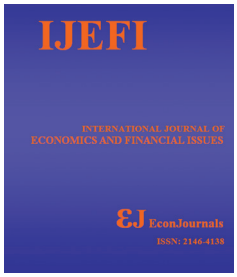

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Less is More: In Search of Sustainable Investment Premium

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ABSTRACT

Considering the inconsistency among various ESG ratings from major agencies, and the conflicting research findings: From superior returns and reduced risk to indicating no significant difference or even underperformance, this study uses a single indicator instead of a complicated scoring system to examines "green" firms categorized with zero fossil fuel exposure, comparing their performance to "brown" firms with fossil fuel exposure investments. The findings indicate that market value-weighted portfolios of these "green" stocks outperform their counterparts, demonstrating potential financial benefits of sustainable investing based on a single indicator. The study employs the Fama-French three-factor model and cross-sectional analysis, showing that "green" portfolios yield higher abnormal returns and exhibit different risk profiles compared to "brown" (non-fossil-fuel-free) portfolios. The research underscores the need simply and standardize ESG metrics to enhance comparability and reliability, thereby aiding investors in making informed decisions aligned with sustainability goals.

Keywords: ESG Investing, Sustainable Finance, Fossil Fuel-Free Investments, Financial Performance
JEL Classifications: G10, G11, G12, M14

1. INTRODUCTION

In recent years, Environmental, Social, and Governance (ESG) investing has garnered significant attention from investors, policymakers, and scholars alike. This interest is driven by growing concerns about climate change, social justice, and corporate governance, alongside a recognition of the potential financial implications of these factors. ESG investing integrates these non-financial factors into investment decisions, aiming to achieve sustainable, long-term returns. However, the field is fraught with challenges, particularly regarding the quality and consistency of ESG data. Discrepancies in ESG ratings among major agencies - such as KLD, Sustainalytics, Moody's ESG, S&P Global, Refinitiv, and MSCI - underscore the difficulty in establishing standardized metrics and hinder effective comparison and analysis across companies and sectors (Berg et al., 2022).

Despite these challenges, the body of literature on ESG investing has grown substantially, producing a wide array of findings. Some studies, such as those by Friede et al. (2015), suggest that ESG investing can lead to superior financial performance, while others, like Brammer et al. (2006), find no significant difference in returns. Additionally, there are studies indicating that ESG-focused funds may underperform traditional funds, especially those that exclude high-performing, but socially controversial industries (Hong and Kacperczyk, 2009; Richey, 2020). This paper seeks to navigate these conflicting findings by examining the performance of environmentally conscious investments, particularly focusing on the subset of the S&P 500 firms with zero fossil fuel exposure.

Using data from "InvestYourValue.org"[1], this study explores whether these "Green" stocks (fossil-fuel-free) outperform their "Brown" (non-fossil-fuel-free) counterparts. The analysis employs both market value-weighted and equally weighted portfolios to

1 Investyourvalue.org is a platform by the non-profit organization As You Sow, providing tools and scorecards to evaluate the sustainability of retirement plans, mutual funds, and ETFs based on various ESG criteria, such as fossil fuel exposure, deforestation, and gender equality.

assess performance differences and applies the Fama and French (1992) three-factor model to isolate abnormal returns. The study further explored the direct impact of being green on the excess returns of the portfolios by using Fama and MacBeth (1973) cross-sectional regression. By investigating these dimensions, this paper aims to contribute to the ongoing discourse on the financial viability and sustainability of ESG investing, offering insights into the potential benefits of simplifying ESG metrics by using a single and a few metrics instead of a complicated scoring system.

2. BACKGROUND AND LITERATURE REVIEW

One of the primary limitations in ESG research is the quality and availability of ESG data. Inconsistent reporting practices and the lack of standardized metrics make it challenging to compare and analyze ESG performance across companies and sectors effectively. For instance, it has been demonstrated that environmental, social, and governance (ESG) ratings based on data from six prominent ESG rating agencies.

The literature on ESG investing indeed presents a range of contradictory findings, reflecting the complexity and evolving nature of this field. When it comes to financial performance, the results are inconsistent. Several studies suggest that ESG investing can lead to superior financial performance. For instance, a meta-analysis by Friede et al. (2015) reviewed over 2,000 empirical studies and found that approximately 90% of the studies showed a non-negative relationship between ESG criteria and corporate financial performance, with a majority indicating positive results. Similarly, Eccles et al. (2014) demonstrated that companies with strong sustainability practices significantly outperformed their peers over the long term in both stock market and accounting performance. Several studies suggest that ESG investing can lead to superior financial performance. For instance, Garvey et al. (2018) and In et al. (2019) found that green stocks often outperform their brown counterparts. Similarly, Cheema-Fox et al. (2021) demonstrated that companies with strong sustainability practices significantly outperform their peers over the long term in both stock market and accounting performance. Further evidence by Giese et al. (2021), Huij et al. (2021), and Ardia et al. (2022) supports the notion of green outperformance. Recent studies by Bauer et al. (2022), Pastor et al. (2022), Zhang (2023), and Berg et al. (2023) also align with these findings, indicating positive financial returns for ESG-focused investments.

