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ESG vs Conventional Funds: a Comparative Analysis of Returns and Alpha

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Summary

Introduction

This paper stems from the idea of contributing to one of the most relevant and controversial debates that has emerged in the contemporary financial landscape, which is the real effectiveness of sustainable investment strategies in generating real added value in terms of performance for investors compared to conventional investment strategies. In a context in which Environmental, Social and Governance (ESG) criteria are assuming an increasing central role in the allocative choices of market players, it becomes crucial to ask if such strategies represent an effective driver of extra-return, capable of combining competitive financial performance with the integration of ethical principles and social responsibility, or if, on the contrary, the implementation of an ethical and responsible approach to investments leads to an inevitable trade-off, in which the achievement of positive externalities and sustainability objectives takes place at the expense of profit maximization. This paper therefore aims to analyze the actual relationship between sustainability and performance, assessing whether and to what degree ESG strategies are able to offer measurable added value over traditional investments.

As a starting point, the first chapter describes the current condition of the market, defining the meaning of Socially Responsible Investing (SRI) and illustrating its growing relevance within the global asset management market, while also highlighting how, even at the regulatory level, policy makers are actively promoting this type of investment. Next, a review of the currently available literature is presented, in which various papers compare the returns of ESG-managed funds with those of conventional funds over time. As will be seen, three main schools of thought emerge: the first believes that ESG funds are able to generate more value than conventional funds; the second argues that there is no significant difference, as both are primarily driven by market dynamics; and the third asserts that ESG funds give up a portion of the financial return in favor of ethical and responsible behaviour.

The second chapter provides the theoretical basis for empirical analysis, clarifying the distinction between return, which can be viewed in part as a “crude” measure of performance, and alpha defined as the additional return obtained over and above that explained by general market movements. The latter represents the asset manager's ability to generate extra-performance through active portfolio management, that is, through

investment choices that allow it to beat the reference market. Next, the main theoretical asset pricing models used to isolate Alpha are presented, including the Capital Asset Pricing Model (CAPM), the Fama-French (FF) model, and the Fama-French-Carhart (FFC) model.

The third chapter starts by defining two reference clusters, one consisting of ESG funds and the other of conventional funds, both selected from the Morningstar database. Once the clusters are outlined, a descriptive analysis is conducted to highlight differences in historical returns, both on a monthly and annual basis, referring to a 10-year time horizon. Then, using the same performance data, the asset pricing models illustrated in the previous chapter, which are the Capital Asset Pricing Model (CAPM), the Fama-French (FF) model, and the Fama-French-Carhart (FFC) model, are implemented through the Python programming language in order to isolate the Alpha for each cluster. As a closing step, the final considerations of the analysis are drawn, providing an answer, limited to the sample examined, to the core question regarding the comparison between sustainable and conventional investment strategy

1. Integrating ESG Factors in Investments: a Literature Review

The topic of sustainability in finance has grown significantly in the current economic stage, influencing the investment strategies and actions of both institutional and retail investors. The concept of Socially Responsible Investing (SRI), an investment strategy that seeks to foster positive externalities for society and the environment in addition to financial rewards, must be defined within this framework. Unlike conventional investment approaches, this one brings ethics into the process of selecting assets, analysing they effect they have on society and the environment. Such an attitude promotes responsible and clear business practice

Socially responsible investment is concerned with the selection of companies that have sustainable business models, with the explicit exclusion of those that engage in harmful-to-society or harmful-to-the-environment activities, such as the production of fossil fuels or weapons. Companies that belong to the renewable energy sector, the circular economy, and the ecological transition sector are usually included in sustainable portfolios, with the exclusion of industries related to the production of fossil fuels, weapons, and ethically questionable activities such as gambling and tobacco. These investments follow the guidance of Environmental, Social, and Governance (ESG) criteria, with the use of strict screening filters to make sure that only companies that comply with predetermined sustainability criteria are included[1].

1.1 ESG Framework

The term Environmental, Social, and Governance (ESG) emerged in the latter half of the 20th century, as investors started to recognize the ethical dimensions of their financial choices. Starting from the 1960s, some investment funds started avoiding controversial sectors, such as tobacco and war industries[2]. However, it was not until 2004 that the term ESG reached a precise and globally recognized definition, following the publication of the "Who Cares Wins" report by the United Nations[3]. This study supported the inclusion

1 Bauer, R., Koedijk, K., & Otten, R., 2005, International evidence on ethical mutual fund performance and investment style.
2 Sullivan, R., & Mackenzie, C., 2017, Responsible Investment: A Handbook for Sustainable Finance.
3 United Nations, 2004, Who Cares Wins: Connecting Financial Markets to a Changing World.

of ESG considerations in investment decision-making processes by highlighting the link between sustainability and the generation of financial return.

In 2006, the United Nations has further boosted ESG investing with the launch of the Principles for Responsible Investment (PRI), which consists of six guiding principles to promote the integration of sustainability into investment strategies. Principles for Responsible Investment encourages institutional investors to incorporate ESG factors into investment analysis and reporting. By 2023, over 5000 asset managers across the world have signed Principles for Responsible Investment, sealing the global commitment to responsible investment. Principles for Responsible Investment have significantly altered the ESG landscape, influencing institutional investors and resulting in the widespread application of ESG factors in investment decision-making[4].

As ESG investment continued to evolve, regulatory authorities have increasingly focused on enhancing transparency and comparability of ESG disclosure. The European Union launched the Sustainable Finance Disclosure Regulation (SFDR) in 2021, which mandates that financial market participants disclose exhaustive information regarding the ESG components of the products they provide, including the integration of ESG risks and the consequent sustainability effects. The SFDR aims to provide a more harmonized way of ESG investment in Europe[5].

In addition to the Sustainable Finance Disclosure Regulation, other important regulatory regimes have surfaced in Europe to address ESG investment, supporting the need for open and harmonized ESG disclosure. The EU taxonomy for sustainable activities, launched in 2020, provides a system of determining which of a firm's activities constitute environmentally sustainable and which do not. It allows investors to ascertain if the investment they hold is in line with ESG criteria, especially with a focus on achieving the EU's environmental and climate targets, such as net-zero emissions by 2050. The taxonomy aims to prevent the practice of greenwashing and to make investment truly contribute to environmental sustainability[6].

4 PRI, 2006, Principles for Responsible Investment.
5 Duarte, M., Rebelo, A., & Pinto, C., 2022, ESG Disclosures and Regulatory Challenges: A Comprehensive Review.
6 EU Commission, 2020, EU Taxonomy for Sustainable Activities.

Unlike the European Union's wide-ranging regulatory system for ESG investment, the United States approached ESG regulation more gradually, with more fragmented authority. While no federal ESG disclosure mandates exist, a number of U.S. regulatory bodies have moved to address the demand for more uniform and transparent reporting of ESG factors.

Most notably, the Securities and Exchange Commission (SEC) has taken a leading position in the ESG transition in the U.S. In 2021, the SEC issued guidance that companies have to disclose material climate risks that could impact the bottom line, showing a trend toward more robust ESG reporting. Then, in March of 2022, the SEC proposed more expansive rules that call for public companies to disclose climate risks, including greenhouse gases and attempts to achieve U.S. climate targets[7].

ESG analysis uses both quantitative and qualitative indicators to assess a company's performance in terms of environmental, social, and governance factors. In fact, the three key evaluation areas are:

- Environmental factors (E): These assess a company's direct and indirect environmental impact, including carbon emissions, energy efficiency, water resource management, renewable energy adoption, and waste reduction policies. Other elements include biodiversity conservation, compliance with environmental regulations, and climate adaptation strategies.
- Social factors (S): These take into consideration a company’s impact on society, more precisely on its stakeholders. Key criteria include human rights compliance in the supply chain, workplace safety and health, diversity and inclusion, community engagement, and respects of labour rights. Ethical data management and customer relationship practices are also significant social factors.
- Governance factors (G): These evaluate corporate management and decision-making transparency. Key aspects include board composition, the presence of independent members, transparency in internal and external communication, executive compensation policies, anti-corruption measures, and respects of

7 Securities and Exchange Commission, 2022, Proposed Rule on Climate-Related Disclosures

financial transparency and corporate ethics. An essential factor is managing the balance between majority and minority shareholders.

