How green is green? Anatomy of ESG funds' selection*

Dunhong Jin[1], Roni Michaely[1], and Menghan Wang[1]

[1]University of Hong Kong

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Abstract

We examine the stock selection processes of ESG funds and evaluate their effectiveness in delivering meaningful environmental and financial outcomes by comparing them to appropriate benchmarks. On average, ESG portfolios exhibit an average emission 36% lower than otherwise identical portfolios. Yet over 90% of this is achieved through strategic elimination strategic elimination of the 2% holdings comprising the top 25 corporate emitters—highlighting a reliance on extensive-margin selection. Active ESG funds employ this approach more aggressively through industry-level exclusions, whereas index ESG funds achieve reductions through stock-level selection within industries. Despite these adjustments, ESG funds maintain holdings closely aligned with their benchmarks, incurring minimal compromises in diversification and systematic risk, and performing on par financially. Notably, ESG index funds outperform both active ESG funds and their non-ESG counterparts. While ESG funds only have modestly higher ESG scores, they demonstrate significantly lower ESG risk exposure. By dissecting the mechanisms underlying ESG portfolio construction, our findings clarify how targeted divestment drives environmental outcomes and why its limited scope constrains broader impact.

Keywords: ESG, Selection, Mutual funds, Benchmark, Top emitters

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*Emails: dhjin@hku.hk (Dunhong Jin), ronim@hku.hk (Roni Michaely), menghanw@connect.hku.hk (Menghan Wang). We thank Gustavo Grullon, Emirhan Ilhan, Taylan Mavruk, Ran Duchin, Xavier Giroud, Zhan Shi, seminar participants at the University of Melbourne, UNSW, the University of Sydney, Macquarie University, Korea University, Sungkyunkwan University, ESCP Business School, the Hong Kong University of Science and Technology (Guangzhou), and conference participants at Lapland Investment Fund Summit, 2nd HKU-TLV Summer Finance Conference, EFMA, ASFA, SWUFE International Conference on Green Finance and ESG, HKU Inaugural ESG Conference, HKU-Belgium Sustainability Conference, Inaugural HKU Governance and Sustainability PhD Workshop (invited lecture) for helpful comments and suggestions. The usual disclaimer applies.

1 Introduction

The growth of ESG funds has encountered notable challenges, as 2023 marked the first calendar year of net outflows in over a decade (Morningstar, 2024).[1] Society demands to know whether and how these funds meet their sustainability promises. Existing literature documents that ESG funds exert minimal, if any, "treatment" or engagement with the companies they hold (e.g., Heath, Macciocchi, Michaely and C. Ringgenberg, 2023; Atta-Darkua, Glossner, Krueger and Matos, 2023). Any impact is likely through stock "selection," though the exact manner and extent of such selection remain ambiguous.[2] Hence, understanding how these funds select and adjust their portfolios in pursuit of ESG objectives has important implications for investors' assessment of fund performance and risks, as well as for firms' cost of capital and corporate attention to environmental concerns.

The goal of this article is to systematically anatomize and quantify the stock selection practices of US equity ESG funds. Specifically, we examine whether and how ESG portfolio holdings differ from otherwise identical non-ESG funds (or relative to benchmark indices) in terms of carbon emissions, ESG scores, and ESG risk scores; and the costs associated with these selection strategies, including impacts on diversification, sensitivity to energy prices and climate as well as inflation risks, and overall performance. We also explore differences in stock selection strategies between active and index funds.

Our research provides several novel insights into the stock selection processes of ESG funds. We highlight four key findings here. First, we find that ESG funds largely retain the primary components of benchmark indices in their portfolios, exhibiting minimal deviations in holdings, while selectively eliminating many of the top 25 emitting companies at extensive margin. This approach results in significantly reduced emissions at their portfolio level relative to benchmarks and non-ESG funds, with over 90% of the emission reduction attributable to adjustments in approximately 2% of holdings comprising the top emitters. This is important

[1] Larry Fink, CEO of BlackRock, committed to "put sustainability at the center of investment approach" in his 2021 letter to CEOs, a move that was largely welcomed by many stakeholders at the time. Yet, by 2023, Fink faced criticism for his ESG-focused investment strategy, with detractors arguing that BlackRock's emphasis on ESG was either insufficient or misguided (Financial Times, 2023).

