

An Investigation Into the Relationship Between ESG Scores and Risk-Adjusted Returns Across the Technology, Energy and Healthcare Sectors

Aryan Paul
aryandubai2010@gmail.com

ABSTRACT

This study investigates whether companies with higher ESG (Environmental, Social, Governance) scores generate superior risk-adjusted returns than companies with low ESG scores, across the technology, energy and healthcare sectors, with the chosen sample period being 2017 to 2024. The analysis includes classifying companies into high and low ESG for each sector, using S&P Global ESG Scores, and creating an equal-weight portfolio for high and low ESG per sector. This results in six portfolios constituting three companies each. Monthly stock price data sourced from Yahoo Finance is used to conduct analysis on Python, and metrics such as Sharpe ratio, annualized returns, annualized volatility, and t-tests are used. Findings showed the high ESG portfolio performing better in the technology and energy sectors, while the converse was surprisingly true in the healthcare sector. The t-test results showed that the observed differences in returns between portfolios for each sector was statistically insignificant, implying that ESG classification alone is insufficient to predict a company's performance. Other factors such as sector context and market conditions also play a crucial role. However, the qualitative discussion reveals that companies with strong ESG practices may enjoy certain advantages over their peers.

INTRODUCTION

ESG stands for Environmental, Social, and Governance and is defined as the comprehensive system by which companies are measured beyond the traditional financial metrics. It is defined by three pillars: the way the company interacts with nature (Environmental), the way the company interacts with its stakeholders (Social), and the way the company is run (Governance). ESG has seen tremendous growth in the past few years; in fact, ESG assets grew to over \$35 trillion globally in 2020, as reported by the Global Sustainable Investment Alliance. Investors are increasingly realising that the impact of non-financial factors on financial performance is significant in the long run, and ESG has proven itself as a valuable tool that can be used to quantify this impact.

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The key question that this study aims to find the answer to is whether ESG investing actually provides investors with higher returns. It is argued that companies with sustainable investment models are likely to tackle uncertain situations more effectively and are therefore less likely to be volatile. However, the counterargument is that ESG investing causes companies to get rid of high-performing assets in the name of sustainability. This debate is reflected in academic literature, with Friede et al. (2015) finding predominantly positive but mixed results across over 2,200 empirical studies.

This paper examines the relationship between companies' ESG scores and risk adjusted returns across three sectors, namely technology, energy and healthcare, with each being chosen for its unique ESG risk profile.

Therefore, the research question is:

“To what extent does ESG classification predict risk-adjusted financial performance across the technology, energy and healthcare sectors, and does this relationship vary by industry?”

To investigate this, monthly stock price data from January 2017 to January 2024 was retrieved for eighteen companies across three sectors, classified as high or low ESG based on S&P Global ESG Scores, and evaluated using annualized return, annualized volatility and the Sharpe ratio, with the S&P 500 ETF serving as a market benchmark. The data was sourced from yfinance and analysis was conducted on Python.

LITERATURE REVIEW

The largest meta-analysis on the relationship between ESG and financial performance to date was conducted by Friede et al. (2015). It examined over 2,200 empirical studies from between 1970 and 2014 and found that approximately 90% of the studies reported a non-negative relationship between ESG and financial performance, with the majority reporting a positive relationship between the two. It found that ESG factors generally do not reduce financial performance but instead increase it.

In the study by Khan et al. (2016), the researchers investigated whether all ESG factors are created equal or if some are more important than others. It was also the study that introduced the concept of materiality – that some factors are more relevant to certain industries than others, but not all are relevant at all. It made use of the SASB (Sustainability Accounting Standards Board) to identify the material and immaterial factors. It found that companies with good performance on the material ESG factors significantly outperformed their peers, but the same was not true with the immaterial factors.