A number of rating organizations, including MSCI ESG Ratings, Morningstar, and Refinitiv, use proprietary methodologies to provide scores in order to evaluate a company's or fund's ESG exposure. For examples, companies are ranked on a seven-tier scale by MSCI ESG Ratings, for instance, from "ESG Leaders" to "ESG Laggards," based on how well they are able to handle opportunities and risks associated with sustainability[8]. Another widely used tool is the ESG Disclosure Score, which measures the quality and transparency of ESG information provided in corporate sustainability reports[9].

An important point to make is the difference between Corporate Social Responsibility (CSR) and Environmental, Social, and Governance (ESG) criteria. Although these two definitions are frequently used interchangeably, their impact, focus, and breadth are very different. A company's voluntary efforts to enhance its social impact are emphasized by the broader idea of Corporate Social Responsibility (CSR). Topics like philanthropy, community involvement, and moral business practices are the most engaged with. It is primarily concerned with a company's commitment to positive social change, typically without a direct link to the core business and its financial performance[10]. In contrast, ESG criteria are more specific and measurable. ESG factors are used by investors to benchmarking a company's performance in managing environmental risks, its social impact on stakeholders, and its governance practices, with a direct focus on how these factors contribute to long-term sustainability and value creation for investors[11].

In recent years, the ESG investment market has experienced rapid growth. According to the Global Sustainable Investment Alliance (GSIA), ESG assets reached 40,5 trillion USD globally in 2022, accounting for nearly 36% of total assets under management (AUM). Europe has been a key driver of this growth, holding approximately 84% of global ESG assets[12]. However, in 2023, there was a slowdown in capital flows towards

8 MSCI, 2023, MSCI ESG Ratings and Scores.
9 Morningstar, 2022, ESG Disclosure Score and Transparency.
10 Carroll, A. B., 1999, Corporate social responsibility: A case approach.
11 Friede, G., Busch, T., & Bassen, A., 2015, ESG and financial performance: Aggregated evidence from more than 2000 empirical studies.
12 Global Sustainable Investment Alliance, 2023, Global Sustainable Investment Review.

sustainable funds, primarily due to macroeconomic challenges such as the war in Ukraine and rising inflation.

Considering these difficulties, the growth of the ESG sector remains strong, driven by regulatory momentum and increasing awareness among investors of the importance of sustainability criteria. The ongoing evolution of regulations and ESG assessment tools will continue to play a pivotal role in shaping the future of sustainable finance

1.2 Growth in ESG Asset Under Management (AUM)

In recent years, ESG investments have experienced exponential growth, consolidating their position in the global financial market. As said before, according to the Global Sustainable Investment Alliance (GSIA), sustainable investment assets will grow exponentially in next years, while Europe remains the leading market for these investments, accounting for approximately 85% of global ESG fund assets, while the United States has shown slower growth due to regulatory and political uncertainties.

However, ESG investments have been influenced by several geopolitical and economic factors that have affected their development. The war in Ukraine, tensions between the United States and China, and conflicts in the Middle East have placed pressure on financial markets, complicating the integration of ESG criteria into investment strategies. Furthermore, the global energy crisis has caused to some nations, like Germany, to re-evaluate the short-term role of fossil fuels, which has slowed the shift to renewable energy. This has sparked questions regarding the coherence of ESG tactics in a setting where energy security has emerged as a major concern.[13].

The growth of ESG investments has also been negatively impacted by the increase in interest rates and inflation, especially for businesses engaged in the green transition that need to invest a significant amount of capital in new initiatives, as Capex. However, there has been an increase in interest in instruments like the sustainability-linked bonds, also known as green bonds or sustainable bonds, which provide variable yields depending on how well the companies using the funds accomplish particular ESG objectives.[14].

13 International Energy Agency, 2023, World energy investment report 2023.
14 Sullivan, R., & Mackenzie, C., 2017, Responsible investment: A handbook for sustainable finance.

Despite these challenges, ESG investments are still in great demand. As estimated by PwC, assets managed under ESG criteria will reach 33,9 trillion USD by 2026, representing 21,5% of global assets under management (AUM)[15]. Similarly, Allianz expects that ESG AUM could reach 50 trillion USD by 2025 worldwide[16]. These expectations are driven by increasing investment in the energy transition to the green economy, considered a key driver of the fulfillment of Agenda 2030 and Net-Zero Emission 2050.

As estimated by the International Energy Agency (IEA), to meet such European Union targets, the world must step up investment in the energy transition to 4,5 trillion USD a year by 2030, a sharp increase compared to the current 1,8 trillion USD a year. Such an increase is needed to expand the world's clean energy capacity and reduce the use of fossil fuels by over 25% by 2030. These figures prove the rising importance of sustainable finance and the need to accelerate the ecological transition to meet long-term climate targets.

1.3 ESG Factors in Investment Decisions

ESG-driven investments, which continue to grow in significance, not only look for financial returns but also promote ethical and sustainable business practices. The latter include goals such as increasing workforce diversity, improving working conditions, and demonstrating that socially responsible approaches can generate long-term financial benefits. ESG investors adopt different strategies: some of them focus on companies involved across all three ESG pillars (environmental, social, and governance) while others concentrate capital towards businesses particularly committed to one aspect, such as environmental sustainability or governance improvements[17].

The growing interest in ESG investments is supported by academic research examining the connection between sustainability and financial performance. Early studies primarily focused on risk and economic feasibility, but the current debate focuses on comparing the returns between ESG investments and conventional ones. Some studies suggest that ESG

15 PwC., 2023, ESG investment trends report 2023.
16 Allianz, 2023, ESG assets under management forecast.
17 Clark, G. L., Feiner, A., & Viehs, M., 2015, From the stockholder to the stakeholder: How sustainability can drive financial outperformance.

investments yield returns comparable to traditional investments, while others state that there are significant variations, depending on sector and methodology.

In particular, three main hypotheses explain the relationship between ESG investments and their financial performance. The first suggests that ESG funds yield returns similar to conventional ones, implying that sustainability does not directly influence corporate performance. The second states potential financial disadvantages for companies adopting ESG practices due to higher compliance and sustainability[18]. The third one suggests that companies with high ESG standards may achieve superior returns through greater operational efficiency, reduced risks, and increased attractiveness to investors[19].

These dynamics are examined through two primary schools of thought: the "neoclassical perspective", which states for a trade-off between financial performance and social responsibility; and the "value creation theory", which points that integrating ESG factors offers a competitive advantage by promoting innovation, operational efficiency, and long-term profitability[20]. This is also supported by evidence showing that companies dedicated to sustainability have contributed to the development of financial instruments like ESG ETFs and green bonds, which not only improve market transparency but also attract more investors focused on environmental and social issues, thereby fostering a more responsible approach in global finance[21].

Despite the rising interest in ESG investments, issues such as greenwashing remain a significant concern. Greenwashing is the practice with which companies overstate or show false commitment to environmental or social goals to attract investment, misleading stakeholders and diluting the credibility of the sustainability sector. Such a problem undermines the efficacy of sustainability efforts, as it leads to the misallocation of capital to companies that lack a real commitment to ethically sound practices. Studies suggest that the absence of standardization and transparency in ESG reporting makes it easier for companies to make fake claims, which further complicates the investment decision-making process. As a result, the need for more stringent regulations to substantiate ESG

18 Krüger, P., 2015, Corporate social responsibility and financial performance: The dark side of the link.
19 Clark, G. L., Feiner, A., & Viehs, M., 2015, From the stockholder to the stakeholder: How sustainability can drive financial outperformance.
20 Sullivan, R., & Mackenzie, C., 2017, Responsible investment: A handbook for sustainable finance.
21 Sustainalytics, 2020, The rise of sustainable finance: Trends, challenges, and opportunities in ESG investing.

promises with verifiable facts and tangible actions is increasingly being demanded. Some regulatory bodies, such as the European Union through its Sustainable Finance Disclosure Regulation (SFDR), have taken the first step toward preventing such problems, but experts maintain that harmonizing ESG norms across the globe is the key to effectively combating greenwashing[22].

