Does ESG matter more than Tracking Error?*

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Abstract

The surge of interest in socially responsible investment (SRI) over the last decade generates a shift in investors' belief but also new challenges to assess. Both, passive and active investment management step in this new field, integrating extra financial data within investment process. However, this trend opens up a Pandora's box for active portfolio managers. The ESG-related track error induced by the integration non-pecuniary factors within the decision-making process emerges. This paper investigates whether investors may favor securities presenting features in line with fundamental portfolio guidelines, namely better ESG quality and optimal Index tracking. Using US-listed firms of the USA MSCI Index and Refinitiv ESG score from 2013 to 2021, we propose a double sort methodology to assess our assumption. We found that Low ESG-Beta stocks are relinquished by investors in order to answer new constrains and generate higher risk adjusted returns. However, findings do not confirm if this phenomena happens in profit of High-ESG-Beta securities. Our results also involve that this possible phenomena is relatively recent undertaking.

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1 Introduction

Sustainable investing gained a lot of interest over the last decade. Although this new investment theme may be considered as premature, it is undisputable that it cannot be considered as a niche anymore. Starks (2023) illustrated this "increasing broad interest" by showing that, still, even if Low ESG-companies account for a large fraction; conventional mutual fund portfolio managers increased their exposure in higher ESG score firms. Interestingly, while trend is asymmetric between geographic locations, both, US and Europe ESG ETFs' Asset Under Management (AUM) rose significantly. Recent backlash to ESG, especially in the US, raised concerns over the future of the sustainability investment. However, officials at Morningstar argued that ESG "It is more an expression of your own values and preferences", rather a value creation purpose and, as a result, it would not affect its fate. In fact, the investor's preference for the Social Responsible Investment (SRI) represent a non-negligible share of investor (Fama and French, 2007). Indeed, investors consider non-pecuniary criteria within their decision-making process. Literature tried to discern different type of investors having sensitivity to an ESG integration within their investment process but also their respective motivation (Pedersen et al., 2021; Starks, 2023). We conclude that, today, ESG consideration is an integral part of the investment process and would reverberate on the portfolio management aspect, no matter what motivation or kind of investors drive the ESG investing.

Seeing that the sustainability investing expanded at a sustained pace, institutional regulators step into this new field in order to control but also protect investors. Recently, the European Union initiates a transparency framework, namely, Sustainable Finance Disclosure Regulation (SFDR), which sets out mandatory ESG disclosure requirements for asset managers. In parallel, a variety of labels and ratings have emerged with a responsible theme. Their goal is to help investors with their capital allocation decision in certifying and promoting sustainable and responsible investment. However, labels and ratings differ. ESG label review and assess the entire process and standard ESG integration in funds. The rating is an aggregating scoring of all holding hold in a fund based on environmental, social and governance characteristics. Major differences between both is that ESG funds ratings does not certify the ESG integration within the investment process at the opposite of labels. It is worth mentioning that labels it is at the initiative of the portfolio managers, whereas the fund rating it is a unilateral agreement at the initiative only of the rating organization. As a result, we argue that those news rules/ regulations affect significantly the way that how portfolios are managed and their asset allocation. In fact, restriction screening - which investors use to to limit exposure to a certain sector and issuers - rose sharply in recent years. More than 20% of total global assets under management (AUM) now uses at least one restriction screen, a surge from just 2% in 2019.

Furthermore, assets managers experienced a behavioral change from their institutional investor's clients. As a reminder, institutional investors solicits assets managers to meet obligation and achieve long-term financial objective resulting to their Strategic Asset Allocation (SAA) which is based on an asset and liability management (ALM) study. Whatever their motivation (Pedersen et al., 2021; Starks, 2023), institutional investors started to ask for ESG consideration within their delegated investment mandate. Today, a majority of RFPs' (Request for proposal) includes Environmental, Social and Governance section that assets managers would have to consider within its investment guidelines. Recently, the PRI (Principles for Responsible Investment) UN-supported network of investors, provide a guide to asset owners to express their ESG requirements through RFP. Important to note that the institutional clients do provide a benchmark - the Board often carry the responsibility for choice of it - to asset managers which should represent the risk profile of the client resulting to its risk management (Kuijl et al., 2019). In others words, no benchmark, no ALM. We noted that several research papers dealing with sustainability investment omitted to consider the benchmark aspect.

We do think that those new constrains imposed to the global financial markets triggered an oppressive portfolio management pressure for funds managers. Funds managers must combine conventional objectives with sustainability goals. In another words, portfolio managers have to *1)* generate return exceeding the fund's dedicated benchmark, *2)*manage the risk of their active position against the benchmark i.e reducing the tracking error and *3)* improve the ESG quality of the portfolio, causing challenge at the portfolio management level. Significantly, the term "ESG-related track error" emerged. The ESG-related error may be defined as the potential variance in performance that arise when an ESG-focused portfolio is compared against a benchmark which does not incorporate ESG consideration. Interestingly, while most of index provider created index integrating ESG or sustainability thematic, substantial proportion of funds, considering ESG characteristic within their investment process, are still manage against conventional benchmarks, raising the probability to face to the "ESG related track error ".

In this paper, we suggest that, in order to achieve both fundamental and sustainability objectives, fund's managers have to select securities presenting characteristics that fully satisfy those requirements. Thus, investors – consciously or unconsciously – tend to prefer stocks offering features matching all requirements and by extension neglect some. This systematic screening may suggest that an anomaly exist within the financial market.

On the passive investment side, another story may ramp up this possible phenomenon. The Global Sustainable Fund Flow report that passive strategies account for a quarter of ESG funds asset and are the most popular vehicles for green investment. As the demand for passive sustainability product surges, the demand for appropriate index heightened. Several leading ESG raters not only provide ESG scoring for firms but also construct index product based on their respective ESG score. As index providers are paid based on funds' assets under management (AUM) using their index, the index licensing may create incentive to build indices on high securities performance. In fact, several studies put in evidence that a positive correlation exists between past equity return and future fund flows. Higher will be the return, higher will be the flow, thus, higher the index license revenue for ESG raters. Agrawal et al. (2023) confirm this assumption and show that raters with strong index licensing print higher ESG score for firms having better returns to compare rates with weaker licensing incentive. In addition, exclusionary screening passive ESG strategy has been the best seller until 2018 (Devine, 2021). As massive flows tilt toward this type of products, securities and industries which do not fit with this strategy may see their respective valuations going down and, by extension, see their expected returns up.

This paper raise the hypothesis that an anomaly may exist within the financial market due to investors' preference for specific stock in order to offset the "ESG-related track error" issue. We argued the idea that investors scrutinize the beta of each stocks, combined with their respective ESG scores. We chose to use the beta as a proxy for the tracking error for two reasons. Since the beta is a concept to measure the volatility of a stock to compare to the broader market, it is defined also as a risk metric which can substitute to the tracking error. Second, this metric comes to complete the leverage constrains that investors face.

Indeed, many investors such as pensions funds and mutual funds are constrained in leverage that can take with their active bet, and overweight in risk securities instead of using leverage Frazzini and Pedersen (2014). In an others words, investors tilt toward high beta stocks to face the leverage constrains imposed to their respective portfolios. Furthermore, the surge of number of passive sustainable product should lead to significant flows shift toward no-sin stocks. By extension, sin-stocks should be renounced, affecting their valuation and, thus their expected returns.

Overall, arguments support the theory that an anomaly may exist due to the excess demand for High-ESG-Beta stocks to compare Low-ESG-Beta stocks. This behavior of tilting toward High-ESG-Beta stocks suggest that High-ESG-Beta assets required lower risk adjusted return than Low-ESG-Beta stocks. The gap of demand between those two baskets of assets would play a major role on valuation of those securities and in extension, their expected returns.

This paper examines whether a market anomaly exist between High-Beta-ESG and Low-ESG-Beta stocks due to preference bias. We contribute to feed the sustainable investing academic research field by focusing not only on the possible benefit of an ESG strategy in term of performance and risk but also how investors react to this impact of it within their portfolio. This paper also feed the "Limited Attention" field with a focus on the ESG and beta criteria . In addition, the paper apply to asset managers involving in sustainability investment.

Using US-listed firms of the USA MSCI Index and Refinitiv ESG score from 2013 to 2021, we propose a double sort methodology to assess our assumption. This straightforward and comprehensive approach allow us to identified two baskets resulting : Low ESG-Beta stocks and High-ESG-betas stocks. Based on the double sort, we analyse how baskets - independently and dependently - affect abnormal returns using both pooled regression and portfolio approach. We found that Low ESG-Beta stocks are relinquished by investors in order to answer new constrains and generate higher risk adjusted returns. However, our first approach does not confirm if this phenomena happens in profit of High-ESG-Beta securities. The ESG-related Beta portfolio performance results, once regressed with standard asset pricing factors and controlled with the ESG and Beta factors premium, prints positive and significant alphas. We infer that an anomaly exist and investors tend to prefer High-ESG-

Beta securities to compare Low ESG-Beta stocks in order to meet with their fundamental and sustainability goals. Our results also involve that this possible phenomena is relatively recent undertaking. Extending our sample period to 2003 reduce the power of our initial findings. This can be explained by the recent emergence of the ESG investment. The practical implications for investors are numerous. First, we conclude that sustainability portfolio constrains and the jump in screening ESG passive products have miss-pricing impact on stocks. Reducing the scope of active bet, along with leverage constrains forced portfolio managers to have a limited attention on the Low-ESG-Beta securities. Second, alternative investment firms may be willing to profit of this opportunity and thus, would erased the anomaly.