A study by Lins, Servaes, and Tamayo (2017) was conducted to examine whether the implementation of CSR (corporate social responsibility, i.e., ESG framework) impacted a company's performance during the 2008-2009 financial crisis. The study concluded that high ESG firms performed better than low ESG firms by more than 4% during this period, with the key takeaway being that ESG is a form of social capital that helps create trust with stakeholders during uncertain times. During the period of the financial crisis, the companies that performed well were the ones with strong ESG practices. They were able to

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maintain good relationships with their stakeholders, reducing the impact of the downturn. Therefore, ESG is not necessarily a performance enhancer; it is more of an insurance policy, i.e., it prevents the company from underperforming. The time period selected for this study encompasses the COVID-19 pandemic, which provides an excellent opportunity to assess whether this pattern reveals itself during a more recent crisis period.

Fama and French (1993) developed the three-factor model that added to the conventional analysis of market risk by considering size and value premium as variables that determine returns on assets. The study also laid out a basic framework that is used to analyze the performance of portfolios. It established that returns should always be analyzed relative to risk when assessing portfolio performance, as two portfolios with similar returns may have vastly different underlying risks. This is why the Sharpe ratio is used in this study as a primary tool to analyze portfolio performance. It is worth noting that this study does not control for Fama-French factors, implying that some of the findings could be attributed to size or value effects rather than ESG.

METHODOLOGY

For this study, monthly stock prices were obtained from the *yfinance* python library, which retrieves the data from Yahoo Finance. In addition, the ESG rating was obtained from the S&P Global ESG Scores, with the objective of determining whether companies with high ESG scores provide better risk-adjusted financial returns when compared to companies with low ESG scores in the technology, energy, and healthcare sectors.

Companies were selected based on their S&P Global ESG score, which is a comprehensive rating system that evaluates companies according to their performance in managing ESG risks, opportunities, and their overall ESG impact. It is a free and easily accessible database which provides valuable information to a wider audience, not only professionals. The ESG rating is obtained through a combination of company disclosure, media analysis, stakeholder analysis, modelling, and company engagement through the S&P Global Corporate Sustainability Assessment (CSA). ESG scores may also be influenced by structural firm characteristics, such as size and reporting capacity. The companies were selected as follows: the companies with an ESG rating of 60 and above were categorized as high ESG, while the companies with an ESG rating of 40 and below were categorized as low ESG. These particular thresholds were chosen to ensure a meaningful separation between the groups, and avoid overlap or borderline misclassification where there may not be a significant difference in the ESG performance of the high and low ESG group companies. By focusing on the more extreme ends of the ESG threshold spectrum, the expectation is that analysis will capture a more stark contrast in sustainability practices.

Three companies were selected from the high ESG category, three from the low ESG category, making a total of six portfolios, as shown in Table 1. The selection of three firms from each ESG category for each sector was done intentionally, following the exploratory nature of this study. The use of a small but concentrated sample helps achieve more accurate sector-wise comparison and allows interpretation of the Sharpe Ratio in terms of the particular ESG risks associated with that particular industry sector; for

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example, carbon exposure in the energy sector and data governance in technology. This helps improve the validity of comparison within each category. However, it may reduce the generalizability of statistical findings. Besides, there were only a limited number of companies on the S&P Global database that were within the ESG score thresholds of >60 and <40.

Table 1: ESG portfolio classifications and S&P Global ESG scores

Ticker	Company	Sector	ESG Score	Classification
NVDA	NVIDIA Corporation	Technology	62	High ESG
LNVGY	Lenovo Group	Technology	62	High ESG
SIEGY	Siemens AG	Technology	79	High ESG
META	Meta Platforms	Technology	27	Low ESG
TSLA	Tesla Inc.	Technology	28	Low ESG
SNAP	Snap Inc.	Technology	33	Low ESG
ACXIF	Acciona S.A	Energy	84	High ESG
IBDRY	Iberdrola S.A	Energy	86	High ESG
OMVKY	OMV AG	Energy	62	High ESG
CVX	Chevron Corporation	Energy	30	Low ESG
XOM	Exxon Mobil Corporation	Energy	36	Low ESG
NEE	NextEra Energy	Energy	38	Low ESG
CNC	Centene Corporation	Healthcare	60	High ESG
ABT	Abbott Laboratories	Healthcare	60	High ESG
ALPMY	Astellas Pharma	Healthcare	60	High ESG
MOH	Molina Healthcare	Healthcare	31	Low ESG
JAZZ	Jazz Pharmaceuticals	Healthcare	32	Low ESG
PBH	Prestige Consumer Healthcare	Healthcare	31	Low ESG