However, some research, such as that by Alessi et al. (2020) and Bolton and Kacperczyk (2021, 2023), found that ESG investing does not significantly affect financial returns, and in some cases, it may even result in underperformance. Hsu et al. (2023) observed that avoiding "sin stocks" could negatively impact returns, as these stocks often outperform the market. Additionally, studies by Görgen et al. (2020), Pedersen et al. (2021), Aswani et al. (2024), and Alves et al. (2023) found no significant difference in the performance of ESG versus non-ESG investments. This inconsistency in findings highlights the necessity for standardized ESG metrics and reporting frameworks to improve the reliability and comparability of ESG data, as emphasized by Dorfleitner et al. (2015) and Chatterji et al. (2016). The demand for ESG investments is growing, driven by greater awareness of environmental and social issues, especially among younger generations like Millennials and Gen Z, who show a strong preference for sustainable investments, influencing market trends and corporate behaviors (Bollen, 2007; Riedl and Smeets, 2017). Despite the growing interest, skepticism remains among some investors regarding the financial merits of ESG investing, leading to a mixed reception in the market (Nilsson, 2008; Barber et al., 2021). This variability in ESG ratings raises important questions about the necessity and complexity of current scoring systems used to measure a firm's sustainability, prompting discussions on whether simpler, more straightforward approaches could effectively gauge a company's environmental responsibility.

Moreover, a few studies highlight potential drawbacks, suggesting that ESG-focused funds may underperform traditional funds. For example, Hong and Kacperczyk (2009) found that "sin stocks" (companies involved in activities like tobacco, alcohol, and gambling) often outperform the market, indicating that avoiding such stocks might negatively impact returns. Another study by Richey (2020) suggested that ESG investing might lead to lower returns due to the exclusion of high-performing but socially controversial industries.

Further reinforcing this perspective, Cakici and Zaremba (2022) conducted a comprehensive analysis on the impact of ESG ratings on stock returns across 49 countries. Their findings indicated that high ESG-rated stocks generally underperformed low ESG-rated stocks, especially in emerging markets. The study revealed a negative average monthly return for high ESG-rated stocks, pointing to a potential underperformance issue. Additionally, the Kenan Institute (2022) provided an analysis suggesting that while ESG investments may offer lower risk and align better with ethical values, they often result in lower returns. This aligns with broader evidence indicating that portfolios excluding low ESG-scoring firms tend to achieve higher returns, as highlighted by other studies focusing on the performance of excluded stocks. Overall, these findings suggest that while ESG investments can contribute to ethical and sustainable practices, they may not always deliver superior financial performance. Instead, in some cases, they may underperform compared to traditional investments, particularly when high-performing but controversial industries are excluded from the investment portfolio.

In terms of risk management, ESG investing is often associated with lower financial risk and better risk-adjusted returns. Research by Eccles et al. (2014) shows that high sustainability companies significantly outperform their counterparts over the long term in both stock market and accounting performance. Similarly, a study by Albuquerque et al. (2019) found that firms with high ESG scores have lower systemic risk and are more resilient during economic downturns. However, some studies argue that the evidence for risk reduction is not conclusive. For instance, Nofsinger and Varma (2014) found that socially responsible funds do not perform significantly better than conventional funds during market crises. Furthermore, a study by Gibson et al. (2021)

suggested that while ESG integration might reduce some specific risks, it does not necessarily lead to overall lower portfolio risk. One of the major challenges in ESG research is the inconsistency in ESG ratings across different agencies. The lack of standardized metrics and reporting frameworks hampers the ability to compare ESG performance effectively. This inconsistency can lead to contradictory findings and make it difficult for investors to make informed decisions. Studies by Dorfleitner et al. (2015) and Chatterji et al. (2016) emphasize the need for standardized ESG reporting to improve the reliability and comparability of ESG data.

There is increasing demand for ESG investments, driven by greater awareness of environmental and social issues. Younger generations, particularly Millennials and Gen Z, show a strong preference for sustainable investments, which influences market trends and corporate behaviors. Research by Bollen (2007) and Riedl and Smeets (2017) indicates that investors are willing to accept lower financial returns in exchange for social and environmental benefits. Despite the growing interest, some investors remain skeptical about the financial merits of ESG investing, leading to a mixed reception in the market. Studies by Nilsson (2008) and Barber et al. (2021) highlight that while some investors are motivated by ethical considerations, others prioritize financial returns and remain cautious about ESG investments.

