Senior Thesis Description

A Preliminary Study of European ETFs and Mutual Funds

Scott Burstein

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Acronyms

ESG Environmental, Social, Governance
SRI Socially Responsible Investing
CSR Corporate Social Responsibility
ETF Exchange Traded Fund
ROE Return on Equity
IQR Interquartile Range

Introduction

Investors who seek funds with high ESG/SRI ratings can consider sustainability and CSR in many different ways. One of the most common frameworks is profit-driven, and is predicated on the notion that investments with high ESG and SRI ratings will outperform the market as a result of their commitment to ESG values. Another approach factors in ESG performance as a side-effect of the investment, and these investors are willing to yield lower returns as a consequence of their holdings' higher ethical standards and reduced impact on the environment. Recent influxes of millennial and first-time investors signal a shift in traditional market dynamics, and it is important to understand how these trends may impact market sentiment towards ESG/SRI themed investments.

Hypothesis Development

For my thesis, I will first assess whether more sustainable funds yield higher, equal, or lower returns than less sustainable funds. There are many different ways to evaluate this relationship, and a significant portion of my future research will be dedicated to determining the most accurate predictors of an investment's long-term sustainability, fund performance, and potential confounding factors.

Then, I hope to study other markers for an investment's ESG performance, and draw meaningful connections between these sustainability metrics and traditional financial profit/risk indicators. In the process, I will develop reproducible analysis methods in R, increase my understanding of the financial markets, and explore some of the nuanced ways sustainability data is used to make investment decisions.

I recognize that my thesis will need to become more refined as my research continues. Ultimately, I hope that it will lead to actionable steps that portfolio managers and investors can take to make their holdings more climate-friendly and also more profitable.

Potential research questions that I am interested in exploring further include:

Is seeking a causal relationship between ESG and profit wrong? If so, should ESG be considered through an entirely different/new lens?

Will the risks which ESG quantifies become more important in the coming years? If so, is it necessary to develop a more structured relationship between ESG and investment volatility?

Are highly rated ESG/SRI investments currently overvalued as a result of the recent increase in climate-conscious and socially responsible investors? If so, is it best to short ESG/SRI funds?

Are the financial returns on investments and traditional sustainability metrics inversely correlated? If so, are there better ways to invest in the planet such as through industry-specific or thematic funds?

How do ESG/SRI themed funds differ in their construction from other funds?

Developing insights that answer one or multiple of these questions would also contribute to the growing body of literature focused on sustainable investing strategies and serve as a benchmark for future research.

Existing Hypotheses about SRI Returns

Previous research has been focused on the relationship between CSR and investment performance. It is necessary to describe the three potential relationships that exist between an investment's sustainability and financial performance.

Negative Relationship between Sustainability and Financial Performance Milton Friedman was one of the first to argue that a business's social responsibility was to increase profits, and that it is not possible to achieve both profit maximization and direct SRI (Friedman, 1970). This relationship would expect a negative relationship between sustainability and fund performance.

No Relationship between Sustainability and Financial Performance It is also possible that there is a neutral association between CSR and investment performance. Many factors related to a company's CSR initiatives can increase both costs and benefits. Supporters of this relationship point to the complexity of the relationship between CSR and financial performance as indication that strong correlations can be attributed to confounding variables and insufficient data (Ullmann, 1985).

Positive Relationship between Sustainability and Financial Performance The final plausible relationship is that there is a positive association between CSR and investment returns This is driven by the notion that companies with good CSR performance are managed well and have mitigated future ESG risks. This would lead to higher expected returns (Pokorna, 2017).

Data

The data sets contain observations for 9,495 European ETFs and 57,603 European Mutual Funds with 132 variables pertaining to:

General Aspects: portfolio style, total net assets, management company, and size
Portfolio Indicators: cash, stocks, bonds, and sector breakdown
Returns: year to date from 2011 through 2020
Financial Ratios: price/earning, Traynor/Sharpe ratios, alpha, and beta