Source: S&P Global ESG Scores, 2024, www.spglobal.com/sustainable/en/solutions/esg-scores-data

Technology, energy and healthcare were the three sectors chosen for this study due to their distinct and contrasting ESG profiles. The technology sector faces heightened governance and social risks around data privacy and ethical AI development, while the energy sector plays a major role in the global shift away from fossil fuels, meaning that environmental factors have a direct impact on the financial performance of companies in the industry. The healthcare sector is also shaped by social factors surrounding patient safety, labor practices and supply chain management.

The time period selected for the collection of data is from January 2017 to January 2024. This provides 84 months of complete data for each of the given tickers. Although the period chosen is mainly driven by data availability, it also represents the time from when ESG emerged as an important metric for evaluating

companies. This was after the Paris Agreement of 2015, where corporate accountability was increased and companies had to start disclosing their risks, specifically related to climate change. This period also captures significant market events, allowing for an exhaustive evaluation. This includes the COVID-19 pandemic, which was used as a stress test for ESG investing. Research has shown that companies with high ESG ratings were less volatile during this period. This period also includes the tech boom of 2020-2021, after the pandemic, and the energy crisis of 2022.

Monthly returns for each ticker were calculated as the percentage change in closing price from the last trading day of one month to the last trading day of the following month. Monthly rather than daily returns were used to reduce the daily price noise and smoothen out idiosyncratic volatility, consistent with standard practice in academic research. Equal weighted portfolios were constructed by averaging monthly returns of the three constituent stocks of each group. This approach is suitable because it eliminates market capitalization bias and isolates the impact of ESG classification on financial performance. Hence, it prevents mega-cap companies from dominating the results.

The three key performance indicators used to assess results are annualized return, annualized volatility and the Sharpe ratio.

$$\text{Annualized return} = \text{mean monthly return} \times 12$$

$$\text{Annualized volatility} = \text{standard deviation of monthly returns} \times \sqrt{12}$$

$$\text{Sharpe ratio} = \frac{\text{annualized return} - 2\% \text{ risk free rate}}{\text{annual volatility}}$$

Annualized return represents average yearly growth, and volatility is a measure of dispersion of returns. The Sharpe ratio measures return per unit of risk — a higher value is better as it indicates that an investment is delivering higher returns relative to the volatility of its returns. It is calculated using a 2% risk free rate, as it represents the approximate yield of a short-term US treasury security over the sample period. This metric is particularly useful in this context as it can compare portfolios with different volatilities. Deciding on which portfolio performed better based solely on returns is incorrect as it does not consider the underlying risk. Additionally, the S&P 500 ETF (SPY) was included as a market benchmark to provide broader context for portfolio performance. Finally, independent samples t-tests were conducted for each sector to see whether the observed differences in mean monthly returns between the high and low portfolios were statistically significant, with a p-value threshold of 0.05 applied.

RESULTS

The following results were obtained by running Python analysis on monthly closing price data from 2017 to 2024 retrieved from Yahoo Finance.