Moreover, emerging markets present a unique set of challenges and opportunities for ESG investments, but the main issue is that these regions are the less regulated. While these businesses face significant barriers, such as infrastructure gaps and regulatory uncertainty, they also present substantial growth potential, especially in sectors related to renewable energy and microfinance. On the other hand, in markets with less stringent environmental regulations like these, the risk of investing in companies with poor sustainability practices increases, raising concerns about the long-term viability of such investments. However, these markets also offer unique opportunities for impact investing, especially in sectors that are pivotal to achieving sustainable development goals (SDGs), such as clean energy, affordable housing, and financial inclusion[23].

Empirical studies on ESG financial performance show mixed results, with some suggesting that ESG funds can outperform traditional ones, particularly in sectors directly impacted by sustainability. The future of ESG investments lies in the continued development of both advanced financial instruments and more sophisticated audit procedures, which, together with growing investor interest, will likely make ESG investing more accessible and transparent, further enhancing its influence on the global financial system. However, ethical concerns remain about the sincerity of some companies' ESG commitments, imposing investors to remain vigilant in ensuring that sustainability is not merely used as a marketing tool but as a genuine driver of positive change.

1.4 ESG vs Conventional Fund Performance

To better understand the differences in financial performance between ESG funds and conventional funds, it is crucial to examine in deeper way the three hypotheses previously

22 Lyon, T. P., & Montgomery, A. W., 2015, The means and ends of greenwashing.
23 Krueger, P., 2015, The influence of social and environmental performance on the cost of capital: Evidence from emerging markets.

presented. The academic literature provides various perspectives on this comparison, which generally fall into three main categories: studies that find no significant differences in returns, research indicating that ESG funds yield higher returns, and analyses suggesting that ESG funds underperform conventional funds.

Some earlier studies, such as those by Barnett and Salomon[24], examined socially responsible funds and conventional funds founding no significant differences in returns. Specifically, Barnett and Salomon analysed a broad sample of US socially responsible funds and concluded that these funds performed similarly to conventional funds, with no measurable difference in risk-adjusted returns. Similarly, research by Blitz and Fabozzi[25] on ethical and conventional funds in Europe revealed that the performance of sustainable funds closely reflected the one of traditional funds, even during periods of financial instability like the Global Financial Crisis in 2008.

On the other hand, other studies argue that ESG funds have the potential to generate more returns compared to conventional funds. For example, Giese et al.[26] showed that companies with good ESG practices have a better chance of outperforming in the long term as they have the ability to steer clear of risks and pursue new business opportunities. In addition, research by Cheng et al.[27] revealed that companies with good ESG practices had better operational performance, lower capital costs, and improved profitability, which translated into improved stock performance. This was further corroborated by studies such as the one from López[28], which highlighted that companies that emphasize ESG factors have a tendency to achieve higher levels of trust in the capital markets, thus improving their returns.

However, other research suggests the opposite, pointing out that ESG funds may trail behind traditional funds for a variety of reasons. Studies like the one conducted by Bae et al.[29] on "sin stocks" (shares of companies in tobacco, alcohol, gambling, and arms sectors)

24 Barnett, M. L., & Salomon, R. M., 2006, Beyond dichotomy: The curvilinear relationship between social responsibility and financial performance.
25 Blitz, D. S., & Fabozzi, F. J., 2017, Sustainable investing: Revolutions in theory and practice
26 Giese, G., Lee, L. E., Melas, D., Nagy, Z., & Nishikawa, L., 2019, Foundations of ESG investing: How ESG affects equity valuation, risk, and performance.
27 Cheng, B., Ioannou, I., & Serafeim, G., 2014, Corporate social responsibility and access to finance.
28 López, M. V., 2007, Sustainable development and corporate performance: A study of the Spanish stock market.
29 Bae, K.-H., Kang, J.-K., & Kim, J.-M., 2011, Sin stock returns.

found that such shares have the tendency to provide higher returns, but with a higher regulatory and reputational risk. Moreover, further research by Nofsinger and Varma[30] found that the increasing demand for ESG investment has overpriced sustainable companies, to the possible disadvantage of future returns. More recent studies, conducted by Boffo and Patalano[31], confirm that investors in ESG funds are often willing to accept lower returns in exchange for aligning their investments with ethical and social goals.

Studies by Statman and Glushkov[32], analyzing ESG funds in the US and UK, indicated that sustainable funds tended to underperform national benchmarks on average. The performance gap was largely attributed to two factors: higher management fees and the potential overvaluation of sustainable firms. Similarly, research by Dimson et al.[33] based on a Sharpe Ratio analysis, suggested that ESG funds underperformed conventional funds, with diversification constraints and higher costs for information gathering being significant contributors to this trend.

Another key factor in the performance of ESG funds is diversification and the associated costs. Studies by Capelle-Blancard and Monjon[34] and El Ghoul et al.[35] show that ESG funds typically exclude certain sectors, such as tobacco, gambling, and defence (the previous cited "sin stocks"), which limits their investment universe and reduces diversification. Additionally, the costs of obtaining detailed sustainability information and performing ongoing ESG assessments can result in a performance drop.

Once again, certain studies show that ESG funds have an advantage in certain stages of the market. Nofsinger and Varma[36], along with Becchetti et al.[37], found that ESG funds performed better during economic crises, with evidence that socially responsible funds earned a higher Sharpe Ratio during the 2007-2008 financial crisis, suggesting they could

30 Nofsinger, J. R., & Varma, A., 2014, Socially responsible funds and market efficiency: The role of screening and impact investing.
31 Boffo, M., & Patalano, R., 2020, ESG investing: Practices, progress and challenges.
32 Statman, M., & Glushkov, D., 2009, The wages of social responsibility.
33 Dimson, E., Karakas, O., & Li, X., 2015, Active ownership.
34 Capelle-Blancard, G., & Monjon, S., 2014, The performance of socially responsible investment: A meta-analysis.
35 El Ghoul, S., Guedhami, O., Kwok, C. Y., & Mishra, D., 2011, Does corporate social responsibility affect the cost of capital?
36 Nofsinger, J. R., & Varma, A., 2014, Socially responsible funds and market efficiency: The role of screening and impact investing.
37 Becchetti, L., Ciciretti, R., Dalò, A., & Herzel, S., 2017, The performance of socially responsible investment: The role of ESG factors in the financial market.

potentially act as a hedge in volatile markets. Furthermore, a study by Lopez[38] on S&P 500 firms engaged in corporate social responsibility (CSR) found a positive correlation between CSR activities and financial performance, suggesting that companies focused on sustainable business models may see improvements in both operational efficiency and profitability. Similarly, research by Murray et al.[39] found that companies with strong ESG practices tended to achieve superior long-term financial results, indicating that a shift toward more sustainable business practices could enhance both operational and financial performance.

38 Lopez, M., 2011, Corporate social responsibility and financial performance: An analysis of S&P 500 companies.
39 Murray, A., S. H. & Cundiff, T., 2017, How CSR initiatives impact business performance: A review of 100 studies.

2. The Alpha and the Risk Adjusted Pricing Models

As seen so far based on the literature collected, there is no univocal answer regarding the comparison of the performance of ESG and conventional funds. Some exponents argue that sustainable funds because of the higher costs and risks of the strategy may provide a lower return to investors, while others believe that by putting more attention on ESG factors, companies may attract more capital and be more hedged against crises and critical events.

The objective of this paper is to provide an answer this question, using Jensen's Alpha produced by a cluster of ESG and conventional funds as the key metric. Before that, it is necessary to give an explaination of what the Alpha represents and its relationship with the risk-adjusted models of estimation, thus the Capital Asset Pricing Model (CAPM), the Fama-French model (FF) and the Fama-French-Carhart model (FFC).

2.1 The Alpha as a Key Performance Metric

In the field of finance and valuation, Alpha represents one of the key indicators for measuring the performance of an investment. In particular, this metric measures the ability of a company, a portfolio, or a fund manager to generate excess returns relative to the overall market, considering the associated systemic risk. Thus, Alpha (α) is defined by the difference between the actual return of the asset under consideration and the expected return calculated through an equilibrium-pricing model, such as the Capital Asset Pricing Model (CAPM), the Fama-French model (FF) and the Fama-French-Carhart model (FFC). The basic formula can be expressed as:

$$\alpha = Rp - [Rf + \sum \beta * (Rm - Rf)]$$

Where:

- Rp is the portfolio return;
- Rf is the risk free rate;
- β is the sensitivity indicator to the risk factor;
- Rm is the market return.