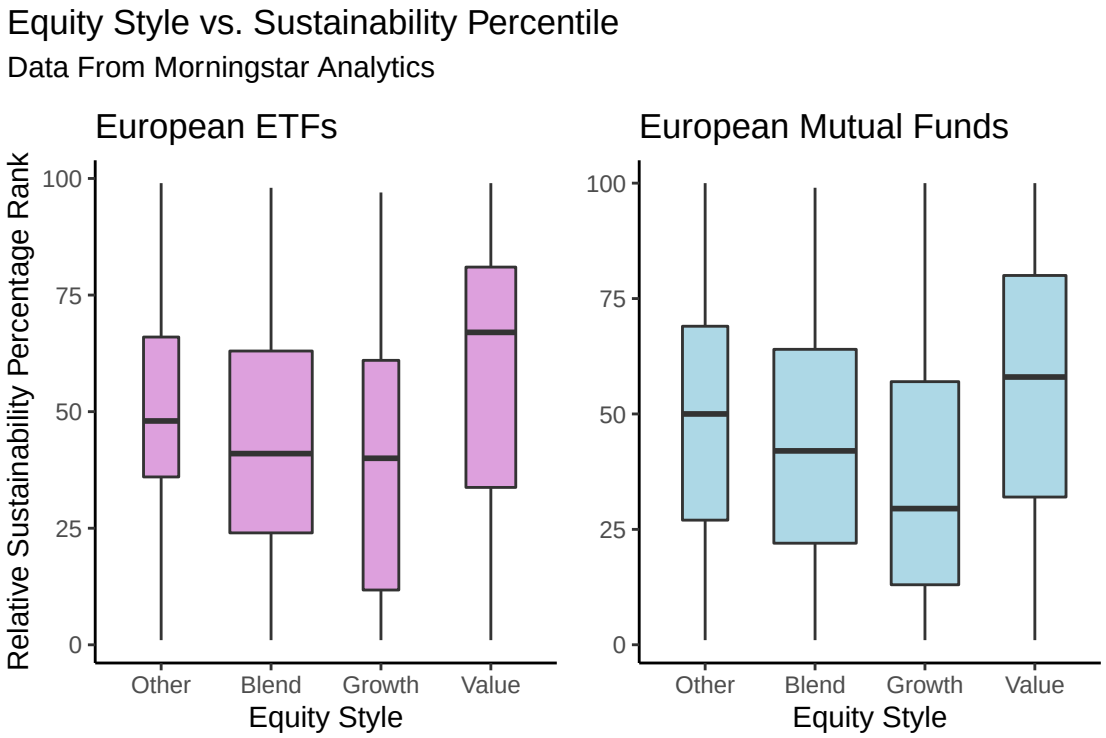
Additional data in terms of sustainability is also available, such as:

Involvement: with controversial commodities, energy sources, and "sin" activities
ESG Scores: aggregate as well as individual environmental, governance, and social scores
Sustainability Rank: relative rank by sector is included for each fund