This remainder of this paper is organized as follow. Section 2 introduces the literature review of sustainable investing portfolio management issue. Section 3 describes the methodology our our research. The data used are presented in Section 4 followed by the results in Section 5. Then, the section 6 will exhibits the robustness check. The section 7 conclude our research paper.

2 Litterature Review

2.1 ESG and asset pricing

Sustainable investment has been covered in the academic asset pricing literature. The Asset-pricing anomaly within the financial market is a hot topic for economic actors and have been discussed within the literature. In order to identify the possible benefit of an ESG strategy at the portfolio level, a lot of paper analyzed if a no sin stock's premium exist. Recent research on responsible investing suggested the existence of a positive ESG premium (Pedersen et al., 2021; Pástor et al., 2022) . Pedersen et al. (2021) conceptualized the ESG-efficient frontier and evaluated the cost and the benefit of responsible investing. Within their empirical study, they form portfolios; sorting stocks based on four ESG proxies and run a long-shorts strategies for all of proxies. Authors also adopt pooled regression approach in order to identify the ESG impact on securities valuations. They found that the Governance proxy predict strong future fundamental and attract modest investors demand, leading to relatively cheap valuation and positive abnormal returns. Whereas the demand for the E, S, and overall ESG appear stronger, leading to insignificant alpha and higher valuations. Pástor et al. (2022), argued that higher returns deliver by green asset are mainly due to environmental strong increase in environmental concerns rather than high expected returns. Although they found conclusive outcomes on abnormal returns perspective, significantly, the demand effect seems to play a major role in their findings. Becchetti et al. (2012) also investigate the Corporate Social Responsibility (CSR) field over stocks returns. They introduce their domain specific CSR risk factors and verify if the stakeholder risk is correctly priced by standard risk factors (Carhart, 1997; Fama and French, 1993). They show the existence of pricing anomalies and confirm that responsible investors screen out companies with higher probability to face future litigations with stakeholders. Consequently, lower demand for those stocks lead to a return premium for the screened stocks.

Literature's findings exhibit the the benefit of including extra-financial screening within the making decision process and show also the important role of ESG demand, and thus, the ESG preference concept. Although most of these researches focus on the active investment management side, authors forgot that active investors manage their investment against a benchmark. Our contribution in this paper will not ommit the aspect.

2.2 Benchmarking

Institutional investors established the Strategic Asset Allocation (SAA) which is supposed to reflect the balance between the required rate of returns to meet long-term goals and the risk attitude. The SAA is the result of an Asset Liability Management (ALM) study, where several simulation are performed of the fund's invested assets and liabilities considering financial risk metrics but also macro-economic factors. The use of benchmark plays an important role here as it forms the basis of quantification and fixing the investment risk profile along with others functionalities such as the tracking error. Also, using benchmark enable institutional investors to monitor the agent, here the asset managers, on the portfolio manager's risk taking but also to evaluate the performance attribution of the investment(Kuijl et al., 2019). On the other hand, benchmark is often use as a base for the remuneration of the portfolio managers. Considering those arguments, benchmark is essential for each stakeholders. Furthermore, since institutional investors expanded their ESG policies, they started to include this new factors within their respective ALM practice. However, although

ESG index providers created ESG standard benchmark, those are a challenges within the ALM since there not a long of historical data available about ESG benchmark(Kuijl et al., 2019). In addition, the cost of those benchmark is in average higher than conventional benchmarks. In addition, since there is not standard ESG methodology, each methodology will result to a completely different list of excluded companies.

While most of anomalies are psychological driven, some of them tend to be initiated by constrains imposed to investors such as the leverage constrains (Frazzini and Pedersen, 2014). In fact, several institutional investors investors are constrained in leverage that can take with their active bet, and overweight in risk securities instead of using leverage. The Capitals Asset Pricing Model (CAPM) implies that the exposure to market risk should be compensated with the market risk-premium. However, empirical studies put in evidence that High Betas stocks earn negative alphas ,whereas lower stock Beta generate positive alphas (Jensen et al., 1972). Fama and French (1992) demonstrated that, after controlling for size and book-to-market characteristic, the beta returns relation become even flatter. Recently, Frazzini and Pedersen (2014) developed a “betting against-beta” strategy and confirm the underperformance of high beta stocks. But, antagonist claim that the non standard construction of this factor to compare traditional factor (Carhart, 1997; Fama and French, 1993) make unfeasible investors to replicate within their portfolios. The ranking weighting scheme proposed by Frazzini and Pedersen (2014) has an impact on the securities allocation. In fact, the factor is significantly overweight in micro-cap stocks. In line with their size, those stocks are most of times defined as illiquid and expensive. Furthermore, once accounting for trading cost, the performance of the factors drops and is only significant with the CAPM model.

Their analysis take into account genuinely the investors’ constrains, and do not omit that active investors manage investment against a benchmark. However as ESG started to be consider as a portfolio management constrains, as leverage is, we contribute to add the ESG constrains to the leverage one in this paper.

2.3 Institutional Investors and ESG preference

Recently, Vanguard published a survey related to investors’ ESG preference (Giglio et al., 2023). The survey outcomes exhibits that 45% of the sample do not have any reason to consider ESG within their investments. 25% of the sample assume that they consider ESG for ethical purpose while, 7% of investors believe that sustainability investing outperform the market.

The beleif that ESG strategy generate higher performance returns is supported by the literature, but overall, findings are still controversial. Several studies argued that ESG integration within an investment process contribute in term of risk-adjusted returns. Gompers et al. (2003) affirmed that a Governance trading strategy is profitable. Their findings revealed that “Democracy” firms (with strong shareholder rights) outperformed “Dictatorship” firms. Derwall et al. (2005) asserted that most of environmental efficient stock generate higher returns. Besides, De and Clayman (2015) established a positive correlation between ESG score and risk-adjusted returns. They argued that this relationship improve once excluding low ESG score securities. Interestingly, authors asserted this positive effect, even once controlling to the low-volatility anomaly. In term of risk, empirical studies argued that stock printing higher ESG score have lower risk than lower ESG score securities with the same systematic risk (Bauer et al., 2009). In addition, De and Clayman (2015) show that higher ESG score are positively correlated with lower volatility and, interestingly, claim that this relationship rise during periods of especially high volatility, such as the 2008 financial crisis. Defenders of the ESG risk contribution also argued the reputational risk link to low ESG score’s firms and its long-term consequences. A corporation’s misconduct often leads to a substantial market value loss and occurs almost immediately after its discovery. However, Karpoff et al. (2005) found that the market value losses due to a violation of environmental standards, are roughly equivalent to the legal penalties imposed. Hoepner (2010) argues that using ESG screens reduces portfolio risk, due to the lower total risk and lower specific risk of stocks with a high ESG rating. Antagonist to the idea that ESG create value at the portfolio level is present within the literature. In long term investment horizon, Kanuri (2020) finds that conventional funds outperform ESG-related funds (in terms of average returns and Sharpe ratio), even though ESG funds may sometimes perform better. In addition, Breitz and Partapuoli (2020) analyzed the behavior of several ESG portfolios using the S&P500 components from 2005 to 2018. They claimed that portfolio with lower ESG score securities outperformed both, the market and portfolio with high ESG score securities, even once considering the global financial crisis of 2008. They performed a pooled regression on a panel data as a second approach to identify the possible indirect effect of ESG variables through the accounting and market-based measure. Their findings support that ESG scores has an indirect positive effect on market-based measure while the Environmental pillar print a negative effect through accounting-based measures.

Others authors pointed out that the heightened interest in ESG is the result of behavioral finance. Przychodzen et al. (2016); Rubbaniy et al. (2021) asserted that sustainability investment is undoubtedly more related to both, risk aversion and herding behavior, rather than value creation purposes. Thus, a predisposition to incorporate ESG features in investment decision making would only be due to a behavioral reaction function coming from investors.

Today, investors consider non-pecuniary criteria within their decision-making process. Literature tried to discern different type of investors having sensitivity to an ESG integration within their investment process but also their respective motivation. Pedersen et al. (2021) identified two type of investors using ESG metrics (ESG scores). "ESG-aware" investors use ESG score to update their view but still have a preference to maximize their unconditional mean-variance utility. On the other hands, "ESG-motivated" consider ESG information and have a preference for high ESG scores. Starks (2023) documented that ESG decision making is the results of two mains motivation that the authors named *values* and *value*. Respectively, Starks defined *values* approach as as investors having nonpecuniary preference while *value* approach consider the companies' risk and return opportunities. For us, we conclude that, today, ESG consideration is an integral part of the investment process and would reverberate on the portfolio management aspect, no matter what motivation or kind of investors drive the ESG investing.

Literature arguments support that investors' belief and the ESG preference play an import role in the efficiency of the sustainability market and may have heavy consequences over the portfolio management. Indeed, the ESG investment strategy has come in for the heaviest criticism due to the raise of constrains that this new field brought at the portfolio management perspective. In fact, restricting portfolio to companies and sector which fulfil the ESG criteria requirements lead to create more exposure to specific risk (DiBartolomeo and Kurtz, 1999). In addition, ESG screens reduce the scope of the investment universe and thus lead to poor diversification (Renneboog et al., 2008; Luo and Balvers, 2017).