From an economic standpoint, the Alpha is an indicator of the capabilities and qualities, which can be summarized as "management skills," of an investment manager. Consequently, a positive Alpha is the result of a manager's ability to select high-growth stocks, to be good at market timing, or to capture signals and information in a better way compared to the market average and its competitors. As a result, positive-alpha portfolios have realized a higher return than expected based on the associated risk. This is especially important for those funds that base their strategy on active management and trading, as it would represent a net-added value for their investors.[40]

Conversely, a negative Alpha goes to indicate a worse performance compared to the one of the theoretical equilibrium model. Thus, this means that the portfolio has generated a lower return than the associated risk. The reason for this could be found in an incorrect asset selection by the manager or a wrong market timing, which can be summarized as poor portfolio management skill. In addition, market condition can strongly effect the capacity to create value, either in times of crisis (such as the great financial crisis of 2008 or during the COVID-19 period) or in particularly competitive market sessions it is more likely to generate negative Alpha.[41]

The third case is the case predicted by all equilibrium-pricing models, which is the scenario where Alpha is equal to zero. This indicates that the portfolio has generated a return that is perfectly in line and consistent with the associated level of risk and thus with the benchmark market. Consequently, the manager has generated neither an extra-profit nor a return below the general market, but has only replicated the performance of the base model. This scenario is the basis of equilibrium pricing models, in which no investor can systematically beat the market in the presence of information asymmetries, so one should invest passively rather than through active trading.[42]

Although this metric is widely used, the Alpha requires a careful interpretation which is based on the theoretical model used to estimate it. In particular, its value is strongly related to the reference equilibrium-pricing model and its accuracy. In fact, the Alpha is not an absolute value but it is a relative measure that is derived based on the underlying

40 Jensen, M. C., 1968, The performance of mutual funds in the period 1945–1964
41 Berk, J. B., & van Binsbergen, J. H., 2015, Measuring skill in the mutual fund industry.
42 Fama, E. F., 1970, Efficient Capital Markets: A Review of Theory and Empirical Work.

theoretical model[43]. From this perspective, the robustness of this model assumes vital importance, as the positivity or negativity of the Alpha can vary drastically by moving from a simple model such as the Capital Asset Pricing Model (CAPM) to a multifactor model such as the Fama-French-Carhart (FFC) model[44]. However, this does not reduce the explanatory value of Alpha as a tool for analysis and comparison, especially when applied consistently and comparatively by applying multiple models. In addition, alpha retains a key role in the evaluation of active management strategies because it can summarize in a single indicator the value generated by the manager relative to the risk taken. In particular, in the context of ESG investments, alpha estimation allows analysis of whether the integration of environmental, social, and governance criteria positively or negatively affects the fund's ability to generate returns above the benchmark, after controlling for key market risk factors.[45]

2.2 The Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model (CAPM) is an equilibrium-pricing model and it is one of the pillars of modern finance, first theorized by William Sharpe in 1964[46] and later independently by John Litner in 1965[47]. This model defines a linear relationship between the systematic risk of a financial asset and its expected return. The Capital Asset Pricing Model (CAPM) is derived from Markowitz's Portfolio Theory of 1952[48] and it is an extension of it, stating that there is no other element that drives the expected return of an asset outside of systematic risk, which is measured by the Beta coefficient (β).

This model is based on a number of strong but necessary assumptions in order to simplify the construction of an equilibrium model. These are:

- All investors are rational and risk-averse
- The market portfolio, which contains all available risky assets, is efficient
- Investors share uniform expectations on returns and volatility

43 Fama, E. F., & French, K. R., 1993, Common risk factors in the returns on stocks and bonds.
44 Roll, R., 1977, A Critique of the Asset Pricing Theory's Tests
45 Pastor, L., Stambaugh, R. F., & Taylor, L. A., 2021, Dissecting Green Returns
46 Sharpe, W. F., 1964, Capital asset prices: A theory of market equilibrium under conditions of risk
47 Lintner, J., 1965, The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets
48 Markowitz, H., 1952, Portfolio selection

- The market is perfectly competitive and frictionless, so frictions like transaction costs do not exist
- Investors can borrow capital at a risk-free rate unlimitedly
- Financial assets are perfectly divisible

Building on these foundations, it is possible to state that according to the Capital Asset Pricing Model (CAPM), in a competitive market with no information asymmetries, the return expected by investors for a risky asset is a linear function of the market risk, defined as systematic risk (given by the difference between the expected market return and the risk-free rate of return). Thus, the great insight of the model is that investors are not rewarded for idiosyncratic risk, since it can be eliminated through diversification, but only for general market-related risk that cannot be diversified, which finally means an Alpha equal to zero[49]

In light of this, the Capital Asset Pricing Model (CAPM) formula can be defined as:

$$Ri= Rf+\beta i*(Rm-Rf)$$

Where:

- Ri is the return of the financial asset
- Rf is the risk-free rate
- Rm is the return given by the market portfolio
- βi is the sensitivity indicator of the asset to the market risk

As formalized by Jensen of 1968, the Capital Asset Pricing Model (CAPM) can be used as a baseline to estimate the Alpha generated by an investment fund manager. This can be accomplished through a linear regression of the excess returns of the underlying portfolio against the risk-free rate on the market risk premium. The intercept of this linear regression represents the component of returns not explained by market Beta, hence our Alpha[50]. In mathematical terms, this is given by:

$$(Ri-Rf)=\alpha i+\beta(Rm-Rf)+\varepsilon i$$

49 Sharpe, W. F., 1964, Capital asset prices: A theory of market equilibrium under conditions of risk.
50 Jensen, M. C., 1968, The performance of mutual funds in the period 1945–1964

From the previous formula of the CAPM, here it is possible to see two more factors:

- αi, which is our excess return not explain by the market
- εi, the standard error given by the idiosyncratic shock

Jensen, in his empirical research, set the CAPM as the basic model because being a single factor model, it allows for easy comparison of fund and portfolio performance. At the same time, however, this allows the extra return to be captured only and exclusively with respect to the systematic risk factor, represented by market Beta.

In fact, the Capital Asset Pricing Model (CAPM) has empirical limitations related to the latter issue. The model in question cannot fully capture all the variation in asset returns. In particular, shocks deriving from different firm size and valuation cannot be explained by Market Beta alone. In this view, the main contributions come from the studies provided by Fama and French, which will be addressed next.

Another issue to consider concerns one of the fundamental assumptions, the existence of a perfect and efficient market portfolio. In reality, this is difficult to replicate, even considering indices such as the S&P500 or the Wilshire5000. In addition, the assumptions of homogeneous expectations, absence of transaction costs, and perfect information remain unrealistic conditions.

Despite this, the Capital Asset Pricing Model (CAPM) remains a solid starting point for empirical analysis, especially when the goal is to compare multiple portfolios on a common and theoretically established basis, but which needs to be integrated with other multifactor models.[51]

2.3 The Fama-French Model (FF)

The first extension of the Capital Asset Pricing Model (CAPM) is rppresented by a three-factor model, introduced by Eugene F. Fama and Kenneth R. French in 1993. Their goal was to improve on the basic one-factor model by adding two more risk factors to the Market Beta: the factor relatio to size which I take the name “Small Minus Big (SMB),” and the factor delative to valuation called “High Minus Low (HML)”.[52]

51 Bodie, Z., Kane, A., & Marcus, A. J., 2014, Investments
52 Fama, E. F., & French, K. R., 1993, Common risk factors in the returns on stocks and bonds.