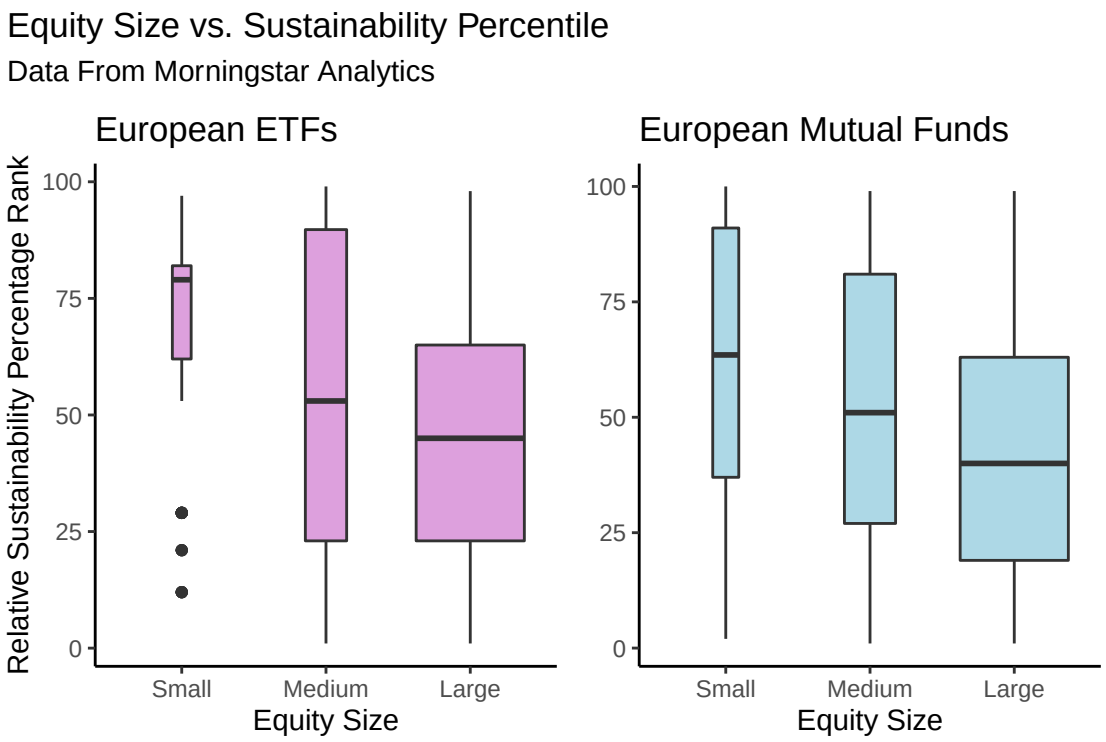
Acknowledgements

Data was scraped by *Stefano Leone* from the publicly available Morningstar website.

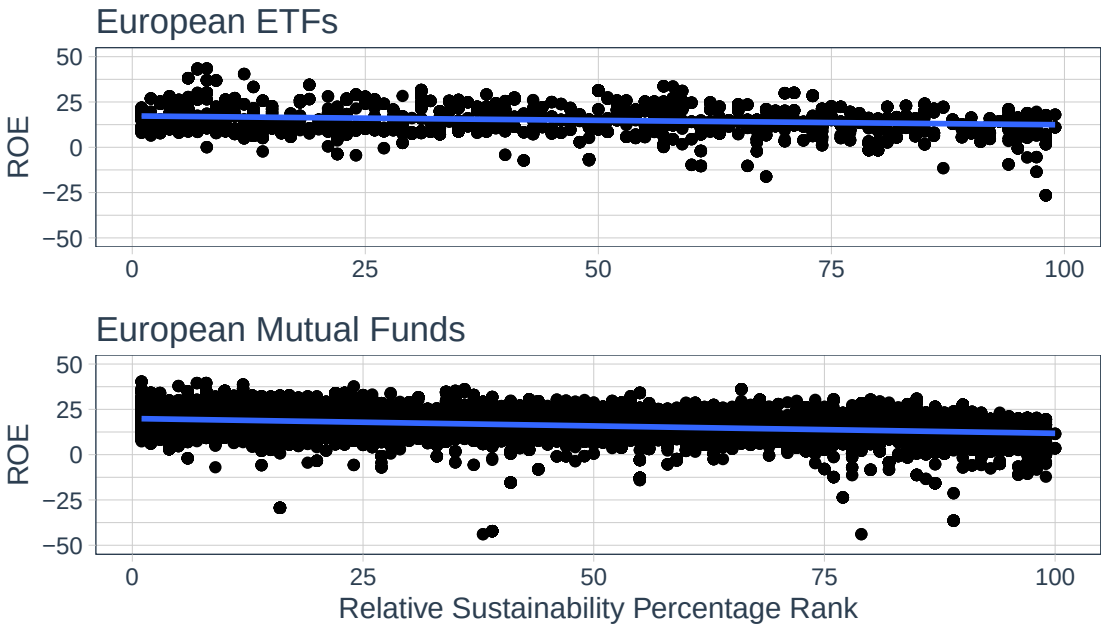
Visual Exploration



Looking at the equity style vs. sustainability percentile box plots, it is evident that both ETFs and Mutual Funds exhibit similar trends, where value funds have higher percentile sustainability rankings on average than blend and growth style funds. Value ETFs have a median sustainability percentage rank in the 67th percentile. Compared to value mutual funds, which have a median sustainability percentage rank in the 58th percentile.



Looking at the equity size vs. sustainability percentile box plots, it is evident that both ETFs and Mutual Funds exhibit similar trends, where small size funds have higher percentile sustainability rankings on average than medium and large style funds. Small size ETFs have a median sustainability percentage rank in the 79th percentile. Compared to small size mutual funds, which have a median sustainability percentage rank in the 64th percentile.



Now we will move on to a quantitative analysis of the relationship between an investment's sustainability score and the fund's ROE. It is important to note that while the above visualizations used relative sustainability percentages, which is a percentile rank of the investment's sustainability score relative to other investments, the below models use Morningstar's sustainability 0-100 sustainability rating.

