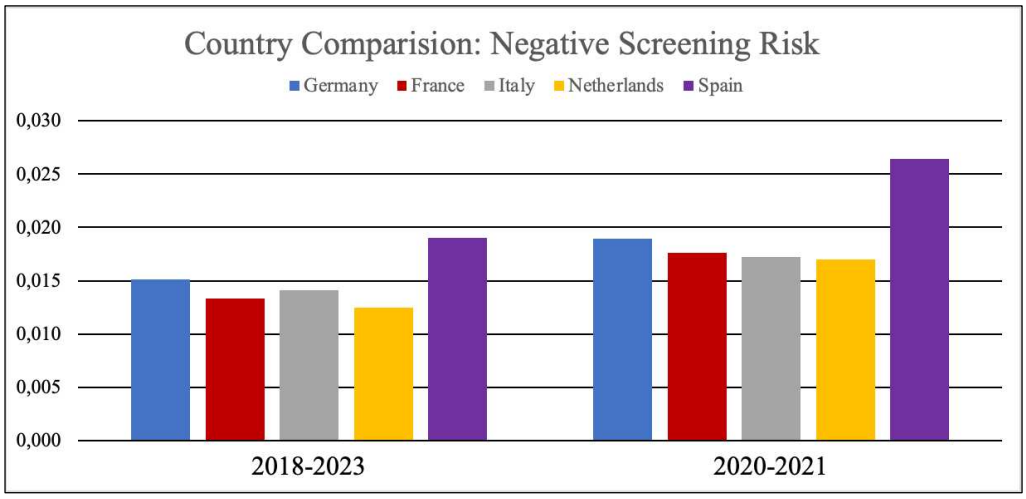

Figure 23: Country Comparison - Negative Screening Risk

Further analysis suggests that selecting the appropriate weights and strategy can lead to enhanced performance in sustainable investments. It is important to recognize that accepting slightly lower financial returns can be justifiable, considering the non-financial positive impacts of sustainable investments, which often cannot be quantitatively measured.

Overall, the analysis reveals that, even within the sub-periods, the Traditional strategy significantly outperformed the two ESG investment strategies.

5.3. Resolution of the Central Research Questions

In the preceding chapters, the results for both the entire period and the sub-periods were thoroughly analyzed. It is now essential to evaluate these findings in the light of the critical research questions that guided this study and to contextualize them within the broader body of the literature, which provides valuable insights into the dynamics of ESG portfolio performance under varying market conditions.

Addressing the Research Questions

Research Question 1:

"Do Sustainability-focused strategies outperform Traditional strategies?"

The analysis of the first research question, as detailed in sections 5.1. and 5.2., shows that neither ESG strategy outperformed the Traditional strategy over the entire period. Consequently, the first research question can be dismissed, as the results clearly indicate no overall outperformance by the ESG strategies.

This result is consistent with Czerwińska & Kaźmierkiewicz (2015), who reviewed empirical studies globally and found that the inclusion of ESG criteria in portfolio analysis does not typically lead to increased efficiency or reduced portfolio risk. Similarly, Aboud & Diab (n.d.) reported that some studies find no significant association between ESG practices and corporate performance, a sentiment echoed by Limkriangkrai, Koh & Durand (2017), who found no significant difference in risk-adjusted returns for portfolios based on ESG ratings.

Over the long-term period from 2018 to 2023, the Traditional portfolio consistently delivered superior performance compared to the ESG strategies across all five EU countries. This dominance aligns with the findings of Friede, Busch, & Bassen (2015), who observed that about 90% of studies reported a non-negative relationship between ESG factors and corporate financial performance. These results suggest that a non-negative relationship does not necessarily lead to superior portfolio performance across all periods. While they confirm the initial insights from the full-period analysis, the sub-period findings, as discussed in chapter 5.2, offer a more nuanced perspective. Furthermore, as Renneboog, Ter Horst, & Zhang (2008), note socially

responsible investors may accept suboptimal financial performance in pursuit of social or ethical goals, but this does not represent the majority.

Research Question 2:

"***Within the context of the two crises and across the three sub-periods analyzed, do Sustainability-focused strategies demonstrate superior performance compared to Traditional strategies?"***

While the Traditional strategy generally maintained its dominance throughout the sub-periods, particularly in the COVID-19 period, variations were observed, especially during the second crisis period (2022-2023). Amid the COVID-19 period, Germany diverged from other countries, with the Best-in-Class strategy outperforming both the Traditional and Negative Screening strategies. This outcome may reflect a shift in investor focus towards sustainability in times of crisis, as noted by Escrig-Olmedo et al. (2019) in their analysis of the 2008 financial crisis. They found that in the midst of such crises, investor attention often shifts towards sustainability, which could explain why the Best-in-Class strategy outperformed in certain contexts.

