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An Analysis of the Impact of ESG Factors on Portfolio Performance

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Abstract

As the demand for sustainable investment strategies rises, understanding the impact of Environmental, Social, and Governance (ESG) scores on investments has become crucial for investors. This study examines the relationship between ESG scores and the performance of S&P 500 firms, from 2004 to 2023. With a dataset retrieved from Bloomberg, two portfolios based on ESG scores criteria were created, and consequently analysed through a hypothetical $10,000 investment. Findings suggest that higher ESG scores **do not** correlate with superior financial returns. This research contributes to the literature on sustainable investing and provides insights for investors looking to enhance their portfolios through ESG criteria.

Keywords – ESG Score, Portfolio Performance Analysis, S&P 500, Asset Allocation.

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1. Literature Review & Hypothesis Formulation

1.1 Historical Context and Evolution of ESG

The evolution of Environmental, Social, and Governance (ESG) factors can be traced back to early discussions around corporate social responsibility (CSR), which proposed that companies had an obligation to consider social and environmental impacts alongside financial performance (Bowen 1953). In contrast, Friedman (1970) famously argued that the primary responsibility of businesses is to maximize shareholder value, challenging the idea that firms should prioritize broader social goals. This created tension between profit maximization and social responsibility, fuelling debates that have persisted over time. However, as society's expectations have shifted towards greater accountability, the narrative surrounding CSR has evolved to embrace ESG factors as integral to long-term value creation (Oh 2021).

As institutional investors increasingly adopt ESG criteria, the academic community responded with an increase of research investigating the impact of these factors on corporate financial performance, which has led to over 1000 studies being published between 2015 and 2020 alone (Whelan, et al. 2021). This increasing academic focus reflects a general investor demand for evidence linking ESG practices to financial performance, driven by increased global awareness of issues such as climate change, social justice, and corporate governance (Tyson, Funk and Kennedy 2023).

1.2 ESG Integration in Firms

Developing this historical framework further, the integration of ESG criteria into corporate strategies has become a central consideration for firms worldwide (McCoy 2022). As investors, regulators, and consumers increasingly prioritize sustainability, companies are incorporating ESG factors to ensure long-term value creation, risk mitigation, and reputation enhancement (Eccles,

Ioannou and Serafeim 2014). As this shift is largely driven by increased awareness of climate change and social responsibility among stakeholders (Cort, et al. 2022), investors are also progressively viewing ESG factors as integral to assessing risk and future profitability, particularly as global regulatory frameworks push for more transparent sustainability disclosures (Clark, Feiner and Viehs 2015). Furthermore, research has shown that firms with strong ESG practices are more resilient during periods of economic volatility, adding another layer of benefits to ESG integration (Whelan et al. 2021; Broadstock et. al 2021).

Environmental integration, focusing on how firms manage their impact on the environment, including energy consumption, carbon emissions, waste, and natural resource use, has become particularly crucial (Oddo 2022). Disclosures related to climate insights and carbon-neutral strategies have increased to align with global sustainability goals, in particular the Paris Agreement (TCFD 2023). Firms that proactively address environmental strategies are often better positioned to face regulatory shifts, reduce operational risks, and capture opportunities in green technology sectors (Broadstock, et al. 2021; Aydoğmuş, Gülay and Ergun 2022).

Social integration emphasizes the management of relationships with employees, customers, and communities. This includes a broad set of aspects, namely labour standards, employee health and safety, human rights in the supply chain, upholding data privacy and security (Radzi, Hamid and Ismail 2023). Firms that prioritize these factors, engaging in fair labour practices and fostering inclusive and diverse work environments, frequently experience higher employee productivity, lower turnover rates, as well as stronger brand loyalty among consumers, achieving notable improvements in performance (Huselid 1995; Molina and Ortega 2003; Herring 2009), further proving that it is no longer simply a question of moral.

Governance integration relates to how a firm's leadership ensures transparency, accountability, and ethical management practices. Strong governance structures are crucial for

fostering ethical business conduct, mitigating risks related to corruption, and maintaining investor confidence (Half 2022). Companies with robust governance reduce their risk of legal infractions and are better equipped to manage reputational crises, contributing to their long-term financial resilience (Keter Environmental Services 2023).

ESG integration within firms has evolved from a moral consideration to a strategic core (Global Regulatory Insights 2024). As regulatory landscapes continue to evolve, particularly in major markets like Europe and the United States of America (USA), ESG integration will likely play an even greater role in shaping the future of corporate strategy (Apex Group 2023). For large market-cap firms, such as those in the S&P500 index, ESG alignment is increasingly seen as essential to ensure long-term profitability and compliance with emerging regulations (Whelan, et al. 2021).

1.3 ESG Integration in Asset Allocation

As firms increasingly integrate ESG considerations into their operational strategies, a parallel movement is observed in asset management, where asset managers are gradually integrating ESG factors into investment decisions (Beal, et al. 2019). The integration of ESG factors into asset allocation strategies has gained significant engagement in recent years, particularly following the publication of the United Nations' Principles for Responsible Investment (PRI) report in 2006 (Atkins 2020). The report saw over 60 investment firms, managing assets totalling $6.5 trillion, committing to integrating ESG issues into their investment processes. By June 2019, this commitment had expanded significantly, with more than 2400 signatories representing over $80 trillion in assets under management (AUM).