The importance of ESG in contemporary economics forced asset managers to offer multiple responsible products with different kind of approach. The most popular one is the negative screening approach. This screening involves excluding firms that do not meet with certain ESG criteria or engage in activities that conflict with sustainability or ethical principles. We would argue that systematic screening base on investor's preference should lead to a return premium on the screened assets. Indeed, systematically lower demand should lead de lower price and higher expected returns. Cao et al. (2023) put in evidence that socially responsible investing, affect the informational efficiency of stock prices. They show that mispricing signal is much stronger for firms held by more socially responsible institutions due to their trading implication. Indeed, socially responsible institutional investors are less likely to buy underpriced stocks with lower ESG score and sell overpriced stocks with high ESG scores. These findings suggest the importance of considering investor's taste for defining stock market efficiency.

Literature also support that constrains brought by the emergence of this new investment field is a challenge for investors and come in in an already constrain environment. Overall, they support our hypothesis that an asset-pricing anomaly have probably emerged due to the SRI investment.

3 Data

This section present data used in this paper. We collects data of US firms in the MSCI USA Index between the period 2013–2021 from Refinitiv. We choose to look at the US market as it is a large market with multiple sectors. In addition, we prefer to use MSCI USA Index, as it includes more firms that the S&P500 Index. We also collect the respective industry's firm information based on the Global Industry Classification Standard (GICS®). At the end, eleven sectors are present within the Index. This sector classification standard has been developed by MSCI and S&P Dow Jones. Since we use MSCI Index in our analysis, we decided to use this standard for consistence purpose.

3.1 ESG scores

Our main data ESG scores at the firm level are from the Refinitiv ESG (formerly known as Thomson Reuters ASSET4 ESG) database. Refinitiv it is well-know and widely used by investors that's why we used it as the main ESG data sources.

The Refinitiv ESG database is consider as one of the most comprehensive databases in the industry, covering more than 15,500 public and private companies worldwide, with about 1,000 of them dating back to 2002. Refinitv ESG scores are transparent and data-driven assessment of companies' relative ESG performance accounting for industry materiality and firm size biases. The Refinitiv data process consist of over 700 research analysts trained to collect ESG data, one of the largest ESG content collection operation in the world.

The Refinitiv ESG scores are constructed in several steps. First, analyst collect companies publicly available information and calculated over 630 company-level ESG measures of which a subset of 186 of the most comparable and material per industry, power the overall company assessment and scoring process. Subset are grouped into 10 categories that reformulate the three pillar scores and the final ESG score. The ESG score is a relative sum of the category weight varying per industry for the environmental and social categories. The governance weight pillar remains the same across all industries. The pillar weights are normalized to percentage ranging between 0 to 100. Refinitv also compute an ESG Combined score that account for ESG controversies gathered from media sources. We decided to not consider this score in this paper. At the end, the ESG scores are available in percentage ranking, spanning between 0 to 100 and letter grades from D- to A+.

Yet, the Refinitiv's ESG database is continuously updated and ESG score are recomputed weekly. Also, ESG score are reported once a year, which reduce the transparency of the ESG performance of firms. In addition, only definitive score are those before the most recent five years. In fact, Refinitiv still updates the ESG score of the most recent five years and those may be revised according to the underlying data. As a result, the timing of gathering data impacts empirical studies that rely on the lasts Refinitv ESG scores.

As its competitors, the Refinitiv's both ESG scores and methodology are not perfect but since there is not standard yet to define how accurately to corporate ESG performance, we consider Refinitiv to provide the most efficient way to measure it so far. Our choice is supported by the literature since Berg et al. (2022) consider Refinitiv ESG scores to be one of the most "exogenous" ESG measures, making them stand out among existing ESG measures. Furthermore, Agrawal et al. (2023) consider Refinitiv as an ESG rater with low index licensing incentives and, in relative, has less incentive to issue higher ESG score for firm with better stock return performance, which goes along with our decision to use Refinitiv as our only ESG sources in this paper.

3.2 BAB

We compute the Beta according to the Pedersen *and al.* methodology as defined in his paper "Betting against Beta" (2013). Authors conceptualized the BAB factor. He asserted that lower beta securities have higher alpha to compare higher beta stocks. Interestingly, this paper attracted academics and practitioners, supported our choice to use the Pedersen *and al.*'s beta computation methodology. The author proposes to calculate the beta by using the correlation and volatility components as per of the formula:

$$\hat{\beta}_i = \hat{\rho}_i \times \frac{\hat{\sigma_i}}{\hat{\sigma_m}} \tag{1}$$

The volatility components are built on past one year rolling window of daily returns and the correlation component on past five-year horizon of daily returns. We collect daily returns for all securities including the MSCI USA Index from 2008 in order to build market Beta for each stock in line the methodology described previously.

4 Methodology

This paper raise the hypothesis that an anomaly may exist within the financial market due to investors' preference for specific stock in order to offset the "ESG-related track error" issue. We argued the idea that investors scrutinize the beta (TE proxy) of each stocks, combined with their respective ESG scores in order to face to this issue.

4.1 Double Sort Approach

To assess our assumption, this paper proposes a "double sort" approach since our hypothesis focused on securities defined by two mains characteristics: 1) ESG score and 2) the Beta. The

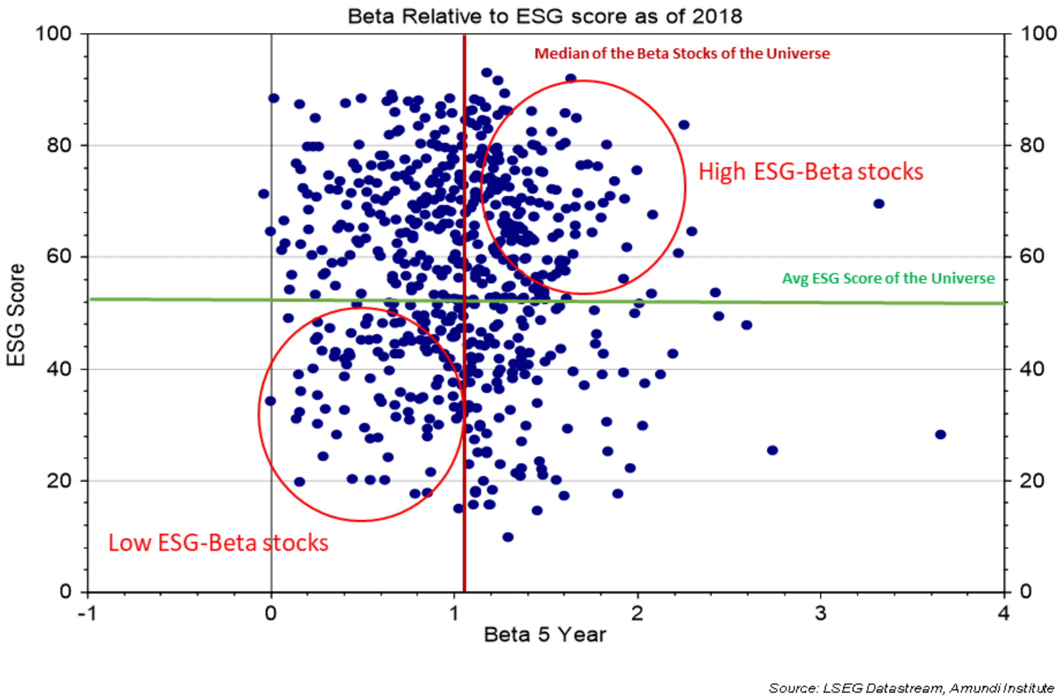

Figure 1: MSCI USA stocks ESG Score Vs Beta .

excess demand for High-ESG-Beta stocks to compare Low-ESG-Beta stocks may conduct to an asset-pricing anomaly. The figure 1 summarize the double sort approach we conduct on the MSCI USA Index. Blue dots are stocks making out the MSCI USA Index in January 2018. Securities are positioned based on their respective Beta (X axis) and their ESG score in (Y axis). We dice the sample according to both, the average ESG score of the universe (horizontal green line) and the median of the stocks' beta making out the universe (vertical red line). Four baskets of securities result of this approach. As mentioned previously, this paper will only study the difference of behavior between the "High ESG-Beta stocks" and "Lower ESG-Beta Stocks".

We use the average of the universe as the cut-out level for ESG score as investors must beat the ESG score of their respective Benchmark in order to conform with their sustainability goal and print Higher ESG rating fund. We inform the reader that the average ESG score approach will change along our analysis. We elaborate later in this section on how and why we adapt this cut out level. For the beta characteristic, we use the median, in line with the Frazzini and Pedersen (2014)'s methodology,they used to build the BAB factor ("Betting against Beta"). A descriptive statistic of ESG and Beta data for our sample period are presented in the table 1. Table 2 exhibits the correlation between those variables.

Table 1: Summary statistics of the Sample

	Number	Mean	St.Dev	Min	25%	50%	75%	Max
ESG	58205	54.932	18.498	0.910	41.700	56.370	69.390	93.320
Beta	58205	1.129	0.394	-0.077	0.865	1.079	1.346	3.838

Table 2: Correlation of ESG vs Beta

	ESG	Beta
ESG	1	
Beta	-0.04	1

Then, two approaches have been performed based on this "double sort" methodology. First, we run a pooled regression, where we created dichotomous variables intended to materialized the double sort approach just described below. Then a portfolio approach have been conducted where a long short strategy between those two baskets have been initiated in order to creat what we call in this paper, the ESG-related beta portfolio.

Subsections below elaborates on the way we conduct those approaches.