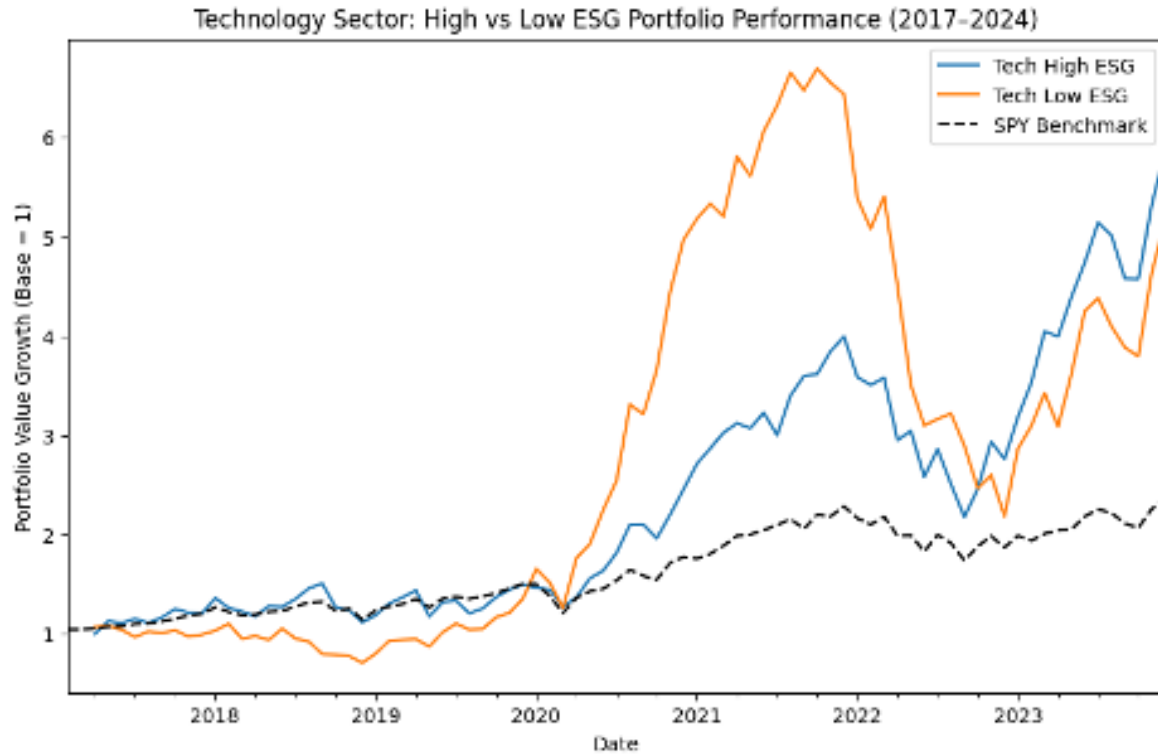
Table 2: Portfolio performance summary (January 2017 – January 2024)

Portfolio	Ann. Return	Ann. Volatility	Sharpe Ratio	Cumulative Growth
Tech High	31.00%	30.13%	0.96	5.86x
Tech Low	32.34%	40.69%	0.75	5.16x
Energy High	15.85%	23.91%	0.58	2.39x
Energy Low	13.38%	20.69%	0.55	2.13x
Health High	11.10%	18.27%	0.50	1.89x
Health Low	14.33%	20.54%	0.60	2.27x
SPY benchmark	13.86%	16.84%	0.70	2.35x

Source: Author's calculations using yfinance data and python programming (2026)