The integration of ESG factors into asset allocation strategies has been shown to enhance long-term risk-adjusted returns by promoting sustainable and responsible investment practices

(Trunow and Linder 2015), as incorporating ESG criteria in equity investing can help investors mitigate risks and identify opportunities tied to environmental, social, and governance issues, ultimately contributing to stronger financial performance over time. A meta-analysis on 2000 empirical studies indicates that approximately 90% of studies confirm a positive correlation between ESG performance and financial performance (Friede, Busch and Bassen 2015). These insights support the growing recognition of ESG as a valuable tool for optimizing investment outcomes. As such, the first aim of this research is to evaluate whether the relationship between ESG integration and financial performance observed in previous studies holds true for companies within the S&P 500 index, using data from 2004 to 2023.

H1: *Portfolios that integrate ESG factors will exhibit superior financial performance compared to traditional portfolios.*

The COVID-19 pandemic has further highlighted the importance of ESG integration, as investors have sought to better understand the risks and opportunities associated with sustainable business practices (Engelhardt, Ekkenga and Posch 2021). This is supported by research showing that companies with strong ESG performance tend to experience improved firm value, profitability, and resilience, including during economic crises such as the 2008 financial crisis and the COVID-19 pandemic (Pickwick and Sewelén 2021; Abedifar, et al. 2022; Sun and Small 2021). However, Pelkonen (2022) examined stock returns during the COVID-19 market crash and found that ESG ratings did not significantly protect stock performance in times of financial distress, contradicting the findings of the studies of Abedifar et al. (2023) and Sun et al. (2021). Therefore, the second hypothesis studies whether ESG-integrated portfolios, consisting of companies in the S&P500,

demonstrate enhanced resilience and performance metrics, especially in volatile market conditions, resolving this lack of consensus.

H2: *ESG-integrated portfolios will demonstrate higher risk-adjusted returns compared to traditional portfolios, particularly during periods of market stress.*

Despite the extensive positive findings, the relationship is not universally favourable and presents several challenges. Numerous analyses highlight neutral or even negative relationships, dependent on specific contexts. The distinct nature of environmental, social, and governance factors means they can have both varying and independent effects on financial performance, making it difficult to assess the overall impact of ESG on corporate performance (Kim and Li 2021), and the timing of these effects can differ significantly (Xu and Zhu 2024). Evidence suggests that, in the Chinese market, governance and social initiatives may yield short-term benefits, while environmental initiatives often require longer timeframes to generate financial gains (Xu and Zhu 2024).

Therefore, as a third hypothesis, this paper analyses the different effects each pillar of ESG may have on the financial performance of the largest USA companies.

H3: *The relationship between ESG integration and financial performance will vary across the different pillars of ESG.*

While institutional investors advocate for stronger ESG practices, these practices do not always translate into higher stock returns. Some financial benefits of ESG may be overstated, as companies often adopt ESG initiatives in response to external pressures rather than for direct

financial gain (Darolles, Le Fol and He 2023). For example, excluding sin stocks from ESG-focused portfolios can lead to underperformance relative to portfolios that include them (Blitz and Swinkels 2021). Companies operating in sectors such as tobacco, alcohol, and gambling have historically provided high returns (Ginsburg 2019), raising the question of whether investors are sacrificing potential financial gains for ethical considerations.

Understanding how these factors interact with financial metrics is crucial for evaluating the performance of ESG-integrated portfolios compared to traditional portfolios, especially those focusing on the S&P 500.

This literature review examines the broad research on the relationship between ESG, financial performance, and asset allocation, providing a foundation for understanding how these findings may be relevant to the companies that compose the S&P 500. It illustrates that the relationship between ESG performance and financial outcomes is complex, and that while ESG can often enhance firm value and profitability, its financial benefits are not guaranteed and can vary.

2. Methodology

The core objective of this research is to empirically evaluate the financial performance and risk-adjusted returns of non-ESG integrated portfolios in comparison to portfolios that integrate such factors. The empirical methodology involves collecting data, constructing two distinct portfolios, and measuring the evolution of the portfolios throughout the years with a hypothetical $10,000 investment in each. Using Python for data analysis and statistical testing, this approach assesses the effect of ESG in asset allocation strategies. This study focuses on companies within the S&P 500, a well-established stock market index which includes the largest publicly traded companies in the USA economy. The research spans 20 years of historical data, providing a

comprehensive view of financial and ESG performance over this period, allowing for reliable statistical analysis and long-term trends to emerge.

2.1 Data Collection

This study uses secondary data retrieved from Bloomberg, an in-depth and widely recognized financial data platform.

The dataset covers both financial performance data and ESG scores regarding each company in the S&P 500 index on July 18th, 2024. Data was collected in a standardized Excel format, each containing detailed, company specific ESG metrics alongside traditional financial performance indicators from 2004 to 2023, a period selected to capture developments related to ESG, both before and after the publication of the United Nations' Principles for Responsible Investment in 2006, a key turning point for ESG integration in financial markets, as mentioned in the literature review.