3. DATA AND METHODOLOGY

The variability in ESG ratings raises significant questions about the necessity and complexity of the current scoring systems used to measure a firm's sustainability. This inconsistency stems from the different methodologies, criteria, and weightings employed by various rating agencies. Such inconsistencies make it challenging for investors to make informed decisions and for companies to understand how to improve their ESG performance effectively. Given these challenges, it is worth considering whether a simpler, more straightforward approach could be used to evaluate a company's "greenness." Focusing on a single, clear aspect of a firm's actions, such as its carbon footprint, water usage, or renewable energy adoption, could provide a more accessible and easily comparable measure of environmental responsibility. This approach could reduce the complexity and improve the transparency of ESG evaluations, making it easier for stakeholders to assess and compare the sustainability performance of different companies.

For instance, a simplified metric focusing on a firm's carbon emissions could serve as a proxy for its environmental impact. Companies could be ranked or categorized based on their carbon intensity, providing a clear and direct indicator of their efforts to reduce greenhouse gas emissions. Such a metric would be relatively easy to understand and track, both for investors looking to make environmentally conscious investment decisions and for companies aiming to demonstrate their commitment to sustainability.

Furthermore, a more straightforward approach could help standardize ESG reporting and reduce the burden on companies to comply with multiple, often conflicting, rating systems. By focusing on a few key indicators, it would be possible to create a more harmonized and coherent framework for assessing corporate sustainability. This could lead to greater consistency and reliability in ESG ratings, ultimately benefiting all stakeholders involved. Therefore, could focusing on a single, clear aspect of a firm's actions be sufficient to determine whether it belongs on a "good" or "bad" list in terms of sustainability? Such an approach could serve as a proxy to gauge a firm's environmental responsibility more easily.

The website InvestYourValue.org measures public companies using various pillars, such as exposure to fossil fuel and deforestation. InvestYourValue.org is a project by "As You Sow," a 501(c)3 nonprofit empowering shareholders to change corporations for good. "As You Sow" is founded in 1992 and promotes corporate responsibility through shareholder advocacy, coalition building, and legal strategies. Their mission is to drive companies toward environmentally and socially responsible practices by engaging directly with corporate executives and institutional investors, filing shareholder resolutions, and leading dialogues. The organization focuses on areas such as climate change, environmental health, executive compensation, and social justice, and publishes reports and tools to help investors align their portfolios with their values.

InvestYourValue.org provides tools to evaluate the sustainability of retirement plans, mutual funds, and ETFs based on various ESG criteria. The website offers sustainability scorecards for retirement plans offered by major publicly-traded companies, rating them on issues like fossil fuels, deforestation, gender equality, gun-free investments, prison-free investments, and tobacco-free investments. The goal is to help employees understand how their retirement savings are being invested and to encourage more sustainable investment options within these plans. For example, "Invest Your Values" analyzes the holdings of mutual funds to determine their exposure to fossil fuels, deforestation-risk companies, and other social and environmental risks. It provides a detailed breakdown of how different funds and retirement plans measure up against these sustainability criteria, helping investors make more informed decisions aligned with their values. By using data from various research organizations and non-profit advocacy groups, "Invest Your Values" aims to increase transparency and promote sustainability in investment practices. You can explore more about their methodology and specific company ratings on their website Invest Your Values.

This study focuses on the score card provided by the website where public companies are rated by either a yes or no in certain sustainable categories, such as fossil fuel exposure or deforestation. Using the data on fossil fuel exposure, I selected all firms in the S&P 500 with zero exposure to fossil fuel to measure their performance, compared to those S&P 500 companies that are with exposure to fossil fuel. By narrowing the scope to tangible actions, such as the exclusion of fossil fuel exposure, we can potentially gain clearer insights into the performance and sustainability of these firms. To illustrate this analysis, I focus on the stocks within the S&P 500 index. Stock prices and firm financial information are collected from Yahoo Finance. Firstly, from the company's screening spreadsheet provided by "Invest Your Value," I selected

stocks that are part of the S&P 500 index, focusing exclusively on those categorized as "Fossil Fuel Free." This subset of stocks was then analyzed to determine their monthly returns. These returns were compared against the returns of the remaining stocks within the S&P 500 index that do not fall under the "Fossil Fuel Free" category. Additionally, the differences between these two groups of stocks were examined.

To provide a comprehensive analysis, accumulated returns and Sharpe ratios were calculated. The Sharpe ratio, which measures risk-adjusted returns, is particularly useful in this context to compare the performance of fossil fuel-free stocks against their counterparts. Furthermore, I applied the Fama-French three-factor model (Fama and French, 1992) to estimate the excess return, referred to as alpha, after adjusting for specific risk factors. These risk factors include Market (the overall market return), Value versus Growth (comparing value stocks to growth stocks), and Small versus Large (comparing small-cap stocks to large-cap stocks). This model helps in isolating the performance attributable to these risk factors and provides a clearer picture of the true performance of the fossil fuel-free stocks.