The continued dominance of the Traditional strategy throughout the entire period and in several sub-periods suggests that most investors still prioritize higher returns and lower risks.

The third sub-period (2022-2023), another crisis phase, also presents an interesting case. The Negative Screening strategy showed superior performance in France and Spain, while the Best-in-Class strategy outperformed in the Netherlands. However, these findings must be interpreted with caution due to certain limitations:

- Refinitiv did not provide ratings for a significant number of companies for the year 2023, making it risky to place too much emphasis on the 2022-2023 period (Refinitiv, 2024). This could distort the analysis, which is why the COVID-19 sub-period, with its complete data, is more heavily emphasized.
- The ongoing Russia-Ukraine conflict contrasts with the concluded COVID-19 crisis, making the 2022-2023 period less definitive and more of a snapshot than a conclusive result.

These considerations underscore the need for further research to fully comprehend the implications of ESG performance during crisis periods, particularly in the context of the ongoing Russia-Ukraine conflict. The findings regarding the second research question are mixed: while it is partially confirmed for certain sub-periods, it must be rejected for others. Additionally, it is important to recognize that crisis periods often serve as a 'turning point' for some investors, shifting their focus towards sustainability (Dai, 2022; Zhang et al., 2024).

The complexities surrounding ESG performance in times of crises are further highlighted by the mixed evidence presented by Lööf, Sahamkhadam, & Stephan (2022). Their study reveals that while some evidence supports the effectiveness of ESG strategies in crises, other studies indicate no effect or even negative outcomes. These conflicting findings further emphasize the need for more in-depth research to fully understand the dynamics at play.

Research Question 3:

"Do ESG ratings impose constraints on diversification that could potentially limit investment performance?"

The third research question, which focuses on diversification, reveals critical insights. Diversification issues were particularly evident in Germany's performance during the COVID-19 period under the Best-in-Class strategy. Germany was unique in that the Best-in-Class strategy outperformed the Traditional strategy in the 2020-2021 period. Nevertheless, it's important to note that the Best-in-Class in Germany included 13 stocks, while other countries had significantly fewer stocks, ranging from 6 to 11. This discrepancy raises questions about whether the outcomes might have differed had other countries included more stocks in the Best-in-Class strategy.

Data availability is a critical factor in this analysis. The higher ratings observed for German companies may not accurately reflect their true performance, underscoring the variability in ratings across different providers. Given that this thesis utilized data from Refinitiv, the results might differ if another rating agency were employed, highlighting the challenges posed by the lack of standardization across rating agencies. This discrepancy raises significant concerns regarding the impact of data availability and the choice of rating agency on the findings. Moreover, the results confirm the third research question, suggesting that ESG exclusion strategies may be suboptimal due to the considerable constraints they impose on portfolio diversification.

This conclusion is consistent with prior research, which indicates that optimal diversification generally requires 20-30 stocks (Evans & Archer, 1968; Elton & Gruber, 1977; Goetzmann & Kumar, 2008). Besides, the study reinforces critiques that excluding investments based on sustainability criteria could excessively limit diversification.

In this study, the ESG portfolios generally had fewer stocks compared to the Traditional portfolio, which included 15 or 18 stocks, depending on the country. As a result, the diversification effect in ESG portfolios was less effective, increasing overall risk due to higher firm-specific risk.

Overall, this study finds significant issues related to diversification, particularly regarding the varying number of stocks in the Best-in-Class portfolio and the limited number of stocks in the Negative Screened portfolio. Both ESG strategies featured significantly fewer stocks than the Traditional portfolio. This suggests that sustainability strategies may not perform as well as Traditional portfolios, a challenge further compounded by the inherent difficulties in achieving adequate diversification within ESG portfolios. Although equally weighted strategies improved diversification to some extent, the limitations remain apparent.

The results of this thesis underscore the need for further research to better understand the relationship between ESG factors, diversification, and portfolio performance, particularly in times of crisis and when using different rating agencies.

6. Discussion and Limitations

In discussing the findings and limitations of this thesis, several critical aspects must be addressed to ensure a comprehensive and rigorous interpretation of the results. While the study presents some key positive findings supporting sustainable investments in specific crisis sub-periods, it is important to recognize that, overall, Traditional strategies predominantly outperformed ESG strategies across the entire period. It should be noted, however, that several limitations may have influenced these outcomes.

Firstly, the variability in ESG data is a significant concern. This issue has been thoroughly discussed within the thesis with the literature review emphasizing the inconsistencies in ESG data across different providers. In this study, ESG data were sourced exclusively from Refinitiv, one of the largest providers in the sustainability sector. Nevertheless, relying solely on Refinitiv introduces potential biases, such as the 'size bias' identified by Dobrick, Klein, & Zwergel (2023), which suggests that larger companies tend to receive more favorable ratings compared to underrepresented smaller companies. The exclusive use of Refinitiv data may have limited the analysis, and it remains uncertain whether similar results would be obtained with data from other providers. The root of this issue lies in the lack of unified standards among rating providers, leading to discrepancies and variations in ESG ratings, complicating efforts to achieve consistency across different data sources. This aligns with the findings of Liu, Nemoto, & Lu (2023), who suggest that employing multiple scoring methodologies could enhance the robustness of results by mitigating errors and biases.