The dataset includes both combined ESG scores and individual scores for the three pillars: Environmental, Social, and Governance. The combined score serves as an aggregate measure of overall ESG performance, while the individual scores allow for a more detailed analysis of the separate effects of each pillar on financial outcomes. This thoroughness is critical to testing hypothesis 3, which explores the varying impact of the different ESG pillars on portfolio performance.

2.1.1 Bloomberg’s ESG Scoring Process

Bloomberg’s database provides extensive ESG data for a large number of companies worldwide, updated regularly and categorized into industry-specific peer groups. The scoring methodology is based on global frameworks, including the Sustainability Accounting Standards

Board (SASB) and International Sustainability Standards Board (ISSB), ensuring that ESG metrics are aligned with financial materiality (Bloomberg 2023).

The scoring process begins with identifying relevant ESG issues through industry-specific analysis, leveraging global standards and materiality assessments. Key metrics are weighted and assessed through rigorous data collection and quality assurance, including pre- and post-publication validation. ESG scores are divided into Environmental, Social, and Governance dimensions, with subcategories like resource use, emissions, labor practices, and governance. These dimensions facilitate comprehensive company assessments and cross-industry comparisons (Bloomberg 2023).

2.2 Indicators of Financial Performance in Portfolios

Measuring the financial performance of portfolios is crucial for assessing the effectiveness of investment strategies. In the context of this research, the goal is to analyse whether portfolios that integrate ESG factors outperform non-ESG integrated portfolios, both in terms of returns and risk. This evaluation requires a detailed selection of financial indicators that can measure both the profitability and the risk-adjusted performance of these portfolios.

To effectively evaluate portfolio performance, several key financial indicators are employed. These include total return, which represents the overall gain or loss of the portfolio, calculated using annualized returns ($r = \frac{P_t - P_{t-1}}{P_{t-1}}$, where P_t represents the price of an asset at year t, and P_{t-1} represents the price at the prior year).

To evaluate risk-adjusted performance, the Sharpe Ratio will be used, which measures the excess return per unit of risk. It considers the trade-off between the risk premium and the risk, measured by the standard deviation ($Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p}$, where R_p is the return of the

portfolio, R_f is the risk-free rate which is set at 4.20% according to the USA 10 year Treasury Yield, and σ_p represents the standard deviation of the portfolio return). This risk-adjusted measure will help determine if ESG integration leads to superior performance, as suggested in hypothesis 1 and 2. Risk itself will be captured using the standard deviation of the portfolio ($\sigma_p = \sqrt{\sum_{i=1}^{N} w_i^2 \sigma_i^2 + 2 \sum_{i=1}^{N} \sum_{j=1, j \neq i}^{N} w_i w_j \sigma_{ij}}$, where N is the number of assets in the portfolio, w_i corresponds to the weight of asset *i* in the portfolio, σ_i is the standard deviation of the returns of asset *i*, and σ_{ij} is the covariance between the returns of asset *i* and asset *j*).

By using these financial indicators, this study aims to provide a detailed analysis of whether ESG-integrated portfolios outperform traditional portfolios, as proposed in the hypothesis.

2.3 Variable Construction

In this study, variable construction is essential for analysing the relationship between ESG integration and financial performance. Portfolio performance and risk are measured through indicators such as total return and risk-adjusted metrics, namely the Sharpe Ratio. These metrics help assess whether ESG integration contributes to superior financial outcomes.

The ESG scores and their subcomponents (environmental, social, and governance) serve as key variables, offering insight into companies' sustainability practices and their potential connection to financial performance. Additionally, control variables account for external factors that may affect performance, including firm size ($log(Market\ Cap)$) and the financial leverage ratio ($Debt - to - Assets\ Ratio = \frac{Total\ Debt}{Total\ Assets}$), ensuring that the analysis isolates the specific effects of ESG scores.

Variables	Definition/Description	Source
Environmental Score	Assesses a company's impact and practices related to environmental issues, such as energy efficiency, emissions, and resource use.	Bloomberg
Firm Size	Measured by market capitalization to control for size-related effects.	Bloomberg
Financial Leverage	Total Debt divided by Total Assets, representing a firm's financial leverage.	Bloomberg
Governance Score	Assesses a company's impact and practices related to corporate governance, including board structure, transparency, and accountability.	Bloomberg
Jensen's α	The excess return of a portfolio beyond its expected return based on market risk.	Python
Overall ESG Score	An overall score that aggregates individual ESG scores, providing a broad perspective of ESG performance.	Bloomberg
Sharpe Ratio	The ratio of the portfolio's excess return to its standard deviation, indicating risk-adjusted returns.	Python
Social Score	Measures how well a company manages social issues, such as labour practices, community engagement, and diversity.	Bloomberg
Standard Deviation	Measures the volatility or risk of the portfolio returns.	Python
Total Return	Measures the overall return of the portfolio, including capital appreciation and dividends.	Python

Table 1: Variable descriptions

2.4 Research Method & Regression Model

2.4.1 Portfolio Construction

This study employs quantitative methods to evaluate the financial performance of ESG-integrated portfolios compared to traditional portfolios. The analysis will rely on a combination of descriptive statistics and regression models to test the hypothesis related to portfolio performance, risk, and the individual impact of each pillar of ESG on both portfolio's performance. Python is used to programmatically create two distinct portfolios. The "Sustainable Portfolio", where only companies with ESG scores above 60 were retained, as this is the score that is commonly used to differentiate between good and bad performances (Lucas 2022), reflecting a commitment to high environmental, social, and governance standards; and the "Traditional Portfolio", which included companies with ESG scores below 60, representing investment practices without specific ESG considerations.