Lastly, to examine how being green (fossil fuel free) influence stock return, I carried out cross-sectional stock analysis prosed by Fama and Macbeth (1973). Its primary aim is to determine whether exposure to fossil fuel (single factor in ESG) is a significant predictor of stock returns, assessing whether companies perform better or worse than those that are less green. This regression helps isolate the effect of single environmental factor from other traditional risk factors like market risk, size, and value. By including one ESG factor alongside other factors, the Fama-MacBeth regression can evaluate whether this single factor provide additional explanatory power for variations in stock returns after adjusting for risk, thus helping to understand the risk-adjusted performance of the investments. Additionally, the methodology examines how the influence of a single environmental factor on stock returns varies over time, providing insights into the stability and consistency of the predicting power of returns. Furthermore, it helps identify whether these scores act as systematic risk factors affecting stock returns, which is crucial for portfolio managers who aim to incorporate ESG factors into their investment strategies while managing risk.

The findings from this analysis are remarkably consistent: stocks that are fossil fuel-free significantly outperform those that are not. This outperformance is evident in both the raw returns and the risk-adjusted returns, suggesting that excluding fossil fuel investments can lead to superior financial performance within the S&P 500 index.

For simplicity, I will refer to the stocks categorized as "Fossil Fuel Free" as green stocks and the rest as brown stocks. In this analysis, a total of 491 stocks from the S&P 500 index had sufficient price data available to calculate the 60-month return, spanning from April 2019 to April 2024. Among these, 370 stocks were identified as green, and 121 stocks were classified as brown.

To comprehensively analyze the performance of these stocks, I constructed both market value-weighted portfolios and equal-weighted portfolios for both green and brown stocks. The market value-weighted portfolios were designed to reflect the performance of the stocks based on their market capitalization, giving more weight to larger companies. In contrast, the equal-weighted portfolios assigned an identical weight to each stock, regardless of its market size, ensuring that each stock contributed equally to the portfolio's performance. The data for the monthly Fama-French three factors, the market return, and the risk-free interest rate were obtained from the online library[2] maintained by the original authors. These three factors include the Market Risk Premium (MRP), which is the excess return of the market portfolio over the risk-free rate; Small Minus Big (SMB), which is the return differential between small-cap and large-cap stocks; and High Minus Low (HML), which is the return differential between value stocks (high book-to-market ratio) and growth stocks (low book-to-market ratio).

These factors were instrumental in evaluating the performance of the portfolios through the Fama-French three-factor model, which adjusts for various risk factors and provides a clearer understanding of the true performance of the green and brown stock portfolios. The market return represents the overall performance of the market, while the risk-free interest rate serves as a benchmark for measuring the performance of riskier investments against a theoretically risk-free asset.

4. RESULTS

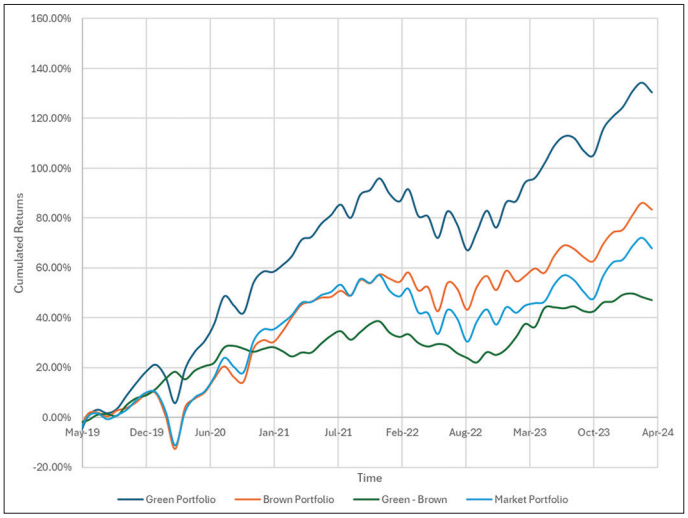
Figure 1 illustrates the cumulative returns over the 60-month period for four different market value weighted portfolios: Green stocks, brown stocks, a long-short strategy involving green stocks minus Brown stocks, and the market return. This figure provides a visual comparison of the performance of environmentally conscious investments against traditional investments and the broader market index. The long-short strategy, in particular, highlights the relative performance of green stocks versus brown stocks, showcasing the potential benefits of a portfolio that favors sustainable investments.

The Green Portfolio, represented by the dark blue line, consists of stocks from companies classified as environmentally sustainable, specifically those with zero fossil fuel exposure. Over the observed period, this portfolio shows the highest cumulative returns, peaking at approximately 140%, indicating that investments in environmentally sustainable companies have significantly outperformed others. In contrast, the Brown Portfolio, depicted by the orange line, includes stocks from companies that do not meet the green criteria and likely have fossil fuel involvement. This portfolio also exhibits positive growth but lags behind the Green Portfolio, ending with cumulative returns slightly above 80%.