Technology sector

Figure 1: High vs Low ESG portfolio performance for technology sector

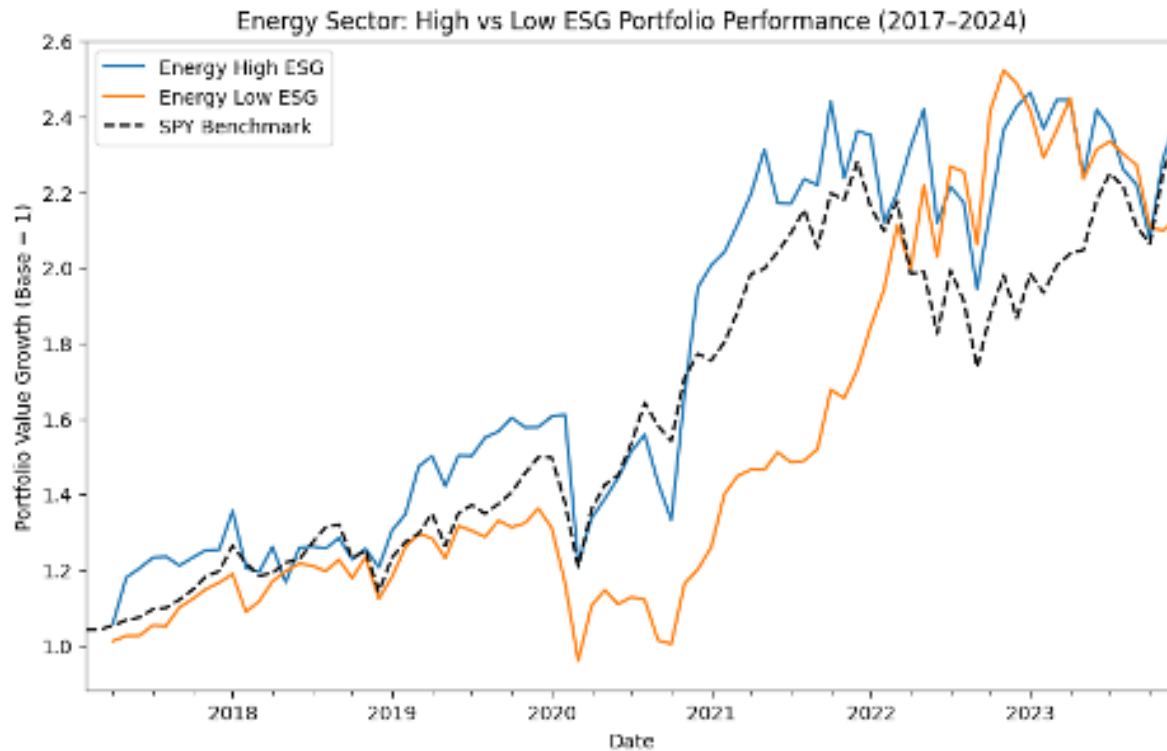


Source: Author's own calculations using monthly closing price data retrieved from Yahoo Finance via yfinance (2026)

From Figure 1, it can be observed that both tech portfolios were relatively flat from 2017 to around mid-2020. The COVID-19 pandemic then triggered a major tech boom from mid-2020 onwards, causing both portfolios to rise sharply. Initially, the Tech Low portfolio spiked higher, reaching around 6.5x by early 2022. Subsequently, both portfolios dropped significantly as a result of the 2022 tech selloff. By the end of 2023, Tech High recovered more strongly, finishing at 5.86x to Tech Low's 5.16x. Further, it can be noted that although Tech Low finished at a higher raw return (32.34%), the Tech High portfolio had the superior Sharpe ratio (0.96 vs 0.75). This is due to Tech Low having a much higher volatility (40.69% vs 30.13%). Finally, both portfolios significantly outperformed the SPY (only 2.35x), with the high ESG outperforming by more on a risk adjusted basis.