4.2 Pooled Regression Approach

We construct a pooled dataset including all firms included within the MSCI USA Index from 2013 to 2021. From Refinitiv, we consolidate the month-to-date performance and the ESG score for each asset i at time t. In addition, we merge our pooled with the beta of each securities at time t as we consider this risk measure as a tracking error's proxy in this paper.

The pooled data is unbalanced as components of the Index vary over time. In fact, assets within the universe vary due to several factors: 1) entry and exit of the index, 2) number of securities included within the index change, 3) ISIN change for the same assets, and 4) company's bankruptcy. We otherwise remind the reader that the ESG-related track error is the variance in return between an ESG-focused portfolio and a conventional benchmark. Since investors face to those challenges within their respective investment universe, we decide to leave the pooled data unbalanced the way it is, as it reflect the truly environment as investors face.

We create two dichotomous variables. Stock matching conditional features will be equal to one. The creation of those variables are described as follow:

- ESGXBeta++: Stock > Beta median AND Average Universe ESG Score = 1
- ESGXBeta - -: Stock < Beta median AND Average Universe ESG Score = 1

Securities above two conditional features are equal to 1 within the dummy variable ESGX-Beta++. Those below are equal to 1 within the dummy variable ESGXBeta - -.

Equation (2) present the pooled regression we perform with this approach. We use the abnormal returns i.e the alpha of i stocks at time t as dependent variables. To compute the alpha of each stocks, we extended our sample data period to 2003 in order to avoid outlier that could skew our results. This process consist of two step and are described in Appendix A. We regress alphas' securities with dichotmous variables defined previsously. We also include ESG and Beta variables as control variables. Furthermore, the litterature argued that the possible outperfromance of ESG strategies may be explain by the active exposition that the strategy bring to a certain type of sectors. Le Sourd (2023) shows that the outperformance of ESG investing is largely driven by sector bias. Author show that after controlling to this bias, a negative alpha is obtained after. Besides, Bolton and Kacperczyk (2021) found that a carbon premium exist but disappear once we control for industry. To ward this bias effect off, we include the Industry fixed effect within the regressions. Besides,

$$\alpha_{i,t} = \beta_1 ESG_{i,t} + \beta_2 Beta_{i,t} + \beta_3 ESGXBeta++_{i,t} + \beta_4 ESGXBeta--_{i,t} + \epsilon_{i,t} \tag{2}$$

4.3 Portfolio Approach

Our hypothesis in the paper suggest that an anomaly may exist on the ESG investment side, due to new portfolio management constraints. As portfolio managers have to respect news guidelines inside their fund: *1)* beating ESG score of the benchmark, *2)* deliver positive alpha and *3)* do not exceed a certain level of TE, the combination of ESG score and Beta in selecting stock process may result to an anomaly in the market.

The portfolio approach also consist to a double sorting portfolio construction. First we consider stocks which are above (below) the average ESG score of their respective industry.

We prefer to sort ESG score at the sector level rather than consider the universe average score here for two reasons. On the one hand, the ESG score distribution within the US universe may create some sector bias. In fact, the average ESG score differ significantly at sector level, according to the Refinitiv ESG score methodology. Therefore, creating a long-short strategy based on the ESG characteristics may create long bias to one specific sector and a short bias to an other. In appendix (B), charts exhibits the sector rotation of a long leg and a short leg of an ESG long-short strategy from 2013 to 2021 apply on the MSCI USA Index. The stock picking is only based on the securities' ESG score . The long leg, namely the portfolio Q1, represent the last quantile of the ESG score distribution, meaning best ESG score securities. The portfolio Q5 represents the short leg, thus the worst ESG score securities. As you notice, Q1 portfolio has a long bias exposure on the IT sector which has in average higher ESG score. The portfolio has also a short bias exposure in Utilities from 2015 to 2019, as this sector is not represented within this portfolio during this sample period. On the other hand, the Q5 portfolio has a short bias in the Energy industry. Considering this methodology, the ESG long-short strategy may be used as a proxy for a sector long-short strategy. Also, charts suggest high turnover within both portfolios. The turnover aspect is essential for investors as it deteriorates the overall performance of the portfolio due to its cost.. Thus, if we do not consider the ESG score average at the sector level, you may omit to consider some sectors which in turn, may disrupt the robustness of our analysis. Second, the outperformance of an ESG investment strategy has been a lot review within academic field. Some authors argued that the ESG outperformance may be only due to sector bias rather than value creation (Le Sourd, 2023). Our approach within this first sorting process create two portfolios where all sectors are represented in both side.

Second we consider the Median beta of each constituent within the US universe. We chose to use the median rather than average for two reasons. First, because we rely on the Frazzini and Pedersen (2014)'s BAB factor methodology. Second the average term may create some exuberance in terms of Beta magnitude due to outliers that some securities within the universe may displayed.

Each portfolios are built equally weighted at sector level. We distinguish sector as defined by GICS®. The Global Industry Classification Standard (GICS®) define 11 sectors, which summarize the overall business activities within the economy. Thus, each sector are weighted for 9,091% (100/11 = 9,091). We chose to build portfolio in this way based on previous argument just mentioned but also to avoid concentration induced by high market capitalization‘s firms issue and thus, sector bias.

This process results of a creation of two portfolios: 1) Low-ESG-Beta portfolio and 2) High-ESG-Beta portfolio. These portfolios include stocks combining the two conditionals features mentioned previously. The Low-ESG-Beta portfolio includes stocks which are below both, the average industry ESG score and the median of the stocks beta of the whole universe. At the opposite, The High-ESG-Beta portfolio consider stock above these conditionals features. Respectively, those portfolios are denoted as "ESG-Beta-" and "ESG+Beta+" in the equation (3). We repeated this process over the sample period (2013-2021) on monthly basis at time t and calculate the performance of portfolios over the following month *t+1*. Then, as described in the equation (3), we compute the spread return of the two portfolios representing a strategy long Low-ESG-Beta and short High-ESG-Beta stocks. This process provide us the the excess performance return of the ESG-related beta portfolio.

$$R_t(ESGBeta+-) = R_t(ESG-Beta-) - R_t(ESG+Beta+) \tag{3}$$

In this approach, we also tried to use another proxy of excess returns in order to confirm results in our exploratory study. We use a benchmark here to compute the excess return of the ESG-related Beta portfolio illustrated in the equation 4. We compute the excess return of the long leg by subtracting the performance return of the Low-ESG-Beta securities portfolio by the benchmark. On the other hand, we subtract the benchmark performance return by the short leg portfolio, namely, the High-ESG-Beta portfolio. The spread represent the excess return and is used as dependent variable in our regression.

$$R_t(ESGBeta+-) = (R_t(ESG-Beta-) - R_t(Benchmark)) - (R_t(Benchmark) - R_t(ESG+Beta+)) \tag{4}$$

We use the MSCI USA Index as a benchmark. But we recompute the performance return of the Index by tilted sectors weights of the Index. Indeed, as our portfolio is equally weighted at the sector level to avoid any sector bias or concentration issue, which was also a critical argument for the antagonist of the ESG strategy's outperformance, we rebuilt the

Index aptly in order to get a benchmark which was also equally weighted at the sector level.

Literature argued that an ESG premium may exist (Pedersen et al., 2021; Pástor et al., 2022). In addition,Frazzini and Pedersen (2014) found that lower alpha securities generate higher alpha to compare higher beta stocks. Since our approach considers ESG and beta, we decide to build those factors which will be used as control variables in our analysis.

We built the ESG factor as per of the Pedersen et al. (2021)'s methodology. For each month, we sort stocks into portfolios based on quintile of their ESG scores. We then compute the return over the following month with the Best-ESG stock minus low-ESG stocks. Portfolios are constructed equally weighted.

Frazzini and Pedersen (2014) conceptualized the BAB ("Betting against Beta") factor which capture the performance attribution of the beta anomaly. We replicated the authors's methodology. We estimated pre-ranking betas by computing all market beta historic for each stock. Then we construct portfolios that are long low-beta securities and short high-beta securities. Low (High) beta portfolios is composed of all stock with a beta below (above) the median of the universe i.e the MSCI USA Index. Each portfolios are weighted by the ranked betas (lower betas securities have larger weights in low-beta portfolio and higher-beta securities have larger weights in the high-beta portfolio). Portfolio are rebalanced every calendar month.

5 Results

5.1 Pooled regression approach

Table 3 presents the results of the pooled regression approach. The regression use alpha of each securities as dependent variables – generated from methodology explained in appendix A. Model (1) represent the alpha from the CAPM, (2) Three French Factors, (3) Five factor model and (4) FF5 with the additional Momentum factor. We control for the sector using industry fixed effect in regressions. We note that the ESG variable by itself has a negative coefficient for the Model (1) and (4) and are statistically significant at 90% level, suggesting that the ESG score does have a direct negative effect on the alpha securities returns. However, coefficients are marginally low. Considering significant results, findings are at the opposite of positive ESG premium's advocates. However there is weak evidence about this effect considering insignificant and positive estimates for Model (2) and (3). It should be remembered that Pedersen et al. (2021) found weak evidence of positive abnormal returns from ESG portfolio (based on MSCI ESG Score) performance after controlling for several assets pricing factors. Besides, the Beta control variable is negative and significant for all models as Frazzini and Pedersen (2014)'s findings suggested. As one can see, the ESGXBeta ++ variable prints positive estimates suggesting that the combination of High ESG stocks and High Beta stocks, has positive effect on abnormal returns. Yet, coefficients are only significant for the Model(4). This results belie hypothesis' expectations. In fact, the excess demand for those stocks would have a negative impact on securities' alpha, thus we would expect negative estimates here. However, the ESGXBeta— print positive estimates and are significant for all models except the model (4), once we include the Momentum factor to the Five factor model (FF5). Also, the magnitude of the coefficients are significantly higher than ESGXBeta ++ results. Given in the importance ESGXBeta—'s estimates to the alpha, findings suggest that the combination of Low ESG stocks and Low Beta stocks are relinquished by investors as a results of an increase in constrains imposed to portfolio managers. However, since our results for ESGXBeta ++ print positive estimates, although insignificant, we cannot say with conviction that investors neglect Low ESG stocks and Low Beta stocks for the profit of the combination of High ESG stocks and High Beta stocks.