The Green minus Brown portfolio, represented by the green line, employs a long-short strategy, taking long positions in green stocks and short positions in brown stocks. Its performance is notably lower than the individual Green and Brown portfolios, remaining

2 The factors data is available on https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Figure 1: Portfolio performances



mostly flat and underperforming the market. This suggests that the difference in returns between green and brown stocks is not substantial enough to make a long-short strategy significantly profitable. Finally, the Market Portfolio, shown by the light blue line, serves as a benchmark representing the overall market performance. This portfolio's cumulative returns are just under the Green Portfolio but above the Brown Portfolio, suggesting that while general market investments are profitable, targeting specific ESG criteria can potentially yield higher returns.

Overall, the graph supports the notion that single factor ESG-focused investing, particularly in green companies, can lead to superior financial returns. However, it also indicates that the performance difference between green and brown stocks may not be large enough to make a long-short strategy particularly effective. This analysis underscores the financial benefits of integrating ESG criteria into investment strategies and highlights the potential for higher returns through sustainable investing.

Table 1 displays the average monthly return, standard deviation and monthly Sharpe ratio for the four portfolios: Green, Brown, Green minus Brown and Market. The Green portfolio has the highest average return at 2.17%, followed by the Market portfolio at 1.13%, and the Brown portfolio at 1.39%. The difference between the Green and Brown portfolios is 0.79%, indicating that the Green portfolio outperforms the Brown portfolio by this margin. Standard deviation measures the volatility of returns. The Green portfolio has a standard deviation of 6.04%, slightly higher than the Brown portfolio's 5.50% and the Market's 5.53%. The Green - Brown difference in standard deviation is 2.56%, showing that while the Green portfolio has higher returns, it also comes with greater volatility. The Sharpe ratio indicates risk-adjusted return. The Green portfolio has the highest Sharpe ratio at 0.33, indicating it offers the best return per unit of risk among the three portfolios. The Brown portfolio's Sharpe ratio is 0.22, and the Market portfolio's is 0.18. The Green - Brown Sharpe ratio is 0.24, suggesting that even when adjusted for risk, the Green portfolio performs better than the Brown.

Next, I use the popular Fama-French three factor model to estimate the abnormal returns after adjusting for various risk factors. The

Table 1: Risk and return of the market value weighted portfolios

Portfolio	Green	Brown	Green - brown	Market
Average return (%)	2.17	1.39	0.79	1.13
SD (%)	6.04	5.50	2.56	5.53
Sharpe ratio	0.33	0.22	0.24	0.18
Annualized sharpe ratio	1.15	0.77	0.84	0.61

SD: Standard deviation

Fama-French three factor model is used to describe stock returns through three factors:

Market Risk Premium (Rm - Rf): The excess return of the market portfolio over the risk-free rate.

SMB (Small Minus Big): The size factor, which represents the excess return of small-cap stocks over large-cap stocks.

HML (High Minus Low): The value factor, which represents the excess return of high book-to-market ratio stocks over low book-to-market ratio stocks.

The model can be represented as:

$$R_i - R_f = \alpha + \beta (R_m - R_f) + s(SMB) + h(HML) + \varepsilon$$

Where:
R_i is the return of the stock or portfolio.
R_f is the risk-free rate.
α is the abnormal return (intercept).
β is the sensitivity to the market risk premium.
s is the sensitivity to SMB.
h is the sensitivity to HML.
ϵ is the error term.

Table 2 shows the results from the Fama-French three factor model, focusing on Alpha, Beta, Size, and Value factors, along with their t-statistics. Green portfolio exhibits a significantly higher abnormal monthly return (Alpha) of 0.9111% compared to 0.2525% for Brown portfolio, with a marginally significant difference of 0.4969% (t-Stat of 1.9424). The Green portfolio also shows a slightly higher market risk exposure (Beta) of 1.0960 versus 0.9745 for the Brown portfolio, with a significant difference of 0.1211. Both groups have negative Size factors, indicating a preference for smaller firms, but the difference is not significant. Green portfolio is more growth-oriented with a negative Value factor of −0.1847, while Brown portfolio is more value-oriented with a positive Value factor of 0.1624, and the difference of −0.3436 is highly significant. This highlights that the green portfolio outperforms the Brown portfolio in abnormal returns, has slightly higher market risk, and is more growth oriented.

Next, I repeat the test with equally weighted portfolios instead of market value weighted portfolios. Figure 2 illustrates the cumulative returns of equally weighted portfolios from May 2019 to April 2024, including the Green Portfolio, Brown Portfolio, Green - Brown Portfolio, and Market Portfolio. Throughout the observed period, both the Green Portfolio and the Market Portfolio

exhibit robust positive performance, ending with cumulative returns of approximately 70-80%. The Brown Portfolio, while also showing positive returns, trails slightly behind, achieving around 60% by April 2024. The Green - Brown Portfolio, representing the differential performance between the Green and Brown portfolios, remains relatively flat, indicating minimal consistent outperformance of Green companies over Brown ones in this equally weighted context. Notably, all portfolios experienced a significant drop around June 2020, likely due to market-wide impacts, but recovered subsequently with the Green and Market Portfolios maintaining a steady upward trajectory, slightly outperforming the Brown Portfolio. This graph underscores that while both Green and Market Portfolios perform similarly well, the Brown Portfolio lags somewhat, and the differential performance of Green over Brown companies is not pronounced in the context of equally weighted portfolios.