To ensure consistency in the portfolio analysis, portfolios will be rebalanced annually to reflect changes in ESG scores. This dynamic rebalancing process ensures that companies that significantly improve or deteriorate in their ESG ratings are either added or removed, capturing the evolution of corporate practices over time. By updating portfolios at the start of each year, the analysis remains aligned with shifting ESG performance, providing a more accurate reflection of the impact of ESG factors on financial outcomes.

2.4.2 Regression Model

To test Hypothesis 3, which examines the individual effects of the Environmental, Social, and Governance (ESG) components on financial performance, a multiple regression model will be employed. This model will include the ESG individual scores as independent variables, with the

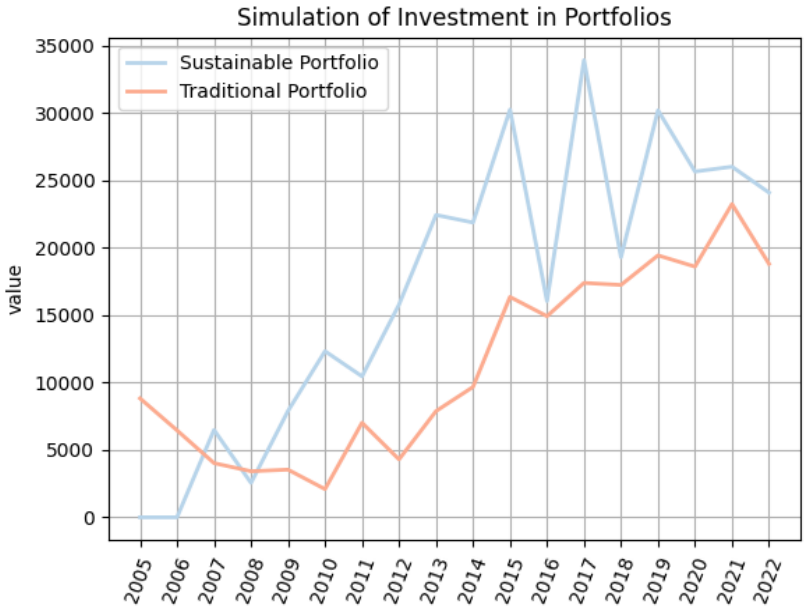
portfolio's return as the dependent variable. Control variables, including firm size and financial leverage, will account for their potential influence on performance.

The regression analysis will focus exclusively on data from 2022, ensuring that the study reflects a period with greater transparency and consistent regulations regarding ESG metrics. Restricting the analysis to this year enhances the reliability of the findings by avoiding earlier periods with inconsistent ESG reporting standards. The regression model is represented as:

$$\boldsymbol{Portfolio\ Return}_{i,t} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1 Environmental\ Score}_{i,t} + \boldsymbol{\beta_2 Social\ Score}_{i,t} + \boldsymbol{\beta_3 Governance\ Score}_{i,t} + \boldsymbol{\beta_4 Control\ Variables}_{i,t} + \boldsymbol{\epsilon}_{i,t}$$

3. Results & Discussion

This section presents the findings from the analysis of the two simulated investment portfolios, that began with an initial hypothetical investment of $10 000 in each, referred to as the "Sustainable Portfolio" and the "Traditional Portfolio", over an 18-year period (2005–2022).