Table 3: ESG and Beta interaction from 2013

	Dependent variable:			
	alpha CAPM	alpha FF3	alpha FF5	alpha FF6
	(1)	(2)	(3)	(4)
ESG	-0.004^{*}	0.001	0.0002	-0.004^{*}
	(0.09)	(0.68)	(0.92)	(0.08)
Beta	-0.77^{***}	-0.45^{***}	-0.52^{***}	-0.59^{***}
	(0.00)	(0.00)	(0.00)	(0.00)
ESGXBeta++	0.03	0.06	0.09	0.15^{*}
	(0.77)	(0.50)	(0.29)	(0.07)
ESGXBeta - -	**0.20****	**0.16***	**0.15***	**0.14**
	(0.04)	**(0.08)**	**(0.09)**	**(0.12)**
Constant	0.95^{***}	0.35	0.47^{**}	0.83^{***}
	(0.0001)	(0.12)	(0.04)	(0.0002)
Securities-fixed effects	No	No	No	No
Time-fixed effects	No	No	No	No
Industry-fixed effects	Yes	Yes	Yes	Yes
Observations	56,498	56,493	56,485	56,467
R^2	0.01	0.004	0.01	0.01
Adjusted R^2	0.01	0.004	0.01	0.01
Residual Std. Error	6.98	6.74	6.61	6.68

Note: *p<0.1; **p<0.05; ***p<0.01

5.2 Portfolio Approach

We regress the excess return of the ESG related Beta portfolio resulting from the equation 3, with different asset pricing factors. Results are presented in the Table 4. Model (1) represents results with the CAPM, (2) Three French Factors, (3), Five factor model and (4) FF5 with the additional Momentum factor. Outcomes suggest the the portfolio has a negative slightly bias to the market beta, i,e the Mkt-RF coefficient. They are all statistically significant for all asset pricing models. It indicates that portfolio is marginally negatively exposed to systematic risk. The low magnitude of those coefficient may be explain by the consideration of the BAB factor in our analysis. The size factor (SMB) influences negatively the portfolio's returns. Negative coefficients for this factor suggest that the ESG-related Beta portfolio has a higher exposure to big market capitalization company to compare smalls firms. Interestingly, as it it has been proved that big size company offer higher ESG score than small firms. Factor loadings for value risk factor are significant and negative for all models except Model (4). Coefficients for RMW and CMA are positive but not significant. In addition, the Momentum factor's coefficient including in the Model (4) is positive and statistically significant. We control for the ESG and BAB factors in our analysis. In line with the authors' findings, BAB factor's estimates are positive and significant for all models. However, the ESG factors appear to have negative effect on the excess returns. We found that the ESG premium - built as defined by Pedersen et al. (2021) - has significant negative impact on our ESG-related Beta portfolio; at the opposite of authors findings. However, authors' findings were not significant once dealing with ESG proxy. In addition, their findings was based on the MSCI ESG score while we use Refintiv ESG score to create the ESG premium factor.

As one can see, constants, i.e alphas, are positive and statistically significant at 95% level for all models. It indicates that the strategy to be long Low ESG-Beta stcoks and short High ESG-Betas stocks generate abnormal returns. This approach confirms our initial findings obtained in the pooled regression approach. We assume that the lower demand for Low ESG-Beta stocks to compare High ESG-Beta stocks demand in order to conform with constrains exists.

Table 4: ESG-related Beta portfolio from 2013 (Sector controlled)

	Dependent variable:			
	ESG Beta portfolio returns			
	(1)	(2)	(3)	(4)
Mkt-RF	−0.04	−0.04*	−0.04	−0.05*
	(0.16)	(0.10)	(0.16)	(0.08)
SMB		−0.12***	−0.13***	−0.13***
		(0.001)	(0.001)	(0.001)
HML		−0.09**	−0.06*	−0.04
		(0.02)	(0.10)	(0.25)
RMW			−0.06	−0.02
			(0.29)	(0.75)
CMA			−0.10	−0.06
			(0.12)	(0.30)
Mom				0.09***
				(0.01)
BAB Factor	0.89***	0.81***	0.82***	0.75***
	(0.00)	(0.00)	(0.00)	(0.00)
ESG Factor	−0.47***	−0.43***	−0.39***	−0.39***
	(0.00)	(0.00)	(0.0000)	(0.00)
Constant	0.22**	0.17**	0.16**	0.16**
	(0.02	(0.05	(0.05	(0.05
Observations	97	97	97	97
R^2	0.94	0.95	0.95	0.96
Adjusted R^2	0.94	0.95	0.95	0.95
Residual Std. Error	0.83 (df = 93)	0.73 (df = 91)	0.73 (df = 89)	0.70 (df = 88)
Note:				*p<0.1; **p<0.05; ***p<0.01

The Table 5 exhibits regression's results using the the excess return of the ESG related Beta portfolio resulting from the equation 4. In this approach, we used a benchmark to compute the portfolio excess returns. Constants, i.e alphas, are still positive and statistically significant at 95% level for all models. Results confirm of our initial findings and assume that the lower demand for Low ESG-Beta stocks to compare High ESG-Beta stocks demand in order to conform with constrains exists.

Table 5: ESG-related Beta portfolio from 2013 (Sector controlled)

	Dependent variable:			
	ESG Beta portfolio returns			
	(1)	(2)	(3)	(4)
Mkt-RF	−0.03	−0.03	−0.01	−0.02
	p = 0.39	p = 0.30	p = 0.74	p = 0.50
SMB		−0.12***	−0.16***	−0.16***
		p = 0.002	p = 0.0002	p = 0.0002
HML		−0.10***	−0.08**	−0.06
		p = 0.01	p = 0.05	p = 0.13
RMW			−0.16**	−0.11*
			p = 0.02	p = 0.09
CMA			−0.04	−0.01
			p = 0.53	p = 0.93
Mom				0.09***
				p = 0.01
BAB Factor	0.89***	0.80***	0.82***	0.75***
	p = 0.00	p = 0.00	p = 0.00	p = 0.00
ESG Factor	−0.49***	−0.43***	−0.38***	−0.38***
	p = 0.00	p = 0.00	p = 0.0000	p = 0.0000
Constant	0.25**	0.19**	0.18**	0.17**
	p = 0.02	p = 0.04	p = 0.05	p = 0.05
Observations	97	97	97	97
R^2	0.93	0.94	0.95	0.95
Adjusted R^2	0.92	0.94	0.94	0.95
Residual Std. Error	0.91 (df = 93)	0.81 (df = 91)	0.79 (df = 89)	0.77 (df = 88)
Note:				*p<0.1; **p<0.05; ***p<0.01

6 Robustness Check

6.1 Pooled regression approach

We extended our sample period to 2003 to identify whether our findings are different with a longer period, especially since the ESG consideration is seen as a fresh trend. Table 5 exhibits the results. We note that the ESG variable by itself has a negative coefficient and is highly significant for all models, suggesting that the ESG score does have a direct negative effect on the alpha securities returns. In comparison to our initial results based on our initial sample period from 2013, all of coefficients are negative and highly significant. Result is at the opposite of positive ESG premium's advocates. At the opposite, no change has been noted for the BAB factor. Coefficients of the Beta control variable is negative and significant, in line with the Frazzini and Pedersen (2014)'s paper. However, the ESGXBeta++ 's estimates are positive and statistically significant while the ESGXBeta- - displays some flat coefficients with weak evidence of direct effect on abnormal returns. Outcomes suggest that the possible phenomenon detected on shorter period in our initial analysis, disappeared over longer period. Outcomes do make sense as ESG investing trend jumped over the last decade and its impact i.e constrains, should only be identified during this period. Besides, it suggests that securities displaying a beta and an ESG score above both, the beta median of the universe and the universe's average ESG score have a direct positive impact on abnormal returns.