With these two new factors, The two researchers wanted to address the empirical limitations of the Capital Asset Pricing Model (CAPM) by trying to further cover the volatility in financial asset returns. In detail, it was empirically demonstrated that stocks of small companies with high book value relative to the market reciprocal generate higher returns than systematic market risk alone, as opposed the stocks of large companies with market value above book value. In detail, Fama and French explained these anomalies, which contradict the Capital Asset Pricing Model (CAPM), through two effects:

- The "Size Effect" which shows that companies with lower market capitalization tend to have higher returns than those with larger market capitalization.
- The "Value Effect" refers to the Book-to Market Ratio of companies. Stocks with a higher ratio are more likely to record higher returns than companies with low ratio. [53]

Fama and French through their empirical analysis confirmed these two effects in a systematic way, showing how the basic CAPM ignored these dynamics. This led them to correct the model by plugging a factor to each of the two effects. For the "Size Effect" the factor "Small Minus Big (SMB)" was added, while for the "Value Effect" the factor "High Minus Low (HML)". Analyzing the two factors in detail, we have:

- The "Small Minus Big (SMB)" factor takes into account the "Size Effect" by measuring the extra-return that is generated by going long on a portfolio containing the stocks with the smallest market capitalization available and going short on those with the largest capitalization. If the related Beta is positive, it means that the portfolio is more sensitive to this strategy based on small caps. [54]
- The "High Minus Low (HML)" factor represents the "Value Effect" and considers the return from a long strategy on stocks with high Book-to-Market ratio that simultaneously goes short on those with low Book-to Market ratio, going to define the duality between "Growth Stocks" and "Value Stocks" . Again, a positive reference beta corresponds to a correlation between the stragia and the portfolio return.[55]

53 Fama, E. F., & French, K. R., 1992, The cross-section of expected stock returns.
54 Banz, R. W., 1981, The relationship between return and market value of common stocks
55 Rosenberg, B., Reid, K., & Lanstein, R., 1985, Persuasive evidence of market inefficiency

Given this explanation, it is possible to define the formula of the Three-Factor Fama-French Model as:

$$Ri = Rf + \beta m * (Rm - Rf) + \beta s * SMB + \beta h * HML$$

Where:

- Ri is the return of the financial asset
- Rf is the risk-free rate
- Rm is the return given by the market portfolio
- βM is the sensitivity indicator of the asset to the market risk
- βs explain the sensitivity of the portfolio to the "Small Minus Big (SMB)" strategy
- SMB is the "Size Effect" factor
- Bh measure the sensitivity of the portfolio to the "High Minus Low (HML)" strategy
- HML is the "Value Effect"

The introduction of these two factors has an important effect on the Alpha estimation described by Jensen earlier. Whereas in the Capital Asset Pricing Model (CAPM) the extra return was only calculated on systematic risk as measured by market Beta, the Fama-French model expands the coverage area to size and valuation risk. Again, as before, Alpha can be calculated through a linear regression, which in this case takes more factors into account. It is developed as follows:

$$Ri - Rf = \alpha i + \beta m * (Rm - Rf) + \beta s * SMB + \beta h * HML + \varepsilon i$$

This expansion allows for greater precision in performance evaluation and comparison, as the return on the asset is explained by multiple factors and is not limited only to market performance. This makes the estimation more robust and at the same time leaves space for substantial differences with the Alpha calculated on the Capital Asset Pricing Model (CAPM).[56]

The Fama-French model becomes even more relevant when applied to ESG funds, as these types of managers usually have a different composition than conventional ones. In

56 Fama, E. F., & French, K. R., 1993, Common risk factors in the returns on stocks and bonds.

particular, ESG funds prefer to invest in large, solid companies that can absorb large expenditures toward new sustainable projects and thus ensure a good ESG rating. As a result, target companies tend to have a higher market capitalization and a lower Book-to-Market ratio, leaving space for a relevant effect of the new factors introduced by Fama and French.[57]

2.4 The Fama-French-Carhart Model (FFC)

Later on, Mark Carhart, with his study ”On Persistence in Mutual Fund Performance” in 1997, wanted to introduce a new factor with the aim of capturing anomalies not considered by the Fama-French Model. This factor that was added carries the name of “Momentum Factor (MOM)” derived from the name of the effect he wanted to capture, that being the “Momentum Effect” demonstrated empirically by Jegadeesh and Titman in 1993. The concept behind this effect is that stock returns are explained not only by systematic risk (Beta Market), size effect (Beta SMB), and value effect (Beta HML), but by an additional factor, namely the tendency of prices to follow past trends.[58]

This dynamic has been observed empirically, showing how stocks that have experienced high returns in the last period tend to continue this trend of good performance. In contrast, those that have experienced negative returns in the last period tend to continue this under-performance. This effect, moreover, shows us how the basic assumptions of pricing models do not fully reflect reality, as it reveals market inefficiency and suggests systematic investor behaviours, such as overconfidence and overreaction to certain publicly released news.[59]

The concept of the momentum effect comes from behavioural finance, a branch of finance that studies how investors' behaviours, emotions and cognitive biases influence their financial decisions, often leading them to deviate from the rationality predicted by traditional models. It in fact represents one of the most relevant anomalies to the efficiency of markets, as it cannot be easily traced back to a theory of risk by deferring purely to investors' behaviour and reactions. Behavioural finance studies, like the ones

57 Pastor, L., Stambaugh, R. F., & Taylor, L. A., 2021, Sustainable investing in equilibrium.
58 Bodie, Z., Kane, A., & Marcus, A. J., 2014, Investments.
59 Jegadeesh, N., & Titman, S., 1993, Returns to buying winners and selling losers: Implications for stock market efficiency.

from Barberis, N., Shleifer, A., & Vishny, R.[60] and from Daniel, Hirshleifer & Subrahmanyam[61] in 1998, have tried to explain this phenomenon by theorizing three main causes:

- The first concerns the lag in reaction to news. Investors tend to adjust slowly to new information in the markets and so this creates a lag in the news-prices pair.
- The second, on the other hand, is the excess of euphoria and overconfidence when stock prices rise rapidly. The over-estimation of this positive phenomenon is the first cause of amplification of the bullish trend.
- Finally, some investors tend to follow market sentiment passively, relying more on mass emotions than economic fundamentals. This tends to corroborate market id trends even when they are not supported by conceptual data.

Although the causes of this effect are multiple and go beyond the three mentioned above, Carhart theorized the momentum factor as a variable added to the Fama-French model making it a four-factor model. In fact, the latter aims to capture the difference in returns between the best-performing stocks over the past 12 months versus the worst-performing stocks. Consequently, the "Momentum Factor (MOM)" is given by the average return of stocks with high past performance minus average return of stocks with low past performance. From the latter, it is possible to scratch the formula of the Fama-French-Carhart Model (FFC) as:

$$Ri = Rf + \beta m * (Rm - Rf) + \beta s * SMB + \beta h * HML + \beta Mom * MOM$$

Where from the previous one:

- MOM is the momentum factor, which measures the propensity of stocks to maintain the yield trend in the short term
- βMom is the sensivity factor related to the MOM return

Inclusion of the momentum factor further reduces the weight of alpha in explaining returns. If a fund has high exposure to stocks with strong positive momentum, its alpha estimated in the Fama-French model may be overestimated if this effect is not taken into

60 Barberis, N., Shleifer, A., & Vishny, R., 1998, A model of investor sentiment.
61 Daniel, K., Hirshleifer, D., & Subrahmanyam, A., 1998, Investor psychology and security market under- and overreactions.

account[62]. Therefore, it is possible to derive the Alpha from the Fama-French-Carhart Model (FFC) as:

$$Ri - Rf = \alpha i + \beta m * (Rm - Rf) + \beta s * SMB + \beta h * HML + \beta Mom * MOM + \varepsilon i$$

Also in this case, the momentum factor becomes very useful in evaluating perfomance of ESG funds compared with conventional funds. Studies show that sustainable funds tend to invest in companies with long-term sustainable growth, which may reduce exposure to high momentum stocks, such as those in technology sectors. At the same time, however, during phases of euphoria in markets the most popular ESG companies may experience a strong positive momentum effect, given by the advent of large amounts of capital from sustainable investors. Including this factor in the model provides clarity regarding this effect, giving an even cleaner Alpha estimate.[63]

2.5 Synthesis of Models and Introduction to the Empirical Analysis

In this chapter, the three models for estimating alpha were analyzed from a theoretical point of view. First, the Capital Asset Pricing Model (CAPM), which measures expected return based on systemic risk. Then, the three-factor Fama-French model, which adds the Size (SMB) and Value (HML) factors to better explain market anomalies. Finally, the four-factor Fama-French-Carhart model, which introduces the Momentum (MOM) factor to capture the effect from amplification of past trends.