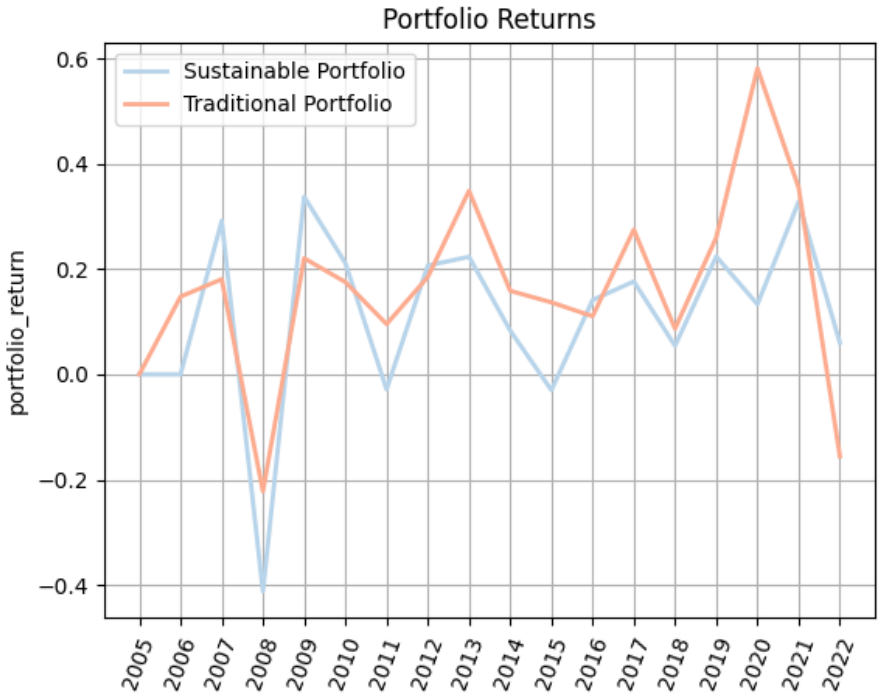


Graphic 1: Portfolio Value Growth of Sustainable and Traditional Portfolios (2005–2022), retrieved from Python

Graphic 1 illustrates the value growth of both portfolios constructed, from 2005 to 2022. The sustainable portfolio was created in 2007 only given that prior to that year no company was in compliance with the ESG criteria. Consequently, the traditional portfolio included the entirety of the S&P 500 index companies. This initial disparity led to the traditional portfolio's dominant valuation in the first year. As time progressed, more companies achieved ESG scores exceeding 60 and became eligible for inclusion in the sustainable portfolio. This gradual inclusion resulted in significant capital allocation toward high-performing companies. On the other hand, the traditional portfolio saw a slight reduction in its scope and growth potential as companies transitioned out to meet ESG thresholds, leading to their allocation in the sustainable portfolio.

This dynamic explains why the value of the sustainable portfolio surpasses the traditional portfolio over time.

3.1 Returns



Graphic 2: Annual Logarithmic Returns of Sustainable and Traditional Portfolios (2005–2022), retrieved from Python

Graphic 2 illustrates a comparison between the sustainable and the traditional portfolio's returns over the period from 2005 to 2022. Throughout most of the observed period, the returns of the sustainable and the traditional portfolios are closely aligned, with both portfolios experiencing volatility, especially during periods of financial crisis or market downturns.

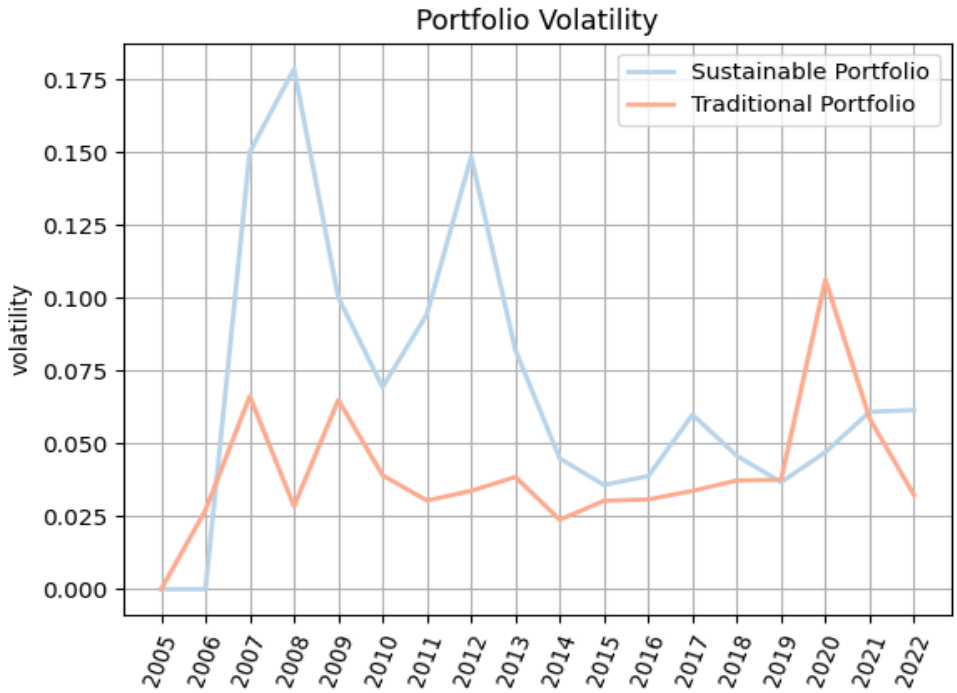
During the 2008-2009 financial crisis both portfolios suffer a substantial decline in returns, with the traditional portfolio slightly outperforming the sustainable portfolio in terms of minimized losses. This could suggest that ESG factors may not shield portfolios from extreme market downturns, as previously suggested in the hypothesis formulation.

Following the crisis, both portfolios experience similar returns with slight fluctuations. During this period, the sustainable portfolio overall exhibits lower returns comparable to the traditional portfolio, indicating that ESG integration does not necessarily translate into significantly higher returns in stable market conditions.