Secondly, the selection criteria for companies, based solely on market capitalization, may have limited the study's conclusions. If alternative selection criteria, such as focusing on companies with the highest price-to-book ratios, had been employed, the outcomes might have differed. This underscores the importance of considering various selection methodologies to avoid potential biases in the analysis.

Another critical limitation relates to the issue of diversification within ESG strategies. The analysis revealed that ESG strategies often struggled to outperform Traditional approaches, not only in times of global crisis but also throughout the entire analysis period. In fact, Traditional portfolios consistently outperformed ESG strategies across all five countries analyzed – France, Germany, Italy, the Netherlands, and Spain – both over the entire period and, in certain instances, during specific crisis periods. This finding emphasizes the need for a more diversified

approach to ESG investing. A comparative analysis incorporating data from multiple providers or including different asset classes could yield more robust and conclusive results.

Nonetheless, it is important to stress that despite these challenges, the results remained predominantly positive – an outcome that might not have been anticipated in times of crisis. When comparing these findings with those of previous studies, the results of this thesis do not significantly deviate from the established consensus, reinforcing the broader performance dynamics between Traditional and Sustainable investment strategies under varying market conditions.

The timeframe considered in this study, from 2018 to 2023, also presents limitations. This period was marked by several significant economic and societal disruptions, including the COVID-19 pandemic and the ongoing Russia-Ukraine conflict. These events have profoundly impacted global markets, particularly in Europe, and may have influenced the performance of both Traditional and Sustainable investment strategies. On top of this, the ESG scores utilized in this study primarily reflect data available up until 2022, with the most comprehensive data covering that period. Significant data gaps were present in the Refinitiv database beginning in 2023, further limiting the ability to draw conclusions about more recent developments. The relatively short comparison period, combined with these data limitations, affects the robustness of the study, as a longer and more comprehensive dataset would likely offer deeper insights into the performance of these strategies under varying conditions. While the COVID-19 pandemic has officially ended, its economic impacts continue to persist. Similarly, the Russia-Ukraine conflict remains ongoing, making it challenging to provide a definitive analysis of its long-term effects.

The thesis's geographical focus poses another limitation. The study is centered on European countries, specifically major industrialized nations such as France, Germany, Italy, the Netherlands, and Spain. This approach excludes emerging markets, particularly in Eastern Europe, as wells as countries from other continents, thereby limiting the generalizability of the findings. On top of that, the analysis is concentrated exclusively on the Euro currency, without accounting for other currencies, which may further limit the applicability of the results to non-Eurozone countries. Consequently, the findings of this study are primarily applicable to comparable countries. Future research should aim to include a broader range of countries and regions, incorporating firms from emerging markets and other continents, as well as different

currencies. This approach would provide a more comprehensive analysis and a deeper understanding of how different regions, economies, and currencies respond to crises.

In conclusion, while this thesis offers valuable insights into the comparative performance of Traditional and Sustainable investment strategies, these findings must be interpreted in the light of the aforementioned limitations. Future research should address these limitations by incorporating data from multiple providers, expanding the geographical scope, and investigating a longer and more recent timeframe. Additionally, taking into account diversification challenges within ESG strategies, the unique impacts of global crises such as the COVID-19 pandemic or the Russia-Ukraine conflict, and incorporating different currencies will be crucial for developing a more resilient and reliable framework for both Traditional and Sustainable investing (Abate, Basile & Ferrari, 2021). These approaches would contribute to a more comprehensive and robust analysis, ultimately enhancing the understanding of investment strategies across varying contexts.

7. Conclusion

Sustainable investing has rapidly evolved into a significant segment within the financial industry, driven by increasing demand from millennial investors, governments, international organizations, and the broader public. This shift reflects a growing understanding that access to capital is not merely a privilege but also a considerable responsibility. Financial professionals are increasingly expected to use their influence in ways that contribute to the advancement of societal well-being and the protection of the environment, ensuring that investment decisions are not made at the expense of future generations (Ballate, 2018; Teti, Dallocchio & L'Erario, 2023). Despite this rising interest, substantial challenges remain in transitioning from traditional to sustainable investing. These challenges include the need for greater ESG education, increased transparency, and, most importantly, the development of standardized reporting systems to streamline the ESG investment process. As previous studies have pointed out, what cannot be clearly defined or measured cannot be improved (Diez-Cañamero et al., 2020). This highlights the urgency of establishing standardized metrics for ESG performance, which remains a critical barrier in advancing sustainable finance (Abate, Basile & Ferrari, 2021; Avramov et al., 2022).