Table 6: ESG and Beta interaction from 2003

	Dependent variable:			
	alpha CAPM	alpha FF3	alpha FF5	alpha FF6
	(1)	(2)	(3)	(4)
ESG	-0.01^{***}	-0.01^{***}	-0.01^{***}	-0.01^{***}
	(0.00)	(0.0001)	(0.0000)	(0.00)
Beta	-0.76^{***}	-0.55^{***}	-0.46^{***}	-0.53^{***}
	(0.00)	(0.00)	(0.00)	(0.00)
ESGXBeta++	0.13^{**}	0.15^{**}	0.14^{**}	0.18^{***}
	(0.05)	(0.03)	(0.03)	(0.005)
ESGXBeta - -	-0.01	0.01	0.01	0.02
	(0.84)	(0.84)	(0.87)	(0.72)
Constant	1.24^{***}	0.80^{***}	0.70^{***}	0.90^{***}
	(0.00)	(0.0000)	(0.0000)	(0.00)
Securities-fixed effects	No	No	No	No
Time-fixed effects	No	No	No	No
Industry-fixed effects	Yes	Yes	Yes	Yes
Observations	106,598	106,593	106,580	106,550
R^2	0.003	0.002	0.002	0.002
Adjusted R^2	0.003	0.001	0.002	0.002
Residual Std. Error	7.46	7.24	7.09	7.03
Note:				*p<0.1; **p<0.05; ***p<0.01

6.2 Portfolio Approach

Our initial portfolio approach's findings findings suggested strong evidence that an anomaly may exist between Low-ESG-Beta stocks and High-ESG-Beta stocks. We decide to reproduce our analysis without considering the ESG and Beta premium as control variables in the regression. Table 6 shows that once we omit to control for ESG and beta premium (BAB) factors, the significativity of constants disappears except for the model (1), although alpha are still positive.

Table 7: ESG-related Beta portfolio from 2013 (Sector controlled)

	Dependent variable:			
	ESG Beta portfolio returns			
	(1)	(2)	(3)	(4)
Mkt-RF	−0.52***	−0.38***	−0.38***	−0.28***
	(0.00)	(0.00)	(0.00)	(0.0000)
SMB		−0.32***	−0.30***	−0.21***
		(0.0003)	(0.004)	(0.01)
HML		−0.37***	−0.40***	−0.19**
		(0.0000)	(0.0001)	(0.03)
RMW			0.06	0.19
			(0.70)	(0.13)
CMA			0.07	0.12
			(0.69)	(0.35)
Mom				0.44***
				(0.00)
Constant	0.71***	0.35	0.35	0.23
	(0.01)	(0.12)	(0.13)	(0.21)
Observations	97	97	97	97
R^2	0.43	0.64	0.64	0.78
Adjusted R^2	0.42	0.63	0.62	0.77
Residual Std. Error	2.52	2.02	2.04	1.60
Note:				*p<0.1; **p<0.05; ***p<0.01

For robustness purpose, we decided to extend our sample period to 2003 in order to confirm that the possible asset-pricing anomaly is something new considering the jump of interest on ESG and the escalation of constrains involved with this new investment field. Table 7 exhibits results and shows that alphas are still positive but only statistically significant for two models (1 and 2). Also, we lost power for ESG factor once we extended the sample period, which is in line with Pedersen et al. (2021) findings. Otherwise, the BAB factor coefficients remain negative and significant for all models.

Table 8: ESG-related Beta portfolio from 2003 (Sector controlled)

	Dependent variable:			
	ESG Beta portfolio returns			
	(1)	(2)	(3)	(4)
Mkt-RF	−0.59***	−0.44***	−0.42***	−0.35***
	(0.00)	(0.00)	(0.00)	(0.00)
SMB		−0.31***	−0.29***	−0.31***
		(0.0001)	(0.0002)	(0.0000)
HML		−0.41***	−0.44***	−0.23***
		(0.00)	(0.00)	(0.0002)
RMW			0.14	0.17**
			(0.15)	(0.05)
CMA			0.16	0.09
			(0.18)	(0.36)
Mom				0.31***
				(0.00)
BAB Factor	0.06***	0.05***	0.05***	0.04***
	(0.0004)	(0.0005)	(0.001)	(0.0004)
ESG Factor	−0.14	−0.02	−0.06	−0.11
	(0.23)	(0.86)	(0.62)	(0.23)
Constant	0.46**	0.30**	0.25	0.20
	(0.02)	(0.05)	(0.11)	(0.11)
Observations	206	206	206	206
R^2	0.55	0.70	0.70	0.80
Adjusted R^2	0.55	0.69	0.69	0.79
Residual Std. Error	2.52 (df = 202)	2.09 (df = 200)	2.08 (df = 198)	1.70 (df = 197)
Note:				*p<0.1; **p<0.05; ***p<0.01

We also tried different way to build portfolios. We perform the same approach but sort the MSCI USA Index's components ESG scores by terciles and quintile rather than using the industry ESG score average. Table 8 exhibits results for the ESG-related Beta portfolio sort by quintile. Constants, i.e alphas, remain positive but are less significant. We note that the significativity of control variables do not change after using this portfolio construction approach. However, the ESg factor's coefficients increase; which may be explain by the fact that authors used also quintile within their building approach.

Table 9: ESG-related Beta portfolio (0.20) from 2013 (Sector controlled)

	Dependent variable:			
	ESG Beta portfolio returns			
	(1)	(2)	(3)	(4)
Mkt-RF	−0.03	−0.04	−0.04	−0.05
	(0.36)	(0.28)	(0.26)	(0.19)
SMB		0.04	0.05	0.05
		(0.41)	(0.39)	(0.38)
HML		-0.10^{*}	−0.07	−0.05
		(0.07)	(0.22)	(0.37)
RMW			−0.005	0.04
			(0.96)	(0.70)
CMA			−0.11	−0.08
			(0.26)	(0.43)
Mom				0.08
				(0.12)
BAB Factor	0.86^{***}	0.84^{***}	0.85^{***}	0.79^{***}
	(0.00)	(0.00)	(0.00)	(0.00)
ESG Factor	-0.65^{***}	-0.56^{***}	-0.53^{***}	-0.53^{***}
	(0.00)	(0.00)	(0.0000)	(0.0000)
Constant	0.15	0.11	0.11	0.10
	(0.23)	(0.40)	(0.39)	(0.41)
Observations	97	97	97	97
R^2	0.89	0.89	0.89	0.90
Adjusted R^2	0.88	0.89	0.88	0.89
Residual Std. Error	1.13 (df = 93)	1.12 (df = 91)	1.13 (df = 89)	1.12 (df = 88)
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 9 exhibits results for the ESG-related Beta portfolio sort by terciles. The portfolio generate alpha after controlled for all model asset pricing factors, even in adding ESG and Beta control variables. Furthermore, alphas are above our initial analysis' findings. However, constants are only statistically significant at 90% level except for the Model (1) wish is at 95% level. .

Table 10: ESG-related Beta portfolio (0.33) from 2013 (Sector controlled)

	Dependent variable:			
	ESG Beta portfolio returns			
	(1)	(2)	(3)	(4)
Mkt-RF	−0.05	−0.05*	−0.05	−0.06**
	(0.15)	(0.08)	(0.12)	(0.05)
SMB		−0.10**	−0.11**	−0.11***
		(0.02)	(0.02)	(0.01)
HML		−0.14***	−0.11**	−0.08*
		(0.001)	(0.02)	(0.06)
RMW			−0.08	−0.02
			(0.27)	(0.74)
CMA			−0.12*	−0.08
			(0.09)	(0.24)
Mom				0.10***
				(0.01)
BAB Factor	0.88***	0.78***	0.80***	0.72***
	(0.00)	(0.00)	(0.00)	(0.0)
ESG Factor	−0.62***	−0.52***	−0.47***	−0.47***
	(0.00)	(0.00)	(0.00)	(0.0)
Constant	0.26**	0.18*	0.18*	0.17*
	(0.02)	(0.06)	(0.06)	(0.06)
Observations	97	97	97	97
R^2	0.92	0.94	0.94	0.95
Adjusted R^2	0.92	0.93	0.94	0.94
Residual Std. Error	0.97 (df = 93)	0.86 (df = 91)	0.85 (df = 89)	0.81 (df = 88)
Note:				*p<0.1; **p<0.05; ***p<0.01

6.3 Environmental, Social and Governance Pillars

We take the analysis a step further in adding granularity in our approach. As the ESG score is an aggregate score of the Environmental, Social and Governance pillar scores, it may be interesting to identify whether one of them contribute more to this phenomena. We conducted the same analysis based on different E,S,G pillars.

6.3.1 Pooled Regression approach

Interestingly, our analysis do not show any evidence that a pillar contribute more to the anomaly highlighted thought our initial findings. Table 10 exhibits outcomes for the Environmental pillars. Both, High-Environmental-Beta and Low-Environmental-Beta securities prints positive estimates, meaning they have a positive impact on risk-adjusted returns. But we cannot assume that Low-Environmental-Beta securities have greater impact as results are non statistically significant. The same observations is observed in Table 11 once we consider Social pillar. However, the Governance pillar seems to have a greater impact on the risk adjusted returns. Table 12 shows that coefficient for Low-Governance-Beta securities are higher than for High-Governance-Beta securities for all models. yet, due to the lack of power of our prediction, we cannot assume that the anomaly identified previously in this paper is mainly due to the Governance aspect. At first glance, we may be surprised by those results but there are several rationales supported those findings.

Our suggests that investors scrutinize more the overall ESG score rather than E,S,G pillar. First, it is important to remember that the overall ESG score is not build equally weighted, meaning that each pillar has their own weight, depending of their respective materially over each industry. As a result, it may be logical that our results are irrelevant once we add granularity in our analysis in focusing at E,S,G pillar, even once adding industry fixed effect within the regression. Second,

as most constrains imposed by funds rating agency such as MSCI and Morning star are based on ESG score, investors consciously or unconsciously tend to focus only focus on the ESG over all scores in order to meet requirements.

- new to discner pilalr - consider ESG overall so far for regulation

Considering E,S,G aspect independently within the investment process is recent.