The analysis performed shows that model choice is critical for robust performance evaluation, as each extension introduces additional factors that can improve alpha estimation and reduce bias from omission of relevant variables. For ESG funds, the use of multifactor models is particularly relevant because such funds tend to have different compositions than conventional funds and, as a result, have different exposures to systematic risk factors.

In the next chapter, an empirical analysis will be conducted to compare the performance of ESG funds and conventional funds using the models presented in this chapter. Specifically, the objective will be to estimate alpha through the Capital Asset Pricing

62 Carhart, M. M., 1997, On persistence in mutual fund performance.
63 Pastor, L., Stambaugh, R. F., & Taylor, L. A., 2021, Sustainable investing in equilibrium.

Model (CAPM), the Fama-French model (FF), and the Fama-French-Carhart model (FFC) in order to determine whether ESG funds actually succeed in generating higher risk-adjusted returns than conventional funds.

3. Empirical Analysis

To assess in depth the ability of ESG funds and conventional funds to generate out-performance, an empirical analysis must be applied. In a first step, the chapter focuses on examining the actual historical returns of funds in both categories to reveal any differences in observed performance. However, since the analysis of ex-post returns does not allow us to determine whether these results can be attributed to a real ability to generate alpha, we proceed with the application, through the Python programming language, of three asset pricing models already illustrated in the previous theoretical chapter: the Capital Asset Pricing Model (CAPM), the three-factor Fama-French (FF) model, and the four-factor Fama-French-Carhart (FFC) model. The models are applied to two balanced samples of funds, equally divided between sustainable and conventional, with the aim of isolating and comparing their respective sources of extra-return.

3.1 Data Source

The analysis conducted is based on the use of historical returns, structural characteristics such as exposure, reference asset class and geographic distribution, and sustainability ratings extracted from Morningstar, a leading independent financial research firm globally. Founded in the United States in 1984, Morningstar offers an extensive database with detailed information on more than 500.000 financial instruments, including stocks, bonds, ETFs and mutual funds. One of its main strengths is the development of proprietary ratings aimed at supporting investors in the decision-making process.

Central among these is the Morningstar Sustainability Rating, a metric designed to assess the ability of funds and ETFs to manage ESG risks within their portfolios. The rating takes the form of a one- to five-star score, calculated based on the weighted average of the ESG scores of individual securities held, adjusted for exposure to possible controversies. ESG ratings of stocks come from Sustainalytics, a subsidiary of Morningstar and a leader in ESG risk analysis. Morningstar then applies a weighting that takes into account two additional corrective elements: exposure to high-risk sectors (e.g., fossil energy) and the quality and severity of ESG controversies (e.g., human rights violations, environmental damage, or fraud).

Finally, each fund is compared with peers within its global category, determined by asset class and geographic exposure, and classified into quintiles according to the following scale:

- 1 star: first 10% - the bottom
- 2 stars: from 10% to 32,5%
- 3 stars: from 32,5% to 67,5%
- 4 stars: from 67,5% to 90%
- 5 stars: from 90% to 100% - the top

In addition, the score is updated on a monthly based considering the new portfolio composition and ESG data. Despite this, this scoring model does not consider the intentionality of companies' sustainability practices, showing vulnerability to tokenism or greenwashing, and does not consider financial data.

3.2 Sample Selection

As previously defined, the selection of the reference sample for the analysis was conducted using Morningstar's database, making the Morningstar Sustainability Rating the main discriminating variable. From this basis, the sample was constructed by dividing 60 equity mutual funds with global exposure into two distinct groups, using the period from April 2015 to April 2025 as the time base. The selected funds are all managed by top-tier asset management firms that show business continuity over the period of analysis.

The first group, called the “Conventional Funds Cluster,” includes funds with a sustainability score between one and three stars, indicating that these funds do not adopt sustainability as a central distinctive element in their investment strategy, but at most integrate it marginally.

Below is a summary table containing the list of funds selected for this group, which is useful in understanding the main characteristics of the cluster analysed.

Conventional Funds Cluster		
Nome	**ISIN**	**ESG Rating**
Blackrock - European Value Fund I2	LU0949170939	3 stars
Candriam Equity Quant Europe	LU2378104223	3 stars
Capital Group European Opportunities	LU2435581314	2 stars
T. Rowe Price European Select Equity Fund	LU2041631891	3 stars
Robeco QI European Active Equities Fund	LU1654173993	3 stars
BlackRock European Value Fund	LU1706558696	3 stars
RBC Funds European Equity Focus Fund	LU1217268827	2 stars
T. Rowe Price European Smaller Companies Equity Fund	LU0382931417	2 stars
Capital Group European Growth and Income Fund	LU2099826336	1 star
M&G European Strategic Value Fund	LU2329590611	1 star
Wellington Focused European Equity Fund	IE00BF4JCJ08	1 star
BlackRock Advantage Europe ex UK Equity Fund	IE00BDDRHC98	3 stars
Fidelity Italy Fund	LU1946852545	2 stars
JP Morgan Europe Strategic Growth Fund	LU0248049172	3 stars
JP Morgan Europe Strategic Value Fund	LU2434698648	1 star
State Street Europe Enhanced Equity Fund	LU1112179558	2 stars
State Street Europe Value Spotlight Fund	LU0892045930	1 star
Vanguard Developed Europe Fund	IE00B4Z8LP80	3 stars
BNP Paribas Aqua I Capitalisation Fund	LU1165135952	3 stars
Candriam Equities L Biotechnology Fund	LU2026682919	2 stars
Goldman Sachs Global Small Cap CORE Equity Fund	LU2360835198	2 stars
Natixis International U.S. Value Equity Fund	LU0648001245	2 stars
Neuberger Berman US Multi Cap Opportunities Fund	IE00B819XJ19	2 stars
Natixis International U.S. Growth Equity Fund	LU1429558064	2 stars
RBC Global Equity Focus Fund	LU1096671539	3 stars
UBS Digital Transformation Themes Fund	LU2198972270	3 stars
Vanguard Global Stock Fund	IE00B03HD209	2 stars
JP Morgan Funds US Select Equity Plus Fund	LU1727359249	3 stars
BNY Mellon U.S. Equity Income Fund	IE00BD7Y0N86	3 stars
Fidelity Funds - Global Industrials Fund	LU1033663482	1 star

On the other side of the analysis, the second group includes funds characterized by a Morningstar Sustainability Rating of four or five stars. This is to indicate a strong focus on sustainability and an investment strategy in which environmental, social and governance (ESG) criteria play a central and structural role. This group has been named the ESG Funds Cluster.

A summary table containing the funds selected for this cluster follows, which is useful in visualizing the key characteristics of the sample analysed.

ESG Funds Cluster		
Nome	**ISIN**	**ESG Rating**
Blackrock Continentlopean Flexible Fund	LU2315844121	4 stars
Comgest Growth Europe Fund	IE00B5WN3467	5 stars
Fidelity Funds - European Dynamic Growth Fund	LU0318940003	5 stars
DPAM B - Equities Europe Small Caps Sustainable Fund	BE0948494282	5 stars
ATLAS Global Infrastructure Fund	IE00BKTZQN06	5 stars
Groupama Euro Active Equity Fund	FR0010890194	4 stars
Guinness European Equity Income Fund	IE00BGHQF300	4 stars
AXA World Funds - Sustainable Equity QI Fund	LU1774150145	4 stars
Aegon Global Equity Income Fund	IE00BF5SVY46	4 stars
BlackRock Sustainable Advantage US Equity Fund	IE00BFZP7V49	4 stars
Candriam Sustainable Equity Climate Action I Fund	LU1932634378	5 stars
Schroder International Selection Fund Global Sustainable Growth	LU0557290854	5 stars
BNP PARIBAS - Low Carbon 300 World PAB Track Privilege	LU2194449232	5 stars
GuardCap Global Equity Fund	IE00BZ036616	4 stars
JP Morgan Europe Sustainable Equity Fund	LU2333214786	4 stars
Robeco QI US Climate Beta Equities I	LU1654174884	5 stars
Candriam Sustainable Equity Future Mobility Fund	LU2258563209	4 stars
BNY Mellon Long-Term Global Equity Fund	IE00B43TC947	4 stars
Fidelity Global Equity Income Fund	LU2219038119	5 stars
T. Rowe Price US Large Cap Growth Equity Fund	LU0174119775	4 stars
T. Rowe Price US Smaller Companies Equity Fund	LU0133096981	4 stars
BlackRock Global Unconstrained Equity Fund	IE00BK70NJ20	4 stars
Artemis US Smaller Companies Fund	LU1807320558	4 stars
BlackRock Sustainable Energy Fund	LU0124384867	5 stars
JP Morgan Global Sustainable Equity Fund	LU2293888785	4 stars
Pictet Global Environmental Opportunities Fund	LU0503631631	5 stars
Pictet Global Megatrend Selection Fund	LU0386875149	4 stars
BlackRock Sustainable Energy Fund	LU0171289902	5 stars
Schroder International Selection Fund US Large Cap	LU0248185604	4 stars
Fidelity Global Technology Fund	LU0099574567	4 stars