Energy sector

Figure 2: High vs Low ESG portfolio performance for energy sector

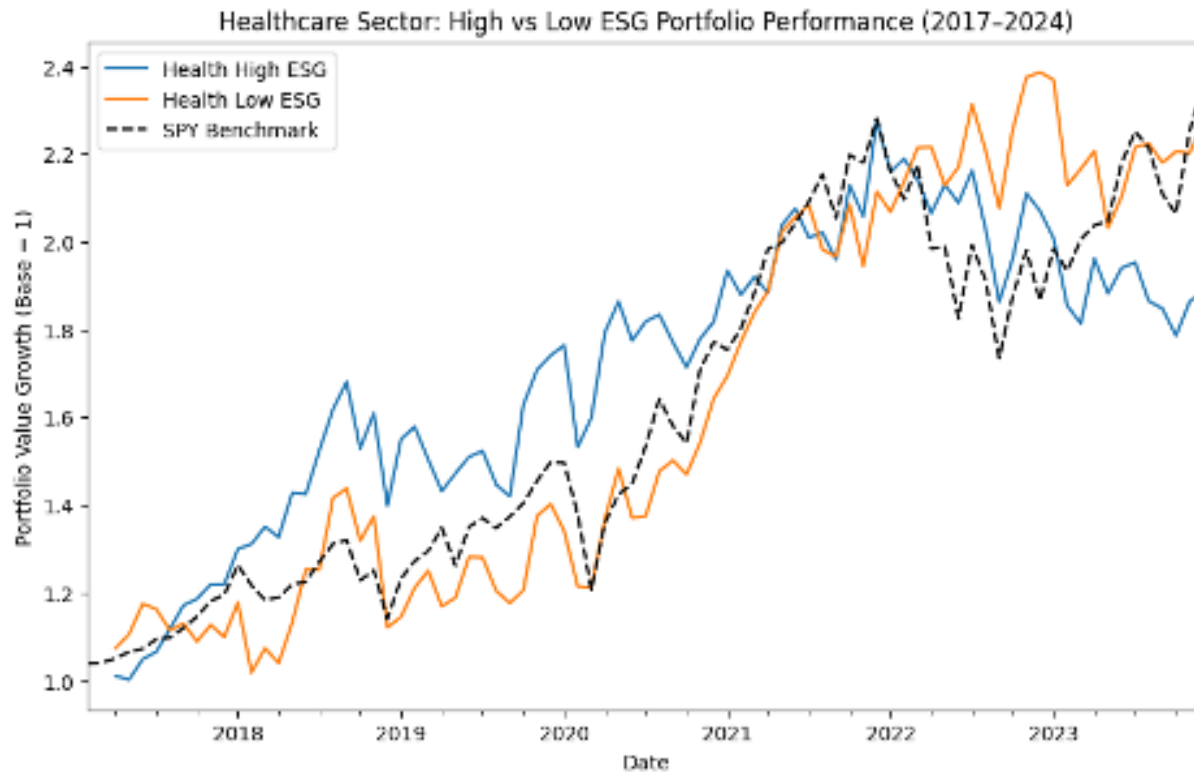


Source: Author's own calculations using monthly closing price data retrieved from Yahoo Finance via yfinance (2026)

Figure 2 illustrates that the Energy High ESG portfolio maintained a consistent lead over Energy Low ESG for most of 2017-2020. The COVID-19 pandemic caused a severe drop for both portfolios, with Energy Low falling close to 1.0x and nearly wiping out all gains since 2017. Energy High recovered considerably faster post-2020, showing stronger resilience during market shock. For the period between 2022 and late 2023, each portfolio spent a portion of time above the other, with both converging towards the end of the sample period. In terms of SPY comparison, Energy High outperformed the benchmark pre-2020 while Energy Low did not. During the pandemic, both largely underperformed the SPY, and eventually outperformed it until the end of the sample period. As shown in Table 2, the Energy High ESG portfolio finished on a higher annualized return (15.85% to 13.38%), as well as a higher Sharpe ratio (0.58 vs 0.55), although the margin between the two was notably narrower than for the Technology sector.

Healthcare sector

Figure 3: High vs Low ESG portfolio performance for healthcare sector



Source: Author's own calculations using monthly closing price data retrieved from Yahoo Finance via *yfinance* (2026)

Similar to the energy sector, Figure 3 illustrates that High ESG portfolio for healthcare maintained a healthy lead over the low ESG one for most of 2017-2020. Interestingly, both portfolios retained an upward trend through the course of the pandemic, which is a stark difference to both the other sectors. Health High was slightly ahead entering 2021 but showed slow growth and then a gradual decrease till the end of the sample period, allowing Health Low to pull clear and finish stronger (2.27x to Health High's 1.89x). Health Low also had a better Sharpe ratio (0.60 vs 0.50) and better annualized return (14.33% vs 11.10%) with similar volatility levels. Before 2020, Health High was outperforming the market benchmark, while Health Low was not. From 2021 onwards, SPY pulled ahead of both portfolios but experienced a brief dip in 2022, during which both portfolios held better positions. However, it recovered quickly and re-established a lead by 2023. It can be noted that by the end of the sample period, Health Low came closer to matching the benchmark than Health High.

T-Test Results

Table 3 shows the T-Test results conducted for all three sectors.