In 2020, a year marked by the instability of financial markets caused by the impact of the COVID-19 pandemic, the portfolios exhibit opposite behaviours. The traditional portfolio shows an increase in performance relative to 2019 (58.11% and 26%, respectively), whilst the sustainable portfolio shows a decrease compared to the previous year (13.30% and 22.37%, respectively), the opposite of what was previously suggested in hypothesis 1. However, in subsequent years, the sustainable portfolio demonstrates a slight outperformance, which can be indicative of the resilience of companies with strong ESG performance.

3.2 Volatility

Volatility, a key measure of risk, reflects fluctuations in portfolio returns, where higher volatility indicates greater uncertainty and risk.



Graphic 3: Annual Volatility of Sustainable and Traditional Portfolios (2005–2022), retrieved from Python

The graphic depicts the volatility of the two portfolios over the period from 2005 to 2022. Across the analysed period, both portfolios demonstrate a general decline in volatility, suggesting a stabilization of market conditions and portfolio performance over time. However, differences in the volatility behaviour of the two portfolios are evident, especially during periods of market stress.

The sustainable portfolio demonstrates a significant higher volatility during earlier years, particularly in 2008–2009, coinciding with the financial crisis period. This increased volatility may be attributed to the concentration of companies with high ESG scores, which often allocate resources to long-term sustainability goals, which could increase vulnerability during short-term market shocks (Eccles, Ioannou and Serafeim 2014).

In contrast, the traditional portfolio maintains greater overall stability, with consistently lower volatility across most of the observation period. This aligns with the nature of traditional investments, which includes companies with lower ESG scores, possibly representing more

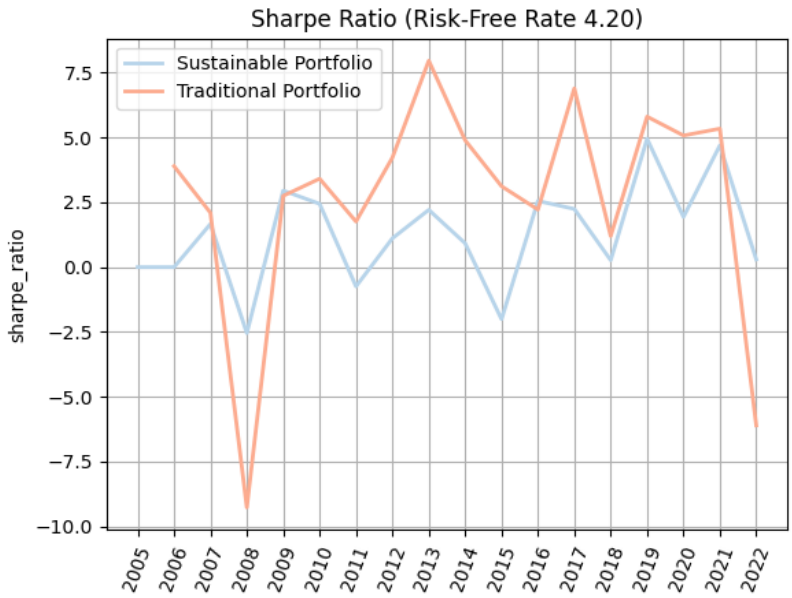
traditional business models with less exposure to market fluctuations driven by innovation or sustainability initiatives.

Remarkably, a convergence in volatility levels between the two portfolios emerges in the latter half of this study, which is then disrupted by the spike in volatility observed in both portfolios around 2020, corresponding to the COVID-19 pandemic, which caused global market disruptions, such as global supply chain disruptions and mass unemployment. Interestingly, the volatility in the traditional portfolio rises more sharply than in the sustainable portfolio during this time, suggesting that companies with higher ESG scores may have been better equipped to navigate the uncertainties introduced by the pandemic, aligning with the research of Whelan et al. (2021) and Broadstock et. al (2021). This could reflect the operational resilience and long-term planning often associated with companies investing in ESG integration. Despite this temporary disruption, the traditional portfolio generally remains the less volatile option. By 2021–2022, the difference in volatility is minor (6.15% for the sustainable, and 3.24% for the traditional portfolio). This convergence may indicate a critical transformation in the financial landscape. Sustainable investments, once perceived as riskier, may now be comparable to traditional portfolios in terms of stability, reflecting their growing resilience and overall acceptance. The narrowing gap may also indicate that market participants increasingly value and reward ESG compliance, leading to greater risk mitigation for companies within the sustainable portfolio.

In summary, while companies in the traditional portfolio initially offered greater stability, the sustainable portfolio demonstrated significant improvements in risk performance, especially during periods of market stress, ultimately converging with traditional investments in terms of volatility.

3.3 Sharpe ratio

The Sharpe Ratio, a measure of risk-adjusted returns, provides critical insights into the performance of the sustainable and traditional portfolios over the analysis period.



Graphic 4: Annual Sharpe Ratio of Sustainable and Traditional Portfolios (2005–2022), retrieved from Python

Throughout the observation period, the traditional portfolio consistently demonstrates a higher Sharpe Ratio compared to the sustainable portfolio.