Launching of mutual funds with a social, and/or environmental bias in their investment strategy occur last years, especially since two major events which are the Paris agreement (Environmental pillar) and the Covid crisis (Social pillar).

Table 11: Environmental Pillar and Beta interaction from 2013

	Dependent variable:			
	alpha CAPM	alpha FF3	alpha FF5	alpha FF6
	(1)	(2)	(3)	(4)
Environmental	-0.002	-0.001	-0.002	-0.001
	(0.18)	(0.49)	(0.34)	(0.40)
Beta	-0.75^{***}	-0.49^{***}	-0.56^{***}	-0.47^{***}
	(0.00)	(0.00)	(0.00)	(0.00)
ESGXBeta++	0.01	0.10	0.12	0.09
	(0.93)	(0.27)	(0.17)	(0.27)
ESGXBeta - -	0.13	0.06	0.05	0.12
	(0.19)	(0.51)	(0.60)	(0.20)
Constant	0.71^{***}	0.41^{**}	0.48^{**}	0.37^{*}
	(0.00)	(0.05)	(0.03)	(0.08)
Securities-fixed effects	No	No	No	No
Time-fixed effects	No	No	No	No
Industry-fixed effects	Yes	Yes	Yes	Yes
Observations	52,883	52,878	52,870	52,858
R^2	0.01	0.004	0.01	0.01
Adjusted R^2	0.01	0.004	0.01	0.005
Residual Std. Error	6.85	6.63	6.51	6.52

Note: *p<0.1; **p<0.05; ***p<0.01

Table 12: Social Pillar and Beta interaction from 2013

	Dependent variable:			
	alpha CAPM	alpha FF3	alpha FF5	alpha FF6
	(1)	(2)	(3)	(4)
Social	−0.002	−0.0002	−0.001	−0.003
	(0.25)	(0.92)	(0.66)	(0.11)
Beta	-0.77^{***}	-0.47^{***}	-0.56^{***}	-0.59^{***}
	(0.00)	(0.00)	(0.00)	(0.00)
ESGXBeta++	0.01	0.05	0.08	0.11
	(0.95)	(0.53)	(0.36)	(0.20)
ESGXBeta - -	0.15^{*}	0.10	0.07	0.10
	(0.09)	(0.28)	(0.44)	(0.26)
Constant	0.91^{***}	0.46^{**}	0.59^{***}	0.83^{***}
	(0.00)	(0.04)	(0.01)	(0.00)
Securities-fixed effects	No	No	No	No
Time-fixed effects	No	No	No	No
Industry-fixed effects	Yes	Yes	Yes	Yes
Observations	56,498	56,493	56,485	56,467
R^2	0.01	0.004	0.01	0.01
Adjusted R^2	0.01	0.004	0.01	0.01
Residual Std. Error	6.98	6.74	6.61	6.68

Note: *p<0.1; **p<0.05; ***p<0.01

Table 13: Governance Pillar and Beta interaction from 2013

	Dependent variable:			
	alpha CAPM	alpha FF3	alpha FF5	alpha FF6
	(1)	(2)	(3)	(4)
Governance	−0.002	0.001	0.001	−0.002
	(0.33)	(0.55)	(0.65)	(0.32)
Beta	−0.73***	−0.45***	−0.52***	−0.56***
	(0.00)	(0.00)	(0.00)	(0.00)
ESGXBeta++	−0.07	−0.02	0.01	0.05
	(0.42)	(0.84)	(0.91)	(0.53)
ESGXBeta - -	0.18**	0.08	0.08	0.10
	(0.05)	(0.39)	(0.36)	(0.26)
Constant	0.84***	0.39*	0.47**	0.73***
	(0.00)	(0.06)	(0.02)	(0.00)
Securities-fixed effects	No	No	No	No
Time-fixed effects	No	No	No	No
Industry-fixed effects	Yes	Yes	Yes	Yes
Observations	56,498	56,493	56,485	56,467
R^2	0.01	0.004	0.01	0.01
Adjusted R^2	0.01	0.004	0.01	0.01
Residual Std. Error	6.98	6.74	6.61	6.68

Note: *p<0.1; **p<0.05; ***p<0.01

6.3.2 Portfolio approach

Table 14: Environmental-related Beta portfolio from 2013 (Sector controlled)

	Dependent variable:			
	ESG Beta portfolio returns			
	(1)	(2)	(3)	(4)
Mkt-RF	−0.01	−0.02	−0.003	−0.01
	p = 0.65	p = 0.48	p = 0.92	p = 0.58
SMB		−0.14***	−0.16***	−0.17***
		p = 0.0004	p = 0.0001	p = 0.0001
HML		−0.12***	−0.10***	−0.08**
		p = 0.0004	p = 0.01	p = 0.04
RMW			−0.11*	−0.05
			p = 0.07	p = 0.39
CMA			−0.01	0.04
			p = 0.84	p = 0.59
Mom				0.10***
				p = 0.003
BAB Factor	0.88***	0.79***	0.80***	0.72***
	p = 0.00	p = 0.00	p = 0.00	p = 0.00
GMB Factor	−0.32***	−0.34***	−0.32***	−0.34***
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
Constant	0.13	0.06	0.05	0.04
	p = 0.19	p = 0.50	p = 0.54	p = 0.58
Observations	97	97	97	97
R^2	0.92	0.95	0.95	0.95
Adjusted R^2	0.92	0.94	0.95	0.95
Residual Std. Error	0.90 (df = 93)	0.76 (df = 91)	0.75 (df = 89)	0.72 (df = 88)
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 15: Environmental-related Beta portfolio from 2013 (Sector controlled)

	Dependent variable:			
	ESG Beta portfolio returns			
	(1)	(2)	(3)	(4)
Mkt-RF	−0.01	−0.01	0.01	0.003
	p = 0.84	p = 0.78	p = 0.71	p = 0.90
SMB		-0.12^{***}	-0.16^{***}	-0.16^{***}
		p = 0.002	p = 0.0003	p = 0.0002
HML		-0.09^{***}	-0.07^{*}	−0.06
		p = 0.01	p = 0.06	p = 0.15
RMW			-0.14^{**}	−0.10
			p = 0.03	p = 0.11
CMA			−0.03	−0.01
			p = 0.65	p = 0.91
Mom				0.07^{**}
				p = 0.05
BAB Factor	0.89^{***}	0.81^{***}	0.82^{***}	0.77^{***}
	p = 0.00	p = 0.00	p = 0.00	p = 0.00
E Factor	-0.36^{***}	-0.34^{***}	-0.31^{***}	-0.31^{***}
	p = 0.0000	p = 0.0000	p = 0.0001	p = 0.0001
Constant	0.17^{*}	0.11	0.10	0.10
	p = 0.08	p = 0.21	p = 0.25	p = 0.27
Observations	97	97	97	97
R^2	0.93	0.94	0.95	0.95
Adjusted R^2	0.92	0.94	0.94	0.94
Residual Std. Error	0.89 (df = 93)	0.79 (df = 91)	0.77 (df = 89)	0.76 (df = 88)
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 16: Social-related Beta portfolio from 2013 (Sector controlled)

	Dependent variable:			
	ESG Beta portfolio returns			
	(1)	(2)	(3)	(4)
Mkt-RF	−0.002	−0.01	−0.01	−0.01
	p = 0.97	p = 0.84	p = 0.87	p = 0.80
SMB		-0.16^{***}	-0.16^{***}	-0.16^{***}
		p = 0.0005	p = 0.002	p = 0.002
HML		-0.15^{***}	-0.12^{**}	-0.11^{**}
		p = 0.0002	p = 0.02	p = 0.03
RMW			−0.03	−0.01
			p = 0.73	p = 0.92
CMA			−0.10	−0.08
			p = 0.23	p = 0.31
Mom				0.03
				p = 0.44
BAB Factor	0.93^{***}	0.81^{***}	0.82^{***}	0.79^{***}
	p = 0.00	p = 0.00	p = 0.00	p = 0.00
S Factor	-0.40^{***}	-0.41^{***}	-0.38^{***}	-0.38^{***}
	p = 0.0000	p = 0.0000	p = 0.0000	p = 0.0000
Constant	0.14	0.06	0.06	0.05
	p = 0.25	p = 0.60	p = 0.61	p = 0.62
Observations	97	97	97	97
R^2	0.89	0.92	0.92	0.92
Adjusted R^2	0.89	0.92	0.92	0.92
Residual Std. Error	1.13 (df = 93)	0.96 (df = 91)	0.96 (df = 89)	0.97 (df = 88)
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 17: Governance-related Beta portfolio from 2013 (Sector controlled)

	Dependent variable:			
	ESG Beta portfolio returns			
	(1)	(2)	(3)	(4)
‘Mkt-RF‘	-0.09^{***}	-0.09^{***}	-0.09^{***}	-0.10^{***}
	p = 0.01	p = 0.005	p = 0.01	p = 0.003
SMB		-0.15^{***}	-0.15^{***}	-0.15^{***}
		p = 0.001	p = 0.003	p = 0.003
HML		-0.02	-0.04	-0.02
		p = 0.69	p = 0.49	p = 0.74
RMW			0.02	0.07
			p = 0.78	p = 0.38
CMA			0.07	0.10
			p = 0.36	p = 0.17
Mom				0.09^{**}
				p = 0.03
BAB	0.87^{***}	0.80^{***}	0.80^{***}	0.72^{***}
	p = 0.00	p = 0.00	p = 0.00	p = 0.00
‘G factor‘	-0.37^{***}	-0.34^{***}	-0.36^{***}	-0.35^{***}
	p = 0.0000	p = 0.0004	p = 0.0005	p = 0.0005
Constant	0.13	0.12	0.11	0.11
	p = 0.23	p = 0.26	p = 0.28	p = 0.29
Observations	97	97	97	97
R^2	0.93	0.94	0.94	0.94
Adjusted R^2	0.92	0.93	0.93	0.94
Residual Std. Error	0.98 (df = 93)	0.92 (df = 91)	0.93 (df = 89)	0.91 (df = 88)
Note:				*p<0.1; **p<0.05; ***p<0.01

7 Conclusion

In this paper, we examine whether an anomaly may exist given this raise in constrains imposed to portfolio managers resulting to the bounce of sustainability investment. We propose a straightforward and comprehensive approach based on a double sort methodology. We assume that investors prefer High-ESG-Beta securities in order to fulfill conventional portfolio guidelines and sustainability goals. By extension, Low-ESG-Beta should be abandoned by investors, suggesting a premium for those assets. We use a pooled regression and a portfolio analysis to identify and quantify this possible phenomena using US-listed firms of the MSCI USA Index and Refiniv overall ESG scores.