[2] Kim and Yoon (2023) find that PRI signatories do not necessarily construct portfolios with higher ESG score as compared to those of others. Gibson Brandon, Krueger and Schmidt (2021) show that higher ESG scores are evident in ESG funds in the global sample; however, this pattern is not present in the US sample.

since it implies that even under the best-case scenario, ESG funds can affect the cost of capital of at most 25 firms. Second, this strategy yields negligible differences in standard risk profiles, such as portfolio standard deviation. Yet, ESG funds are significantly less exposed to ESG-related risks. Thus, despite holding almost identical portfolios to non-ESG funds, ESG funds "walk the talk" by avoiding a handful of highly polluting firms. Third, ESG funds do not compromise financial performance; over the sample period (2000–2022), their returns have been comparable to those of similar non-ESG funds.

Fourth, the stock-selection strategies of index funds and active funds differ. Since index funds are constrained to track the performance of a pre-specified index, ESG index funds achieve emission reductions primarily through stock-level selection. In contrast, ESG active funds, which are less constrained, accomplish this more through industry-level selection. Indeed, most of the avoidance of the heavy polluting firms, which concentrate in only a few industries, is done by active funds.

To gain deeper insight into our research questions, we use two distinct choices for an appropriate risk-adjusted benchmark. Firstly, we follow many related studies that compare ESG funds to non-ESG funds with similar characteristics (e.g., Hartzmark and Sussman, 2019; Heath et al., 2023). This approach enables us to evaluate the deviations in holdings of ESG funds relative to their non-ESG peers, given their focus on ESG considerations. However, this scaling is incomplete, as it does not account for the benchmark performance against which an ESG fund is typically evaluated—such as the Morningstar Category index for the fund's investment category. Indeed, this type of index benchmarking is commonly used when studying mutual fund performance (Ma, Tang and Gómez, 2019; Cohen, Kim and So, 2024). Hence, secondly, we add a comparison to a benchmark that often serves as an objective yardstick for evaluating performance and assessing fund manager compensation.[3]

We begin with investigating the extent to which ESG funds deviate from their otherwise similar non-ESG counterparts, i.e., matched non-ESG funds within the same Morningstar Category. Overall, we find that the holding deviations are negligible—based on the deviation

[3]We maintain the flexibility to incorporate alternative benchmark index choices, such as the subjective Primary Prospectus Benchmark index sourced from funds' prospectuses (e.g., Sensoy, 2009; Cremers, Fulkerson and Riley, 2022), or other objective types of indices. Our main findings remain robust under these alternative specifications, with results displayed in Online Appendix Section I.

levels between non-ESG funds and their closest matching non-ESG counterparts within the same category, serving as a placebo test. In our sample, 80% of ESG funds are classified as large-cap, with an average deviation of only 0.05 percent per stock relative to their similar non-ESG counterparts; this is comparable to a similar 0.05 percent deviation per stock observed when comparing these non-ESG funds to their closest matching non-ESG funds. For the remaining 20% of ESG funds, the deviation can be larger, ranging from approximately 0.5 percent for mid-cap funds to about 1 percent for small-cap funds; yet is also comparable to the levels of deviation between similar non-ESG fund groups. Thus, in terms of deviation from benchmark holdings, there is nothing unique about ESG funds.

A striking observation from the portfolio holdings of ESG funds reveals that emission reductions are achieved predominantly through exclusion at the extensive margin rather than through adjusted weights at the intensive margin. Specifically, among the top 25 corporate emitters—responsible for over half of total reported emissions—35% of ESG funds refrain from holding any shares. Although these divestments represent less than 2% of total portfolio holdings, they account for over 90% of the realized emission reductions attributable to ESG screening. Outside this subset, ESG portfolios are statistically indistinguishable from non-ESG counterparts along environmental dimensions, suggesting that targeted exclusions, rather than broad-based decarbonization, drive the observable effects of ESG investing.