In 2008, both portfolios experienced significant drops due to the global financial crisis in their Sharpe Ratios, with the traditional portfolio facing a larger decline. The crisis strongly hit sectors such as finance and real estate (Gorton 2010), which dominate the traditional portfolio, severely affecting their returns. In contrast, the sustainable portfolio, focused on long-term ESG commitments, faced a less dramatic decline, possibly due to the small number of firms eligible to enter the portfolio that year.

From 2009 to 2020, the traditional portfolio consistently outperformed in terms of risk-adjusted returns, benefiting from stable business models that recovered quickly. Meanwhile, the

sustainable portfolio firms may have struggled to balance long-term sustainability with short-term returns, leading to lower Sharpe Ratios during this period. However, after 2017, the Sharpe Ratios of both portfolios converged, reflecting a growing recognition of ESG principles and increased investment in sustainable companies.

In 2020, the sustainable portfolio's Sharpe Ratio suffers a steeper decline, possibly due to the operational challenges of maintaining sustainability goals under crisis conditions. In contrast, the traditional portfolio, with its greater exposure to stable, established industries, mitigated the impact on its risk-adjusted returns.

Following the disruptions caused by the pandemic, the sustainable portfolio's Sharpe Ratio outperformed the traditional one, with both having a decline in 2022 presumably due to the economic fallout from the war in Ukraine.

In summary, the traditional portfolio historically demonstrated stronger risk-adjusted returns, particularly during periods of economic recovery. However, the sustainable portfolio's performance has significantly improved since 2018, reflecting its increasing viability as an investment strategy.

3.4 Regression Model

The regression analysis provides insights into the relationship between each of the portfolios' returns in 2022 and the individual environmental, social, and governance (ESG) scores, as well as the control variables firm size and financial leverage. The model used to estimate this relationship was previously specified as follows: $\text{Portfolio Return}_{i,t} = \beta_0 + \beta_1 \text{Environmental Score}_{i,t} + \beta_2 \text{Social Score}_{i,t} + \beta_3 \text{Governance Score}_{i,t} + \beta_4 \text{Firm Size}_{i,t} + \beta_5 \text{Financial Leverage}_{i,t}$.

	Traditional Portfolio				Sustainable Portfolio			
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Coefficients*	*Standard Error*	*t Stat*	*P-value*
Intercept	0.0121	0.0037	3.2775	0.0012	-0.0023	0.0064	-0.3538	0.7240
Environmental Score	-0.0015	0.0017	-0.8995	0.3694	-0.0018	0.0023	-0.8128	0.4176
Social Score	0.0033	0.0028	1.1951	0.2333	0.0032	0.0026	1.2345	0.2188
Governance Score	0.0020	0.0038	0.5186	0.6046	-0.0084	0.0060	-1.4069	0.1614
Firm Size	-0.3309	0.0482	-6.8673	0.0000	0.2201	0.0578	3.8054	0.0002
Financial Leverage	0.0010	0.0009	1.1133	0.2668	-0.0006	0.0011	-0.5284	0.5979
R^2	0.2041				0.0985			

Table 2: OLS Regressions Summary, retrieved from Excel

The regression analysis compares factors influencing the returns of the traditional and sustainable portfolios in 2022, focusing on ESG scores and firm-specific control variables. For the traditional portfolio, the intercept is statistically significant ($p = 0.0012$), with a coefficient of 0.0121, indicating a yearly return of 1.21%. In contrast, the sustainable portfolio's intercept is negative (-0.0023) and statistically insignificant ($p = 0.7240$), reflecting a weaker performance.

Individual ESG scores do not show statistically significant relationships with returns in either portfolio, suggesting limited influence on short-term performance. However, the coefficient for environmental scores was negative for both models, the one for social scores was positive for both models, and the coefficient for governance scores was positive in the traditional model and negative in the sustainable model.

A key distinction lies in firm size. Smaller firms seem to be less detrimental to the returns of the traditional portfolio than bigger firms (coefficient = -0.3309, $p < 0.0001$), aligning with the theory of higher growth potential for small companies (Banz 1981). Conversely, larger firms with established ESG practices significantly contribute to the sustainable portfolio (coefficient = 0.2201, $p = 0.0002$), reflecting stability and recognition of ESG efforts. Financial leverage shows no meaningful impact on returns for either portfolio.

The traditional portfolio's model explains 20.41% of return variation ($R^2 = 0.2041$), compared to 9.85% for the sustainable portfolio ($R^2 = 0.0985$), highlighting the greater predictability of the first model.

Overall, the results indicate that ESG factors have limited short-term impact.

3.5 Conclusions

The analysis of the sustainable and traditional portfolios over the 18-year period indicates that the sustainable portfolio did not consistently outperform the traditional portfolio in terms of financial returns. In fact, the sustainable portfolio showed worse overall returns, particularly during certain stable periods. This finding directly **refutes hypothesis 1**, which proposed that ESG-integrated portfolios would exhibit superior financial performance compared to traditional portfolios.