Our findings suggest that Low-ESG-Beta securities are relinquished by investors and generate higher risk adjusted returns. However, our first approach does not confirm if this phenomena happens in profit of High-ESG-Beta securities. The ESG-related Beta portfolio performance results, once regressed with standard asset pricing factors and controlled with the ESG and Beta factors premium, prints positive and significant alphas. We infer that an anomaly exist and investors tend to prefer High-ESG-Beta securities to compare Low ESG-Beta stocks in order to meet with their fundamental and sustainability goals. Our results also involve that this possible phenomena is relatively recent undertaking. Extending our sample period to 2003 reduce the power of our initial findings. This can be explained by the recent emergence of the ESG investment.

The practical implications for investors are numerous. First, we conclude that sustainability portfolio constrains and the jump in screening ESG passive products have miss-pricing impact on stocks. Reducing the scope of active bet, along with leverage constrains forced portfolio managers to have a limited attention on the Low-ESG-Beta securities. Second, alternative investment firms may be willing to profit of this opportunity and thus, would erased the anomaly. Also, the recent backlash in the US may have already offset the misspring phenomena. Recently, (Ishika and Sheryl, 2023) highlighted that hedge fund managers adapted their position from the green hype and initiate short ESG investment strategy.

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8 Appendices

Appendix A Alpha computing methodology

First we employ asset pricing models to identify factors that explain the return of each assets. The most common within the asset pricing field are models developed by Fama and French (1993). They introduced the Three factor models which is an extension of the Capital Asset Pricing Model also called CAPM (Treynor ,1962; Sharpe,1964; Litner, 1965; Mossin, 1966). The CAPM formula is defined as in Equation (3). Models are based on theory that the return generated by the investors are partly due to the factors beyond the portfolio managers's control. The French Three-Factor model (FF3) capture the contribution of three different factors wich are, the market performance (Rm-Rf), the size effect of firms called the Small minus Big (SMB) and the value firm effect, the High Minus Low (HML). The FF3 models is defined in Equation (4). Fama and French extended the FF3 by adding two additional factors and conceptualized the Five-Factors (FF5) model, rationalizing that the privous model was incomplete. They argued that FF3 model did not capture the expected returns caused by profitability and the investment factors. They added the Robust Minus Worst (RMW) for profitability and Conservative Minus Aggressive (CMA) factor for investment effetc. The FF5 model is defined in Equation (5). Then we added the Momuntum factor to the FF5 in Equation (6).

$$R_i - R_f = \alpha + \beta_i(R_m - R_f) + \epsilon \tag{5}$$

$$R_i - R_f = \alpha + \beta_i(R_m - R_f) + \beta_i SMB + \beta_i HML + \epsilon \tag{6}$$

$$\begin{aligned} R_i - R_f = \alpha + \beta_i(R_m - R_f) + \beta_i SMB + \beta_i HML + \beta_i RMW \\ + \beta_i CMA + \epsilon \end{aligned} \tag{7}$$

$$\begin{aligned} R_i - R_f = \alpha + \beta_i(R_m - R_f) + \beta_i SMB + \beta_i HML + \beta_i RMW \\ + \beta_i CMA + \beta_i MoM + \epsilon \end{aligned} \tag{8}$$

R_{it} is the return in month t of one of the portfolio
R_f is the risk free rate
$R_m - R_f$ is the return spread between stock market and cash
SMB is the return spread of small minus large stocks (i.e the size effect)
HML is the return spread of cheap minus expensive stocks (i.e the value effect)
RMW is the return spread of the most profitable firms minus the least profitable
CMA is the return spread of firms that invest conservatively minus aggressively
MoM is the return spread of Winner stocks minus losers (i.s the Momentum effect)

We collect the factors betas of stocks i according to different asset pricing models defined below. Then we use those beta to compute the alpha for i securities at time t for different asset pricing models. The equation (6) represent the formula we use to obtain the alpha securities based on the FF6 model.

$$\begin{aligned} \hat{\alpha}_{i,t} = R_{i,t} - \hat{\beta}_1 \times (R_m - R_f)_{i,t} - \hat{\beta}_2 \times SMB_{i,t} - \hat{\beta}_3 \times HML_{i,t} - \hat{\beta}_4 \times RMW_{i,t} \\ - \hat{\beta}_5 \times CMA_{i,t} - \hat{\beta}_6 \times MoM_{i,t} \end{aligned} \tag{9}$$

Appendix B Sector rotation of an ESG long-short strategy

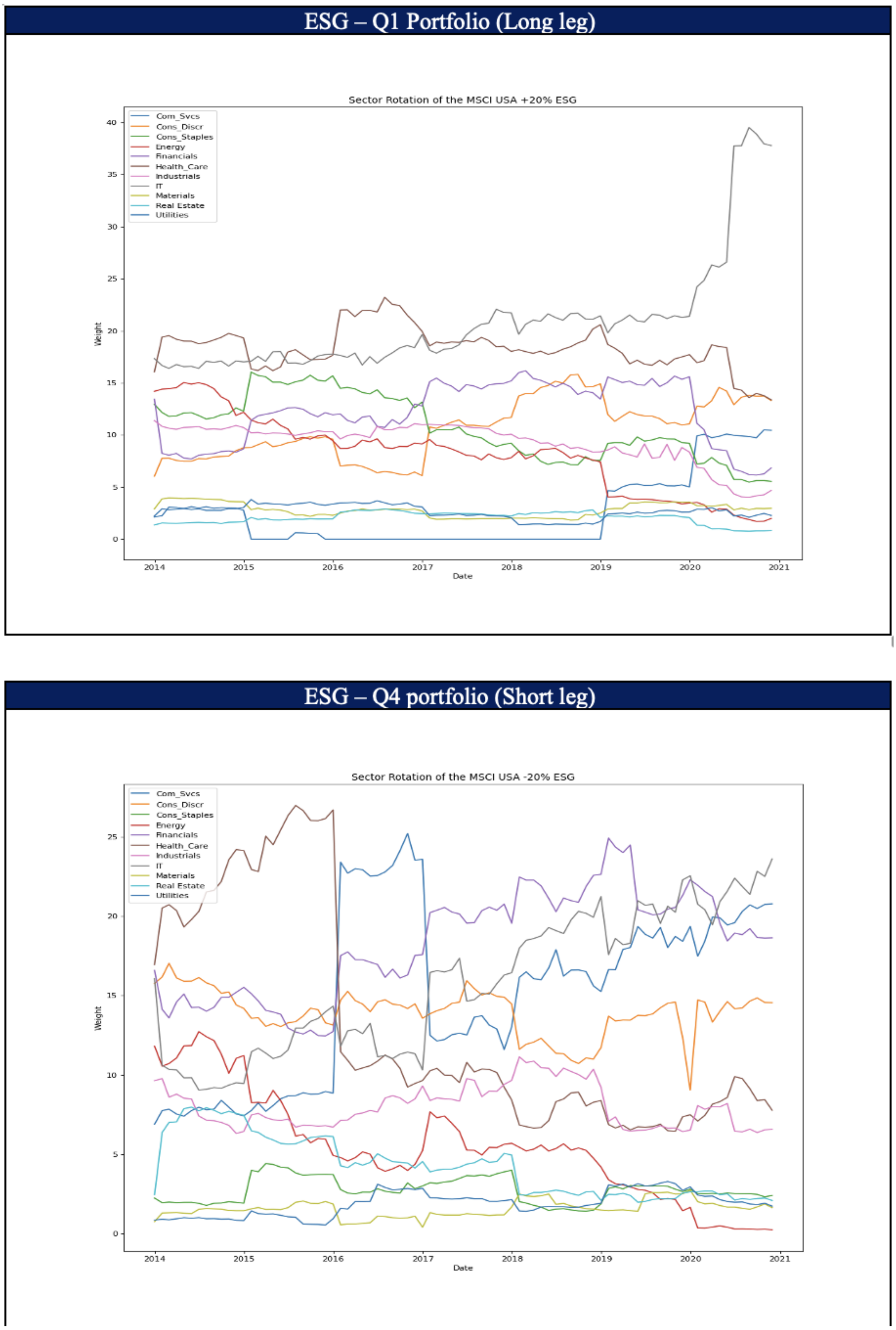

Figure 2: Sector rotation exposure within Q1 and Q5 portfolios.