Upon closer inspection, we find that active and index funds employ somewhat different strategies to cut emission. Concerning the top 25 emitters, 38.9% of ESG active funds hold no shares, compared to just 4.5% of ESG index funds. Another crucial aspect is to understand whether the selection is achieved by de-weighting the brownest firms within each industry or simply de-weighting the brownest industries: measured by emission intensity, 82% of the outperformance of ESG index funds stems from within-industry selection, whereas 57% of the outperformance of ESG active funds results from across-industry selection, echoing active funds' focus on avoiding the top emitters. This is precisely due to the diversification constraints placed on passive funds, which lead them to de-weight specific firms within industries while still retaining the majority of industries in the benchmark.[4]

Subsequent inquiry involves quantifying the greenness of ESG funds using various ESG

[4]We verify using the method in Parise and Rubin (2025) that our results are not driven by ESG firms engaging in window dressing by tilting their portfolios toward ESG stocks near the end of the quarter.

metrics, including emissions, ESG risk exposures, and ESG ratings. We consider both ESG performance between ESG funds and their Morningstar benchmark index as well as benchmark-adjusted ESG performance between ESG funds and comparable non-ESG counterparts, controlling for market-wide fluctuations over time and isolating within-family and within-category variations.

Despite the minimal deviation in holdings, ESG funds are able to achieve significant and meaningful outperformance along some dimensions. The portfolios held by ESG funds display a significant 36% reduction in absolute GHG emissions and a 26% decrease in emission intensity when compared to their benchmark indices, or, when compared to their non-ESG counterparts. However, the outperformance of ESG funds on social aspects, such as board diversity and employee safety, is not significant.

ESG funds' portfolios also do well in term ESG risk: Using the Sustainalytics risk score and various RepRisk measures, we find that portfolio companies of ESG funds have a significantly 4% lower Sustainalytics risk score and a 19% smaller likelihood of ESG incidents compared to those in their benchmark indices, with even greater differences when compared to similar non-ESG counterparts.

Next, we examine the most visible and commonly used metrics—ESG scores. We aggregate firm-level ESG scores provided by third-party rating agencies including MSCI, Refinitiv, S&P, Sustainalytics, and KLD, to portfolio levels. Despite a substantial reduction in portfolio emissions, we observe only a modest yet statistically significant outperformance—less than 1%, corresponding to approximately 19% of a standard deviation—in ESG or E scores when comparing funds to their benchmark indices, as well as between ESG and non-ESG funds. As we elaborate in Online Appendix Section E, the discrepancy between the significant reduction in real outcome (CO2) and ESG scores is due to the fact that the weight of emission is limited in the calculation of the ESG scores.

A key question is whether the selection of green stocks comes at the expense of funds' performance (e.g., financial returns) and fundamental risk profiles, such as diversification, volatility, and exposure to macroeconomic risks.

We begin by examining the performance of ESG funds, a topic of considerable debate

in the literature.[5] In general, net of fees, there are no significant differences between ESG funds and their comparable non-ESG counterparts based on risk-adjusted abnormal returns (e.g., 6-factor alpha, CAPM alpha); though ESG funds tend to slightly outperform non-ESG funds based on benchmark-adjusted net returns (with statistical significance).[6] The outperformance, if any, is primarily driven by ESG index funds; nonetheless, the results are sensitive to the empirical specifications used—with full fixed effect structure and controls employed, the performance differences become negligible. Conversely, ESG active funds do not demonstrate outperformance, partly due to the higher management fees they charged compared to both ESG index funds and non-ESG active counterparts.