Table 3 displays the average monthly return, standard deviation and month Sharpe ratio for the four portfolios: Green, Brown, Green minus Brown and Market. From Table 3 it is clear that the equal weighted Green portfolio no longer outperforms the equal weighted Brown portfolio. However, they still both outperform

Figure 2: Performace of equally weight portfolios

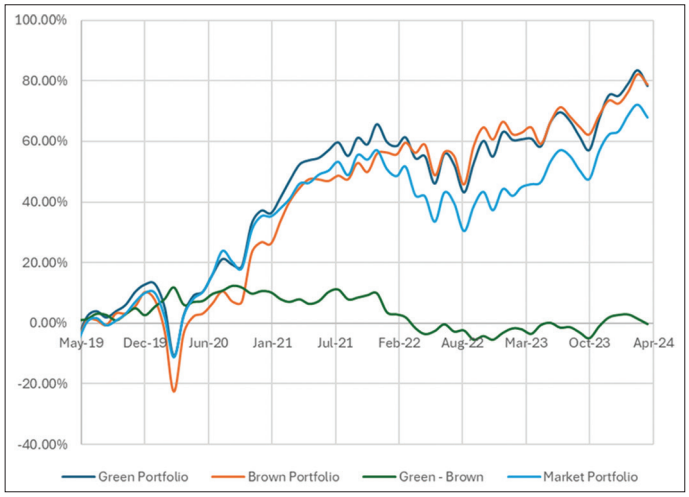


Table 2: Fama-French three factor regression for market value weighted portfolios

Portfolio	Alpha	Beta	Size	Value
Green	0.9111	1.0960	−0.1851	−0.1847
t-statistic	5.9833	38.3411	−3.4465	−5.8035
Brown	0.2525	0.9745	−0.1144	0.1624
t-statistic	1.6441	33.7960	−2.1117	5.0599
Green - brown	0.4969	0.1211	−0.0601	−0.3436
t-statistic	1.9424	2.5213	−0.6666	−6.4269

Table 3: Risk and return of the equal value weighted portfolios

Portfolio	Green	Brown	Green - brown	Market
Average return	1.30%	1.31%	−0.01%	1.13%
SD	5.88%	6.21%	2.13%	5.53%
Sharpe ratio	0.19	0.18	−0.08	0.18
Annualized sharpe ratio	0.67	0.64	−0.28	0.61

SD: Standard deviation

the market. The table provides a comparative analysis of the performance metrics for four different portfolios: Green, Brown, Green minus Brown, and Market. The Green portfolio consists of environmentally sustainable stocks, the Brown portfolio includes stocks not meeting green criteria, the Green - Brown portfolio represents a long-short strategy between the two, and the Market portfolio serves as a benchmark representing the overall market performance.

The average return for the Green portfolio is 1.30%, slightly lower than the 1.31% return for the Brown portfolio, indicating almost equal monthly performance between environmentally sustainable and non-sustainable investments. However, the Green - Brown portfolio shows a negative average return of −0.01%, suggesting that the long-short strategy did not yield positive returns. The Market portfolio has an average return of 1.13%, lower than both the Green and Brown portfolios. In terms of risk, measured by standard deviation, the Green portfolio has a standard deviation of 5.88%, indicating moderate volatility. The Brown portfolio is slightly more volatile with a standard deviation of 6.21%. The Green - Brown portfolio has a much lower standard deviation of 2.13%, reflecting less risk due to the offsetting positions in the long-short strategy. The Market portfolio's standard deviation is 5.53%, showing it is slightly less volatile than the Green portfolio. The Sharpe Ratio, which measures risk-adjusted returns, is 0.19 for the Green portfolio and 0.18 for the Brown portfolio, indicating that the Green portfolio offers slightly better returns per unit of risk. The Green - Brown portfolio has a negative Sharpe Ratio of −0.08, indicating that the strategy did not adequately compensate for the risk taken. The Market portfolio has a Sharpe Ratio of 0.18, similar to the Brown portfolio. Finally, the annualized Sharpe Ratio further underscores these findings. The Green portfolio has an annualized Sharpe Ratio of 0.67, while the Brown portfolio has 0.64. The Green - Brown portfolio's annualized Sharpe Ratio is −0.28, reflecting its poor risk-adjusted performance. The Market portfolio has an annualized Sharpe Ratio of 0.61, slightly lower than the Green and Brown portfolios. This analysis suggests that while both Green and Brown portfolios perform similarly in terms of raw returns and risk-adjusted returns, the Green portfolio slightly edges out in terms of providing better returns relative to the risk taken. The Green - Brown strategy, however, is not effective, and the Market portfolio performs moderately well in comparison.