From the illustrated sample of funds, monthly returns were extracted for each fund. The period considered, from April 2015 to April 2025, yielded a combined total of 7.200 individual return observations.

3.3 Comparative Analysis of Historical Returns

Once the sample under analysis has been defined, the first methodological step is to extract monthly returns from Morningstar and calculate the relative average for each fund. This first metric represents a preliminary indicator for observing performance differences between the two main investment strategies considered: sustainable and conventional. However, this average return should be interpreted as a "raw value" for the purposes of this paper, which requires further elaboration to estimate its Alpha, the strategy's ability to generate extra return.

The first group under analysis is the Conventional Funds Cluster, which has an average monthly return of 0,699%. Below there is the updated table with the average monthly returns of each fund belonging to this cluster, which is useful to highlight internal performances.

Conventional Funds Cluster			
Nome	**ISIN**	**ESG Rating**	**Monthly AVG Return**
Blackrock - European Value Fund	LU0949170939	3 stars	0,548%
Candriam Equity Quant Europe	LU2378104223	3 stars	0,619%
Capital Group European Opportunities	LU2435581314	2 stars	0,866%
T. Rowe Price European Select Equity Fund	LU2041631891	3 stars	0,732%
Robeco QI European Active Equities Fund	LU1654173993	3 stars	0,246%
BlackRock European Value Fund	LU1706558696	3 stars	0,201%
RBC European Equity Focus Fund	LU1217268827	2 stars	0,682%
T. Rowe Price European Smaller Companies Equity Fund	LU0382931417	2 stars	0,882%
Capital Group European Growth and Income Fund	LU2099826336	1 star	1,152%
M&G European Strategic Value Fund	LU2329590611	1 star	0,560%
Wellington Focused European Equity Fund	IE00BF4JCJ08	1 star	0,685%
BlackRock Advantage Europe ex UK Equity Fund	IE00BDDRHC98	3 stars	0,990%
Fidelity Italy Fund	LU1946852545	2 stars	0,692%
JP Morgan Europe Strategic Growth Fund	LU0248049172	3 stars	0,723%
JP Morgan Europe Strategic Value Fund	LU2434698648	1 star	1,253%
State Street Europe Enhanced Equity Fund	LU1112179558	2 stars	0,984%
State Street Europe Value Spotlight Fund	LU0892045930	1 star	0,848%

Vanguard Developed Europe Fund	IE00B4Z8LP80	3 stars	0,803%
BNP Paribas Aqua I Capitalisation Fund	LU1165135952	3 stars	0,503%
Candriam Equities L Biotechnology Fund	LU2026682919	2 stars	0,770%
Goldman Sachs Global Small Cap CORE Equity Fund	LU2360835198	2 stars	0,546%
Natixis International U.S. Value Equity Fund	LU0648001245	2 stars	0,705%
Neuberger Berman US Multi Cap Opportunities Fund	IE00B819XJ19	2 stars	0,470%
Natixis International U.S. Growth Equity Fund	LU1429558064	2 stars	0,463%
RBC Global Equity Focus Fund	LU1096671539	3 stars	0,556%
UBS Digital Transformation Themes Fund	LU2198972270	3 stars	0,712%
Vanguard Global Stock Fund	IE00B03HD209	2 stars	0,789%
JP Morgan US Select Equity Plus Fund	LU1727359249	3 stars	0,546%
BNY Mellon U.S. Equity Income Fund	IE00BD7Y0N86	3 stars	0,739%
Fidelity Funds - Global Industrials Fund	LU1033663482	1 star	0,691%
TOTAL MONTHLY AVERAGE RETURN			**0,699%**

As a first point to note, all the funds analysed have recorded positive average monthly returns over the past ten years, making a real contribution to the creation of value for investors. Specifically, annualizing the average monthly return of the Conventional Funds Cluster yields a compound annual return of 8,71%.

Moving on to the second group, the ESG Funds Cluster shows an average monthly return of 0,745% over the same observation period. Below is the summary table for this group.

ESG Funds Cluster			
Nome	**ISIN**	**ESG Rating**	**Monthly AVG Return**
Blackrock Continentlopean Flexible Fund	LU2315844121	4 stars	0,909%
Comgest Growth Europe Fund	IE00B5WN3467	5 stars	0,827%
Fidelity Funds - European Dynamic Growth Fund	LU0318940003	5 stars	0,887%
DPAM B - Equities Europe Small Caps Sustainable Fund	BE0948494282	5 stars	0,426%
ATLAS Global Infrastructure Fund	IE00BKTZQN06	5 stars	0,949%
Groupama Euro Active Equity Fund	FR0010890194	4 stars	0,972%
Guinness European Equity Income Fund	IE00BGHQF300	4 stars	1,011%
AXA World Funds - Sustainable Equity QI Fund	LU1774150145	4 stars	0,165%
Aegon Global Equity Income Fund	IE00BF5SVY46	4 stars	0,685%
BlackRock Sustainable Advantage US Equity Fund	IE00BFZP7V49	4 stars	0,614%
Candriam Sustainable Equity Climate Action I Fund	LU1932634378	5 stars	0,599%
Schroder International Selection Fund Global Sustainable Growth	LU0557290854	5 stars	1,057%
BNP PARIBAS - Low Carbon 300 World PAB Track Privilege	LU2194449232	5 stars	0,627%
GuardCap Global Equity Fund	IE00BZ036616	4 stars	0,781%
JP Morgan Europe Sustainable Equity Fund	LU2333214786	4 stars	0,648%

Robeco QI US Climate Beta Equities I	LU1654174884	5 stars	0,655%
Candriam Sustainable Equity Future Mobility Fund	LU2258563209	4 stars	0,711%
BNY Mellon Long-Term Global Equity Fund	IE00B43TC947	4 stars	0,644%
Fidelity Global Equity Income Fund	LU2219038119	5 stars	0,607%
T. Rowe Price US Large Cap Growth Equity Fund	LU0174119775	4 stars	0,716%
T. Rowe Price US Smaller Companies Equity Fund	LU0133096981	4 stars	0,533%
BlackRock Global Unconstrained Equity Fund	IE00BK70NJ20	4 stars	0,731%
Artemis US Smaller Companies Fund	LU1807320558	4 stars	0,611%
BlackRock Sustainable Energy Fund	LU0124384867	5 stars	1,008%
JP Morgan Global Sustainable Equity Fund	LU2293888785	4 stars	0,960%
Pictet Global Environmental Opportunities Fund	LU0503631631	5 stars	0,892%
Pictet Global Megatrend Selection Fund	LU0386875149	4 stars	1,219%
BlackRock Sustainable Energy Fund	LU0171289902	5 stars	0,645%
Schroder International Selection Fund US Large Cap	LU0248185604	4 stars	0,558%
Fidelity Global Technology Fund	LU0099574567	4 stars	0,699%
TOTAL MONTHLY AVERAGE RETURN			**0,745%**

Also in this case, the funds included in the ESG Funds Cluster show an overall ability to generate positive value for investors. Annualizing the average monthly return of this group, the latter yields an annual return of 9.30%. This figure is 59 basis points (0,59%) higher than the one provided by the Conventional Funds Cluster, which was 8,71%.