ESG fund strategies may influence not only their returns but also their risk profiles, such as portfolio volatility, diversification, and market beta. We find that the average monthly return volatility of ESG funds is 4.76%, only modestly higher than the 4.56% observed in their benchmark indices, though statistically significant.[7] Not surprisingly, index funds consistently demonstrate lower volatility compared to active funds. This is despite ESG funds holding only 17% of the firms in their benchmark indices (see also Pollet and Wilson (2008)), and having twice the industry concentration of their benchmarks, another measure of diversification (e.g., Kacperczyk, Sialm and Zheng, 2005).

We also assess the systematic risk of ESG funds through their market beta. ESG funds exhibit a lower CAPM beta relative to their benchmark indices, while their beta levels are comparable to those of similar non-ESG funds.[8] Another relevant set of risk factors are certain macroeconomic risks. In particular, many emission reduction strategies of ESG funds frequently lead to the avoidance of energy and utility firms. Measured by exposure to energy

[5]The literature presents mixed conclusions regarding the relationship between ESG performance and financial performance, largely due to the diverse measures employed and the varying perspectives adopted in different studies. For instance, firm-level analysis generally suggests a positive association between ESG performance and financial outcomes (e.g., Eccles, Ioannou and Serafeim, 2014; Friede, Busch and Bassen, 2015; Bolton and Kacperczyk, 2021; Hsu, Li and Tsou, 2023; Bolton and Kacperczyk, 2023); while studies examining ESG funds tend to report a negative relationship (e.g., Hartzmark and Sussman, 2019; Raghunandan and Rajgopal, 2022; Gantchev, Giannetti and Li, 2024).

[6]When comparing the benchmark-adjusted abnormal returns of ESG and non-ESG funds, particularly after including controls and fixed effects, both the economic and statistical significance levels become very small—consistently less than 1 basis point of outperformance per month across all alpha measures.

[7]Note that the monthly return volatility is calculated as the standard deviation of monthly returns. Therefore, a monthly volatility of 4.87% corresponds to an annual volatility of approximately $4.76\% \times \sqrt{12} = 16.49\%$.

[8]As perhaps expected, ESG index funds have a lower market beta (0.831) compared to ESG active funds (0.918); in comparison, their benchmark indices have an average beta of 1.003.

inflation shocks (Fang, Liu and Roussanov (2025)), ESG funds exhibit significantly lower energy beta relative to both their benchmark indices and non-ESG counterparts, demonstrating reduced effectiveness as a hedge against energy-driven inflation. During periods of significant increases in energy prices, ESG funds underperform their non-ESG peers by an annualized excess return of 6.71%. This finding highlights the limitations of ESG funds' strategies in capturing benefits during energy-inflation episodes. Conversely, we also observe that during significant declines in energy prices, ESG funds outperform their non-ESG counterparts by an annualized excess return of 3.97%. Overall, ESG funds are less exposed to energy shocks.

Our paper contributes to the literature on the association between institutional investors and corporate ESG performance (e.g., Pastor, Stambaugh and Taylor, 2025), particularly the selection strategies employed by ESG funds. The existing evidence on "selection" remains mixed and limited across various ESG measures and samples. For example, Raghunandan and Rajgopal (2022) find that self-labeled ESG funds select firms based solely on ESG scores rather than actual carbon emissions or compliance records, while Gibson Brandon, Glossner, Krueger, Matos and Steffen (2022) and Kim and Yoon (2023) report no improvement in ESG scores after US funds became PRI signatories. While the majority of existing research has concentrated exclusively on comparing the performance differences between ESG and non-ESG fund portfolios, this study contributes to the literature by elucidating the underlying mechanisms through which such differences emerge. Our findings indicate that ESG funds deviate only modestly in holdings compared to otherwise identical non-ESG counterparts. Despite these small deviations, ESG funds achieve significant reductions in portfolio-level emissions—primarily by selectively excluding only a very small subset of high-emitting firms.