Similarly, the analysis of the Sharpe Ratios reveals that the traditional portfolio consistently delivered better risk-adjusted returns, especially during the period from 2009 to 2020. Despite some convergence in the Sharpe Ratios after 2018, the sustainable portfolio only outperformed the traditional portfolio in risk-adjusted terms during 2021-2022. This **refutes hypothesis 2**, which suggested that ESG-integrated portfolios would demonstrate higher risk-adjusted returns, particularly during periods of market stress.

Lastly, the regression analysis for hypothesis 3 suggests that none of the individual ESG scores showed statistically significant effects on portfolio returns. However, their coefficients might have proved a negative relationship between environmental scores and portfolio returns, while social scores consistently had a positive association with returns in both portfolios, and a mixed relationship for governance scores. These variations suggest that the influence of ESG

dimensions is not uniform, **partially supporting hypothesis 3**, though their overall impact on financial performance is extremely limited in this study.

Table 3 summarizes the performance metrics for the traditional and sustainable portfolios over the analysis period. As shown, the traditional portfolio consistently outperformed the sustainable portfolio across all key measures.

	Traditional Portfolio	Sustainable Portfolio
Average Return	17.28%	12.49%
Average Volatility	4.23%	7.84%
Average Sharpe Ratio	2.66	1.43
Maximum Draw Down	-19.10%	-43.10%
Average Jensen's α	9.30%	5.08%

Table 3: Summary of performance of both portfolios

The traditional portfolio outperformed the sustainable portfolio with a higher average return of 17.28% compared to 12.49%. This underperformance of the sustainable portfolio can be due to ESG criteria narrowing the investable companies, reducing diversification, and excluding potentially high-performing stocks. Companies focusing on ESG, prioritizing long-term sustainability, often face higher costs, limiting their short-term competitiveness.

The sustainable portfolio also showed higher volatility (7.84% vs. 4.23%), reflecting riskier investments. The narrower range of eligible investments imposed by the ESG criteria limited diversification, amplifying the portfolio's sensitivity to sector-specific risks and broader economic instability, which may explain the increased volatility.

Risk-adjusted metrics further confirm these differences, with the traditional portfolio achieving a higher Sharpe Ratio (2.66 vs. 1.43) and Jensen’s Alpha (9.30% vs. 5.08%). The

sustainable portfolio experienced a larger Maximum Drawdown (43.10% vs. 19.10%), indicating greater vulnerability to market stress.

3.6 Limitations

While the dataset retrieved from Bloomberg provides a solid foundation for analysing the integration of ESG factors over a vast period of time, several limitations regarding the dataset must be addressed to ensure clarity and transparency in this research. One key challenge lies in data availability. Although Bloomberg offers extensive financial and ESG data, not all companies currently in the S&P 500 index have been publicly listed for the entire 20-year period. Companies that were listed more recently, or those involved in mergers, acquisitions, or other corporate restructurings, may not have historical data dating back to 2004. This could potentially limit the study's ability to create accurate samples of sustainable and non-sustainable portfolios over the entire period. Furthermore, variations in ESG reporting practices across firms may introduce some inconsistencies. ESG data has evolved significantly since 2004, and while reporting standards have improved over time, earlier data may lack the precision or accuracy seen in recent years. This could create discrepancies in assessing the historical performance of ESG factors, particularly when comparing companies with varying levels of transparency and disclosure.

These limitations highlight the importance of carefully interpreting the findings of this study, acknowledging the potential gaps in data availability, consistency, and methodology.

Additionally, although the regression model proposed is designed to test the relationship between the individual pillars of ESG and portfolio performance, several potential biases and limitations must be acknowledged. There may be reverse causality between ESG scores and financial performance, as companies that are performing well financially may have more resources to invest in ESG initiatives, leading to higher ESG scores. Therefore, endogeneity could be an

issue. Another potential bias is omitted variable bias, where variables not included in the model might influence both ESG performance and financial outcomes. For example, management quality or innovation capability could impact both ESG efforts and financial results, yet these are difficult to quantify directly and may not be captured in the dataset. Multicollinearity could also be a concern if independent variables, such as the individual ESG scores, are highly correlated. This would make it challenging to distinguish the individual impact of each factor on financial performance.

4. Directions for Further Research

The results of this study help clarify the dynamic relationship between ESG factors and asset allocation by providing a thorough analysis of the performance of two distinct portfolios based on S&P 500 firms and its ESG scores.

While the findings reveal significant differences in portfolio performance, several approaches for further research could deepen the understanding of ESG investing. First, future studies could explore the effects of different ESG score criteria or implement a more in-depth approach by categorizing firms into multiple ESG score groups. This could reveal how different levels of ESG performance influence returns and risk profiles across different market conditions.
In addition, while this analysis employed annual rebalancing, further research might explore the implications of more frequent rebalancing strategies. Shorter rebalancing intervals could potentially capture market dynamics and investor sentiment shifts related to ESG developments, providing deeper insights into the portfolios' responsiveness to changing market conditions.

Lastly, expanding the analysis to include a wider range of firms beyond the S&P 500, such as lower market capitalization or international companies, could provide valuable comparative insights into the impact of ESG factors across different market segments. This could contribute to a more complete understanding of ESG investing's effectiveness.

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