While the momentum behind sustainable investing is undeniable, the lack of unified standards and consistency in ESG ratings continues to present significant challenges (Abate, Basile & Ferrari, 2021). As demonstrated in this thesis, these issues directly affect both the performance and perception of ESG strategies in modern finance. Furthermore, as Busch, Bauer & Orlitzky (2016) stated: ***"If ESG data do not reliably and validly reflect organizational reality, how can sustainability investment practices contribute to sustainable development?"*** This underscores the critical need for accurate and reliable ESG data, without which the potential positive impacts of sustainable investing may remain unfulfilled.

The findings of this study reveal the complexities and limitations of ESG-based strategies. The following conclusions draw upon the analysis conducted and provide insights into the current state of sustainable investing and its implications for financial markets.

By analyzing the performance of the largest companies by market capitalization from France, Germany, Italy, the Netherlands, and Spain, this study compared the performance of ESG and Traditional portfolios across three distinct sub-periods, including the COVID-19 pandemic and the Russia-Ukraine conflict. The results indicate that, overall, Traditional portfolios generated superior returns compared to ESG-focused strategies, not only in terms of returns and

SR but also in risk management, with Traditional portfolios consistently exhibiting lower risk. While this suggests that ESG portfolios do not consistently yield superior financial performance, there were notable exceptions in specific markets and periods where ESG strategies demonstrated competitive outcomes. These instances highlight the potential of ESG approaches under certain conditions, even though Traditional portfolios generally offered stronger performance and more effective risk mitigation across the broader analysis.

A key challenge identified in this study was the limited degree of diversification within ESG portfolios, particularly in the Negative Screening strategy, which consistently experienced poor performance due to the small number of stocks included. This lack of diversification negatively impacted both portfolio performance and risk management. Additionally, the Best-in-Class strategy faced challenges, as the number of stocks in the portfolios varied significantly across countries, further complicating a consistent evaluation of their relative performance. This variability in portfolio composition underscores the limitations in drawing definitive conclusions about the effectiveness of these ESG strategies.

The impact of global crises on investment risk was also significant. Within the COVID-19 period, all portfolios experienced a notable increase in risk, and although some recovery was observed post-crisis, pre-crisis risk levels were not entirely restored in any country. These findings indicate that, while ESG portfolios may offer some resilience in times of crisis, their overall performance does not routinely surpass that of Traditional strategies.

Addressing the research questions posed in this study:

1. ***"Do Sustainability-focused strategies outperform Traditional strategies?"***

The analysis demonstrated that Traditional portfolios consistently yielded stronger results compared to ESG-focused strategies, leading to the conclusion that Sustainability-focused approaches, in their current form, do not provide better performance. As such, the belief that ESG strategies offer a performance advantage over Traditional strategies can largely be dismissed.

2. ***"Do Sustainability-focused strategies demonstrate superior performance compared to Traditional strategies during crises?"***

The findings were mixed. In certain instances, such as the Best-in-Class approach in Germany throughout the COVID-19 pandemic and the Negative Screening strategy in France and Spain amid the Ukraine crisis, ESG strategies demonstrated stronger performance than Traditional approaches. However, the results varied significantly across countries and time periods, making it difficult to conclude definitively that ESG portfolios consistently outperform Traditional strategies in times of crisis.

3. ***"Do ESG ratings impose constraints on diversification that could potentially limit investment performance?"***

This assertion is particularly evident in the case of the Negative Screening strategies, where limited stock selection resulted in inadequate diversification and lower performance. Similarly, the Best-in-Class strategies faced challenges due to varying portfolio sizes across countries, further emphasizing the need for a more unified and standardized approach to ESG ratings.

Several limitations of this thesis should be acknowledged. The reliance on ESG scores from a single provider, Refinitiv, restricts the comparability of the results. This issue is further compounded by the broader lack of standardization across different providers, as frequently noted in different studies. Data availability, particularly for 2023 posed further challenges due to some incomplete ESG scores. The study's focus on European markets also limits the generalizability of the findings, as their applicability to emerging markets – where ESG adoption may follow different patterns – remains uncertain. Moreover, the exclusive use of large-cap companies, specifically those selected from major indices, limits the relevance of the findings to smaller firms, which were not included in the analysis.

Future research should aim to broaden the scope by incorporating multiple ESG providers, enabling a more comprehensive analysis of how different scoring methodologies impact portfolio performance. Expanding the study to include small-cap firms and emerging markets would additionally offer valuable insights into the performance of ESG strategies across various market segments. As sustainable finance continues to evolve, the development of standardized

ESG metrics will be crucial for improving transparency, reducing information asymmetries, and building greater investor trust in sustainable investing.

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