Table 3: Independent samples T-Test results by sector

Sector	T-statistic	P-value	Statistically significant?
Technology	-0.069	0.945	No
Energy	0.203	0.839	No
Healthcare	-0.305	0.761	No

Source: Author's own calculations

Since all three p-values are well above the 0.05 threshold, we cannot reject the null hypothesis in any sector. This means that the differences in returns between the high and low ESG portfolios are not statistically significant, and the observed differences could be attributed to random chance just as much as ESG scores. This potential limitation may be due to the small sample size of only three stocks per portfolio taken for the study.

These results are interpreted in the next section keeping in mind sector context and statistical limitations.

DISCUSSION

This section aims to interpret sector-specific patterns while maintaining consistency with statistical findings.

The results of this study provide fascinating insight into how ESG considerations impact different sectors and suggest that the relationship between ESG classification and financial performance may not be uniform across all three sectors. Rather, they display distinct and contrasting outcomes. While the technology and energy sectors appeared to show higher risk-adjusted returns for high ESG portfolios, the healthcare sector showed the opposite effect. Before diving into extensive analysis however, it is important to reiterate that the T-Test results from the previous section suggest that the differences in returns across all sectors may have been due to chance or other factors apart from ESG ratings.

Role of confounding variables

Differences seen in the performance among different ESG portfolios can be attributed to certain firm attributes besides ESG itself. The size and growth nature of each firm will surely play some role in determining performance. For example, higher-rated ESG firms in the healthcare sector are generally

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larger and older. Meanwhile, in the energy sector, the ESG distinction may be more related to the difference in firm business models, whether focused on renewables or fossils. Since this paper does not consider well-known variables such as those proposed by Fama-French, the findings must be understood in terms of correlation and not causation.

Technology

The high ESG technology portfolio showed better performance than the low ESG technology portfolio based on the Sharpe ratio, despite having similar raw returns. This may be partly attributable to high ESG companies operating in this field, such as NVIDIA and Siemens, tending to have stronger corporate governance structures. This may contribute to better data privacy, less fines from regulators, and less reputational risk. This is a possible reason for the lower observed volatility for the high ESG technology portfolio (30.13%) compared to the low ESG technology portfolio (40.69%), and hence has resulted in a better Sharpe ratio for the high ESG portfolio than for the low ESG portfolio. On the other hand, low ESG technology companies have faced many controversies. For example, Meta has faced major data scandals, and Tesla has faced many corporate governance problems. This appears to be associated with greater price instability and high volatility for these companies. This is consistent with the findings of Khan et al. (2016), who found that companies with high ratings on material ESG issues relevant to their industry gain a significant competitive advantage. In the technology sector, data privacy and governance are considered highly material factors that are the industry's value drivers.

Energy

The energy sector presents the most compelling case in this study, as the distinction in the performance of the two portfolios is not only because of the differences in the management practices but also because of the underlying structural differences in the sector. The high ESG portfolio showed better annual returns compared to the low ESG portfolio, and it had a better Sharpe ratio, but the gap across all metrics was small. The underlying rationale for this is fascinating; the classification of energy companies based on their ESG rating also represents a divide between two fundamentally different business models. The companies in the high ESG category, such as Iberdrola and Acciona, are focused on the renewable sector, and the broader transition towards a greener economy has likely helped these companies. On the contrary, the companies in the low ESG category, such as Chevron and Exxon, are more focused on fossil fuels, and as a result, these companies are relatively more carbon-intensive. During the COVID period, low oil demand had led to a substantial fall in the value of low ESG energy stocks. The above trend was temporarily reversed in the 2022 energy crisis period, where rising oil prices allowed the low ESG stock portfolio to temporarily outperform. However, this effect narrowed the overall performance gap rather than reversing it. This ties into the insights from Friede et al. (2015), who suggest that environmental risks have a strong impact on financial performance in high impact industries like energy.