Table 1: Summary Statistics for the Morningstar Sustainability Scores of European ETFs

minimum	q1	median	mean	q3	maximum	na
9.72	21.83	23.22	23.87	25.5	55.91	3039

Table 2: Summary Statistics for the Morningstar Sustainability Scores of European Mutual Funds

minimum	q1	median	mean	q3	maximum	na
8.83	21.93	23.54	24.08	25.51	60.57	23027

The pure sustainability rating was not used in the above visualizations since the IQR of sustainability ratings for ETFs was [21.83, 25.50] and the IQR of sustainability ratings for Mutual Funds was [21.93, 25.51] in the data sets.

Since the funds were tightly clustered together, it was challenging to infer any meaningful visual interpretation of the data, however it is still possible to calculate β_1 in the model described below.

$$\text{ROE} = \beta_0 + \beta_1 \text{ SustainabilityScore} + \epsilon$$

We want to evaluate β_1 in the above statistical model. Our null hypothesis will be that a fund's sustainability rating does not correlate with the fund's ROE.

$$H_o : \beta_1 = 0$$

Our alternative hypothesis will then be that a fund's sustainability rating does correlate with the fund's ROE.

$$H_a : \beta_1 \neq 0$$

This hypothesis test does not seek to establish a causal relationship between a fund's sustainability score and its ROE. Rather, the results should indicate whether or not there is a positive, nonexistent, or negative relationship. This will provide support for a later discussion of the possible mechanisms which correlate an investment's sustainability rating and it's financial performance.

Since the slope (β_1) of our model represents how much a fund's ROE responds to changes in the fund's sustainability score, we will calculate a 95% confidence interval for the slope, and examine whether it excludes 0. If it does, then we can rule out the likelihood that the slope is 0. Thus, we conclude that there is a significant relationship between sustainability score and ROE.

Table 3: Prediction of ROE given Sustainability Rating for ETFs

term	estimate	std.error	statistic	p.value	conf.low	conf.high
(Intercept)	31.106	0.602	51.658	0	29.926	32.287
sustainability_score	-0.682	0.025	-27.330	0	-0.731	-0.633

The 95% confidence interval for the slope (β_1) in the ETF linear regression model is [-0.731, -0.633]. Since the interval excludes 0, we can conclude that there is a statistically significant negative relationship between sustainability score and ROE for ETFs, with a mean slope equal to -0.682 units of $\frac{net\ income\ /\ shareholder\ equity}{sustainability\ score}$.

Table 4: Prediction of ROE given Sustainability Rating for Mutual Funds

term	estimate	std.error	statistic	p.value	conf.low	conf.high
(Intercept)	33.620	0.306	109.831	0	33.020	34.220
sustainability_score	-0.736	0.013	-57.877	0	-0.761	-0.712

The 95% confidence interval for the slope (β_1) in the Mutual Fund linear regression model is [-0.761, -0.712]. Since the interval excludes 0, we can conclude that there is a statistically significant negative relationship between sustainability score and ROE for mutual funds, with a mean slope equal to -0.736 units of $\frac{net\ income\ /\ shareholder\ equity}{sustainability\ score}$.

Conclusion

One obstacle I will face during this research is obtaining pertinent and high quality data. The data sets used in this preliminary analysis was obtained from Kaggle, an online community of data scientists and researchers. In my future work, I will want to focus on the U.S. markets. Most of the ESG data currently available is either cost prohibitive or outdated. I will want to use data from MSCI, Morningstar, or another sustainability analytics firm for the bulk of my analysis, and am optimistic that I will receive funding from

Duke's Nicholas School of the Environment and the Repass-Rodgers Scholar Program I am part of to get access to these data sets.

Regarding the above analysis, perhaps it was unnecessary to consider ETFs and mutual funds as distinct groups. My logic was that these funds may be constructed in distinct ways, and that these differences may contribute to differences in their overall or relative sustainability performance. However, after seeing that both types have very similar distributions of sustainability scores and also overlapping IQRs for the β_1 sustainability score slope coefficient and the β_0 ROE-intercept in the regression models, it could be that they regard (or disregard) ESG related risks in the same way, and thus diversify their funds in similar ways.

It could also be that studying individual stock performance instead of fund performance allows for a more comprehensive understanding of the relationship between ESG/SRI and financial performance, as individual stocks will have a wider distribution of both ESG ratings and financial returns, since there is no investment diversification.

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https://thesis.eur.nl/pub/41396/Pokorna-M.-449106-.pdf

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Vanguard Perspective:
ESG and alpha: A look inside the numbers
https://advisors.vanguard.com/insights/article/esgandalphaalookinsidethenumbers