Next, the equal weighted portfolios are examined using the Fama-French three factor model. The results are shown in Table 4.

As is shown in Table 4, the outperformance of the equally weighted Green portfolio disappears compared to the market value weighted portfolios. The table compares the Green and Brown portfolios using the Fama-French 3 factor model, showing their Alpha, Beta, Size, and Value factors along with t-statistics. The Green portfolio has an Alpha of 0.1645 (t-stat 1.1085), indicating a positive but not significant abnormal return, while the Brown portfolio's Alpha is slightly higher at 0.1748 (t-stat 2.0533) and statistically significant. Both portfolios have similar market risk exposures, with Betas of 1.0167 (t-stat 36.4976) for Green and 0.9940 (t-stat 1.3933) for Brown, with no significant difference between them (0.0224, t-stat 0.5342). The Green portfolio leans slightly towards small-

Table 4: Fama-French three factor regression for market value weighted portfolios

Portfolio	Alpha	Beta	Size	Value
Green	0.1645	1.0167	0.0545	0.1731
t-statistic	1.1085	36.4976	1.0413	5.5796
Brown	0.1748	0.9940	−0.0065	0.4570
t-statistic	2.0533	1.3933	24.9780	0.5052
Green - brown	−0.1720	0.0224	0.0716	−0.2804
t-statistic	−0.7708	0.5342	0.9093	−6.0116

cap stocks (Size 0.0545, t-stat 1.0413) compared to the Brown portfolio's slight large-cap tilt (Size −0.0065, t-stat 24.9780), but this difference is not significant (0.0716, t-stat 0.9093). In terms of value orientation, the Green portfolio has a significant tilt towards value stocks (Value 0.1731, t-stat 5.5796), but less so than the Brown portfolio (Value 0.4570, t-stat 0.5052), with the difference being highly significant (−0.2804, t-stat −6.0116).

The observation that market value weighted portfolios (Green) outperform Brown stocks in the S&P 500, while equally weighted portfolios do not show the same outperformance, can be explained by several factors. First, in market value weighted portfolios, larger companies have a greater influence on the overall portfolio performance. Many large, well-established companies in the Green portfolio might have better access to capital, advanced technologies, and efficient operations, contributing significantly to the portfolio's overall returns. These large Green companies can drive the outperformance observed in the market value weighted portfolio. Conversely, in equally weighted portfolios, smaller companies are given the same weight as larger ones, diluting the impact of the large, high-performing Green companies and leading to more average returns. Second, larger Green companies are often industry leaders and innovators in sustainability and renewable energy. Their leadership positions allow them to capitalize on new market opportunities, benefit from economies of scale, and maintain competitive advantages. These factors can lead to higher returns that disproportionately benefit market value weighted portfolios. In equally weighted portfolios, the performance benefits of these leaders are less pronounced because smaller and possibly less innovative Green companies have the same weight. Third, large Green companies may have more resources to invest in sustainable practices and technologies, leading to greater efficiencies and long-term profitability. These investments can result in higher returns that are reflected more strongly in market value weighted portfolios. In equally weighted portfolios, smaller companies that may not have the same level of resources or efficiency gains dilute the overall performance. Fourth, larger Green companies may be more recognized and trusted by investors, leading to higher market valuations and stronger performance. Investor confidence in these companies can drive up their stock prices, contributing to the outperformance of market value weighted portfolios. Equally weighted portfolios, which include smaller, less recognized companies, may not benefit as much from this investor confidence.

Additionally, market value weighted portfolios tend to have a built-in risk diversification mechanism, as larger, more established companies often have more stable and diversified revenue streams. This stability can lead to more consistent returns. Equally weighted portfolios might include smaller companies with higher volatility and less predictable performance, reducing overall returns. Lastly, market trends favoring sustainability and environmental responsibility might drive more capital towards larger green companies, enhancing their market performance. This capital inflow can create a positive feedback loop, further boosting the returns of these companies in market value weighted portfolios. Equally weighted portfolios do not capture this dynamic as effectively because the impact is spread across all companies, regardless of size.

Overall, the outperformance of Green stocks in market value weighted portfolios compared to equally weighted portfolios can be attributed to the dominance and influence of large, innovative, and well-resourced Green companies, their ability to attract investor confidence and capital, and the inherent stability and risk diversification they provide. Equally weighted portfolios, by giving equal weight to smaller companies, do not benefit as much from these factors, leading to more average performance.