Healthcare

Contrary to the trend in the technology and energy sectors, the low ESG healthcare portfolio performed better than the high ESG portfolio with respect to both parameters, with the Sharpe ratio as well as the raw returns of the low ESG portfolio being higher. This is an unexpected trend, but it may be explained by analyzing the inherent differences between high ESG firms and low ESG firms in this particular industry. The key point to note here is that the ESG classification in healthcare also represents a contrast in company size and maturity rather than purely ethical practices. Large, well-established companies like Astellas and Abbott place a lot of emphasis on ESG reporting, which is the reason these companies have high ESG scores, while companies like Molina and Jazz Pharmaceuticals, which are relatively smaller, cannot afford the expenses of sustainability reporting, hence lower ESG scores. Consequently, it is clear that in this sector, ESG partly acts as a proxy for firm size and reporting capacity rather than a pure encapsulation of sustainability standards. Hence, the healthcare sector's dynamic indicates that lower ESG scores do not necessarily imply mismanagement or bad practices. Furthermore, since healthcare is a defensive sector where demand remains stable regardless of market conditions, ESG factors have a slightly less influential impact on revenue compared to sectors like energy where ESG classification directly determines the business model.

This study suggests that across all three sectors, ESG alone is insufficient to consistently predict returns. However, when viewed in industry specific context and considering market conditions, it may serve as a valuable metric that investors can use to determine a company's earnings potential and future path. Nevertheless, it is worth reiterating here that given the statistically insignificant t-test results and small sample size, these findings should be interpreted as descriptive patterns rather than definitive conclusions.

CONCLUSION

This study aimed to investigate ESG classification and its impact on risk-adjusted returns in the technology, energy and healthcare sectors between 2017 and 2024. The results suggested that the high ESG portfolio in the technology sector outperformed the low ESG one on Sharpe ratio, despite having similar raw returns. Similarly, the high ESG portfolio in the energy sector performed better than the low ESG one across all aspects. Healthcare showed surprising findings, as the low ESG portfolio performed better.

The independent samples T-Tests conducted for each sector revealed that the observed differences in returns between the high and low ESG portfolios were statistically insignificant, which implies that ESG alone cannot accurately predict a company's returns. Other factors such as company size and market conditions also play a role. However, a company with a high ESG rating may enjoy certain benefits that could contribute to a competitive advantage over its peers, as revealed in the qualitative discussion section.

The main limitation of this study was the small sample size of only 3 stocks per portfolio, which means that findings cannot be generalized to broader markets. Future research could aim to incorporate a larger sample size, as well as control for Fama-French factors, so that the impact of ESG classification is more clear-cut.

REFERENCES

- Fama, Eugene F., and Kenneth R. French. "Common Risk Factors in the Returns on Stocks and Bonds." *Journal of Financial Economics*, vol. 33, no. 1, 1993, pp. 3–56.
- Friede, Gunnar, Timo Busch, and Alexander Bassen. "ESG and Financial Performance: Aggregated Evidence from More than 2,000 Empirical Studies." *Journal of Sustainable Finance and Investment*, vol. 5, no. 4, 2015, pp. 210–233.
- Global Sustainable Investment Alliance. *Global Sustainable Investment Review 2020*. GSIA, 2020, www.gsi-alliance.org.
- Jia, Siqi. "Impact of ESG Risk on Portfolio Optimization and Returns: An Analysis Using the Markowitz Model." *Highlights in Business, Economics and Management*, vol. 40, 2024, pp. 1184–1192.
- Khan, Mozaffar, George Serafeim, and Aaron Yoon. "Corporate Sustainability: First Evidence on Materiality." *The Accounting Review*, vol. 91, no. 6, 2016, pp. 1697–1724.
- Lins, Karl V., Henri Servaes, and Ane Tamayo. "Social Capital, Trust, and Firm Performance: The Value of Corporate Social Responsibility during the Financial Crisis." *Journal of Finance*, vol. 72, no. 4, 2017, pp. 1785–1824.
- S&P Global. "S&P Global ESG Scores." *S&P Global Sustainable1*, 2024, www.spglobal.com/sustainable1/en/solutions/esg-scores-data