This difference could indicate a greater effectiveness of the sustainable strategies adopted by managers in the ESG Cluster in generating extra-return. However, this conclusion cannot be assumed conclusively, as the observed performance could be influenced by other systematic factors such as the momentum effect or size exposure. Therefore, more in-depth analysis using the asset pricing models introduced in the previous chapter is needed.

3.4 Performance Analysis Trough Capital Asset Pricing Model, Fama-French and Fama-French-Carhart Model

Analysing the historical returns of the selected funds, as highlighted in the previous section, the ESG fund cluster experienced slightly higher average returns than conventional funds. This difference might suggest, at first impression, that managers of sustainable funds, by adopting strategies based on ESG criteria, are able to achieve higher returns than those adopting conventional investment approaches. However, although

performance is a central dimension in investors' evaluation of a fund, it does not allow for an accurate isolation and measure of investment ability, nor does it allow for an understanding of whether the results were achieved through actual value generation or simply as a consequence of exposure to specific market risk factors.

That said, a fund may have achieved high returns not so much because of the skill of the manager but because of greater exposure to systematic risk premia such as those associated with the stock market, the size of companies, their value or growth nature, or the momentum effect. To more rigorously assess the ability of funds to generate value in excess of that justified by the risk taken, therefore, a more analytical and structured approach is needed. To this end, we proceeded with the application of the asset pricing models already introduced and described in the second chapter, aimed at understanding whether indeed managers in the ESG cluster are able to produce extra-return than those in the conventional cluster.

The empirical analysis presented in this section therefore aims to test whether, based on the historical returns observed over the decade 2015-2025, ESG funds are indeed able to produce higher alpha than conventional funds, and whether this result is robust to the progressive introduction of explanatory factors in the estimation models. In particular, we will assess the persistence of significant differences between the two clusters as the complexity of the model adopted changes from CAPM to the Fama-French three-factor model and finally to the extended Fama-French-Carhart model.

The following tables show the average alpha and risk factors of the two groups of funds for each model, along with key statistics.

MODEL	**CLUSTER**	**AVG. ALPHA**	**BETA MKT**	**BETA SMB**	**BETA HML**	**BETA MOM**	**R^2**
CAPM	ESG	0,047	0,98	-	-	-	0,74
CAPM	Conventional	0,041	1,01	-	-	-	0,73
FF	ESG	0,028	0,97	0,22	0,6	-	0,76
FF	Conventional	0,023	1,02	0,19	0,07	-	0,78
FFC	ESG	0,012	0,96	0,2	0,04	0,07	0,86
FFC	Conventional	0,009	0,97	0,18	0,06	0,11	0,87

The progressive application of the three asset pricing models allows the origin of the returns of the ESG fund cluster and the conventional fund cluster to be analyzed in detail, offering a more structured reading than simply observing historical average returns. The results reported in the table show a clear dynamic: regardless of the model adopted, the ESG fund cluster experiences slightly higher average alpha than the conventional fund cluster. However, the magnitude of this difference is small and deserves to be interpreted in light of other evidence from the analysis.

In detail, according to the results of regressions obtained with the CAPM model, which considers only the market factor as systemic risk, ESG fund cluster achieve an average alpha of 0,047% on a monthly basis, while conventional funds are slightly lower at 0,041%. Even at this early stage of the analysis, the extra return of ESG funds appears modest, but it suggests a potential added value of sustainability-oriented strategies.

Continuing with the introduction of the Small Minus Big (SMB) factor and the High Minus Low (HML) factor in Fama and French's three-factor model, the average level of alpha decreases for both clusters. ESG fund cluster shows an average abnormal return of 0,028%, while conventional funds stop at 0,023%. The narrowing of the differential between the two clusters suggests that part of the initial outperformance of ESG funds could be attributed to a different structural composition of the portfolios, and not necessarily to greater management efficiency. In particular, the greater exposure to the SMB factor (0,22 for ESG versus 0,19 for conventional) and the HML factor (0,06 for ESG versus 0,07 for conventional) suggests that ESG cluster tends, on average, to invest in relatively smaller securities with more value-oriented characteristics.

Finally, the integration of the Momentum Factor (MOM) into the Fama-French-Carhart (FFC) model leads to a further reduction in estimated alpha to near zero: 0,012% for ESG funds and 0,009% for conventional funds. This further erosion of the residual abnormal return reinforces the hypothesis that most of the observed performance can be explained by systematic exposure to key risk factors. The coefficients for the momentum factor (0,07 for ESG and 0,11 for conventional) indicate some tendency for funds, particularly conventional funds, to invest in stocks with positive recent performance, consistent with trend and sector rotation-oriented strategies.

Another important element is the explanatory power of the models, as measured by the values of R^2. As might be expected, the average value of R^2 increases as model complexity increases, from 0,74-0,73 in the CAPM, to 0,76-0,78 in the FF3 model, to 0,86-0,87 in the FFC model. This improvement suggests that the introduction of the additional factors allows an increasing share of the variance of returns to be explained, reducing the unexplained residual component. Interestingly, the conventional fund cluster shows slightly higher R^2 in the FF3 and FFC models, which could be indicative of management strategies that are more adherent to benchmarks or systematic factors, as opposed to ESG strategies that are potentially more oriented toward discretionary stock selection.

3.5 Conclusion: Interpretation of Results and the Difference Between Return and Alpha

The empirical analysis conducted so far, based on the application of major asset pricing models such as the Capital Asset Pricing Model (CAPM), three-factor Fama-French Model (FF), and four-factor Fama-French-Carhart (FFC), has allowed us to investigate the relationship between performance and sustainability in mutual funds. The objective was to test whether, and to what degree, ESG funds are able to generate superior risk-adjusted returns compared to conventional funds. The results obtained suggest a gray answer, departing from both excessive enthusiasm for sustainable investing and a skeptical attitude based on the idea that adoption of ESG criteria implies a sacrifice of financial performance.

First, the analysis of the entire period considered, so starting from April 2015 to April 2025, shows that ESG funds had a slightly higher average Alpha than conventional funds in each of the estimated models. However, this difference is marginal and tends to cancel out as more risk factors are introduced into the models. The average alpha gradually decreases from 0,047% to 0,012% for ESG funds, and from 0,041% to 0,009% for conventional funds. This trend suggests that almost all of the performance can be explained by systematic factors such as market risk, firm size, value/growth style, and momentum effect. In other words, net of exposure to risk factors, no statistically significant differences in terms of the ability to generate extra return emerge between the two investment approaches. Consequently, it can be said that ESG and conventional funds offer broadly comparable performance in the medium to long run, debunking both

expectations of systematic outperformance by sustainable funds and fears of their structural under-performance.

Second, due to the period taken into analysis, which took into account turbulent and non-turbulent market phases, including both the crisis given by Covid-19 and fluctuations due to the war in Ukraine, it was also possible to analyze the risk management patterns between the two clusters. From this, it was also possible to explore any differences in risk management between the two categories of funds. Again, the results show no significant evidence, indeed there is no evidence of better risk management by either cluster. Market betas appear very similar between the two clusters, and risk factor exposures appear structurally close, suggesting that ESG strategies do not offer an intrinsic advantage in terms of portfolio protection during market discontinuities. This result reinforces the idea that sustainable investing is not a defensive strategy by nature, neither as a more resilient solution to shocks, but rather as an alternative capital allocation approach that can coexist with traditional market logics.

Finally and most significantly from a practical perspective, the findings support the idea that sustainable investing represents both an ethical and financial opportunity. Although ESG funds do not systematically produce significantly higher returns than conventional funds, they provide competitive performance against a strategy oriented to ESG criteria, and good governance. In other words, the investor is not constrained to choose between returns and ethicsl values while the adoption of a sustainable investing attitude does not penalize financial performance and, in some cases, can even help strengthen the intermediary's reputation and investor trust. In addition, the growing demand for sustainable financial products from institutional and retail investors could further consolidate this market segment, stimulating innovation and improvement in the transparency and quality of ESG metrics. Therefore, sustainability can be seen as an integrative driver of performance, enabling operators to pursue economic goals while respecting ethical values and collective well-being.

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