Lastly, to examine the direct impact of being fossil fuel free on stock returns, we employed Green as an indicator (dummy) variable and conducted a cross-sectional regression as specified in Fama and Macbeth (1973), similar to the setup in Halbritter and Dorfleitner (2015). This approach allows us to investigate how being a fossil fuel-free company impacts excess returns, controlling for other relevant firm characteristics. By incorporating methodologies from prior studies, such as Galema et al. (2008) and Hong and Kacperczyk (2009), we ensure that our model is robust and comprehensive. Following these methodologies, I use the natural logarithm of market capitalization, the book-to-market ratio, and the average return over the last 12 months as control variables. The natural logarithm of market capitalization helps to account for the size effect, as larger firms tend to have different risk and return profiles compared to smaller firms. The book-to-market ratio captures the value effect, indicating whether a firm is valued more by its book value or market value, which can influence its returns. The average return over the last 12 months provides a momentum measure, reflecting the past performance of the firm's stock.

$$R_{i,t}-R_{f,t}=\gamma_{0,t}+\gamma_{1,t}\beta_{i,t}+X_{i,t-1}\,\gamma_{X,t}+Green_{i,t-1}\gamma_{Green,t}+u_{i,t}$$

Where $R_{i,t}-R_{f,t}$ is the excess return (risk premium) of company i over the risk-free rate. $X_{i,t-1}$ is the lagged control variable matrix including market capitalization, book to market ratio and the average return in the past 12 months. $Green_{i,t-1}$ is the binary (dummy) variable where equals one if the company is fossil fuel free.

By using this regression model, I can examine whether fossil fuel-free companies exhibit different excess returns compared to other firms, after controlling for key firm characteristics. This analysis helps us understand the financial implications of being environmentally sustainable and provides insights into whether investors value fossil fuel-free companies differently.

The results are displayed in Table 5.

The Beta coefficient (0.0671) with a t-stat of 2.5231 indicates a significant positive relationship with excess return. The size factor

Table 5: Fama-MacBeth regressions

Factors	Excess return
Beta	0.0671
t-statistic	2.5231
ln (size)	−0.0428
t-statistic	−6.7350
Ln (BM)	0.2953
t-statistic	2.4124
MOM	0.0542
t-statistic	1.6673
Green	0.0551
t-statistic	6.6231

with a coefficient of −0.0428 and a t-stat of −6.7350, shows a significant negative impact, suggesting larger firms yield lower excess returns. The Book-to-Market ratio has a coefficient of 0.2953 and a t-stat of 2.4124, implying a significant positive effect. The Momentum factor with a coefficient of 0.0542 and a t-stat of 1.6673 is positive but less significant. Lastly, the variable "Green," which represents an ESG factor specifically focusing on fossil fuel exposure, has a regression coefficient of 0.0551 and a t-statistic of 6.6231. This positive coefficient indicates that firms classified as "Green" (i.e., those with zero fossil fuel exposure) tend to have an excess return that is 0.0551 units higher compared to their non-Green counterparts. The t-statistic of 6.6231, suggests that this positive impact on excess return is highly significant. This finding underscores the potential financial benefits of excluding fossil fuel investments from portfolios, highlighting that environmentally sustainable practices can lead to superior financial performance. The high significance level also adds robustness to the conclusion that ESG factors, particularly those related to fossil fuel exclusion, play a critical role in driving positive excess returns.

5. CONCLUSION

The analysis of S&P 500 firms with zero fossil fuel exposure—termed "Green" stocks—reveals that these firms can indeed outperform their "Brown" counterparts, particularly when evaluated through market value-weighted portfolios by using only a single metric of the of the ESG pillars. This outperformance is evident in both raw and risk-adjusted returns, suggesting that integrating one single ESG criteria, in this case fossil fuel exclusion, can lead to superior financial performance. This shed light on the focus on ESG investing, or rather is less more? Should we focus on one or a few crucial environmental aspects instead of relying on a complicated scoring system when considering ESG investing? This study shows that with this particular pillar, fossil fuel exposure, it works for large stocks for the past 5 years.

Furthermroe, the study also noted that equally weighted portfolios did not demonstrate the same level of outperformance compared to market value weighted portfolios. This discrepancy points to the significant role that larger, well-established firms play in driving the overall performance of ESG portfolios. Moreover, the application of the Fama-French model reveals that "Green" portfolios exhibit higher abnormal returns and distinct risk profiles, further validating the financial merits of ESG investing.

Despite these promising results, the study acknowledges the ongoing challenges in ESG research, particularly regarding data quality and standardization. The significant discrepancies in ESG ratings across different agencies complicate the evaluation process and highlight the need for standardized reporting frameworks. Addressing these challenges is crucial for enabling more accurate and comparable assessments of ESG performance.

In conclusion, while ESG investing presents its share of complexities and inconsistencies, this study provides robust evidence that sustainable investment strategies—specifically those excluding fossil fuels—can yield favorable financial outcomes. As investor interest in ESG continues to grow, it is imperative to refine data quality and standardization efforts to fully harness the potential of sustainable investing, ultimately aligning financial performance with broader societal and environmental goals.

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