Prior literature suggests that ESG investing may have limited real-world impact on corporate behavior and capital allocation. Edmans, Levit and Schneemeier (2023) demonstrate that exclusion strategies fail to effectively incentivize high-polluting companies to undertake corrective actions. Similarly, Berk and Van Binsbergen (2025) show that ESG investing exerts minimal impact on firms' cost of capital. Broader empirical evidence also reveals minimal treatment and causal effects from ESG investment strategies.[9] Our findings align with these

[9]Heath et al. (2023) show that ESG funds primarily engage in selection rather than treatment. Atta-Darkua et al. (2023) find that climate-conscious investors rebalance their portfolios towards firms with lower emissions, yet there is little evidence of active engagement.

results and provide the mechanistic explanation for these limited firm-level effects: the negligible divergence in holdings between ESG and non-ESG funds translates into equally negligible pressure on firms. This fundamental similarity in portfolio composition thus explains why ESG funds fail to generate meaningful pressure on corporate ESG practices or cost of capital.

Our study also contributes to the ongoing debate on the relationship between ESG performance and financial performance. Prior research using emissions as a metric has found evidence of a positive carbon premium (e.g., Bolton and Kacperczyk, 2021; Hsu et al., 2023; Bolton and Kacperczyk, 2023) and developed related theoretical frameworks (e.g., Pástor, Stambaugh and Taylor, 2021). However, more recent studies report no premium when considering emissions intensity or disclosed emissions metrics, or accounting for data release lags (e.g., Zhang, 2025; Aswani, Raghunandan and Rajgopal, 2024; Atilgan, Demirtas, Edmans and Gunaydin, 2023). Similarly, while some studies using ESG scores, such as Friede et al. (2015), find a positive relationship between ESG and financial performance, others, like Brammer, Brooks and Pavelin (2006) and Duque-Grisales and Aguilera-Caracuel (2021), report a negative association. Our paper addresses this question from the unique perspective of investment funds, employing a range of return metrics such as factor model alphas and benchmark-adjusted returns. Using those factor models, we find that ESG funds' net-of-fee financial performance is not significantly different from that of their benchmarks or comparable non-ESG peers, especially with controls and fixed effects employed, which reinforces our earlier insights into the fund selection strategies. Beyond this average effect, we find that ESG index funds stand out by consistently outperforming both ESG active funds and non-ESG funds. Understanding these nuances can aid investors in making more informed decisions that align with both their non-pecuniary values and financial objectives.

2 Data and Sample

To construct our sample, we use quarter-end holding data of all mutual funds investing in US equity from 2010 to 2022, sourced from Morningstar. We require that the US equity holdings in our sample funds comprise at least 50% of the total fund holdings. We identify ESG funds using two variables from Morningstar: a fund being a sustainable investment

product (based primarily on fund's prospectus and closely aligned with name-based classifications), or compliance with EU SFDR Article 8 or Article 9 ("EU SFDR" criteria apply to all funds marketed in EU, including those investing in US equity markets). There is virtually no time-series variation in our ESG classification: over the entire sample period, only four funds ever switch between ESG and non-ESG status.

Within the sample, we identify a fund as index fund, i.e., passively tracking the performance of an index, based on the "Index Fund" label from Morningstar. The rest would be identified as active funds.

The ESG scores we employ are divided into two categories. The first type is a general score, which primarily measures a firm's positive contributions to ESG, with a higher score indicating better ESG performance. Our analysis incorporates general ESG scores from five rating providers: MSCI, Refinitiv (formerly Asset4), KLD, S&P Global (formerly RobecoSAM), and Sustainalytics, to account for potential discrepancies as shown by Berg, Koelbel and Rigobon (2022). We adjust all the scores to a scale of 0 to 100 for comparison. Sample coverage varies across scores: MSCI and Refinitiv are available throughout our entire sample period, while KLD and (legacy) Sustainalytics scores are available until 2019, and S&P scores are available from 2013.

Another type of score is the ESG risk score, which primarily evaluates a company's exposure to ESG-related risks, with higher scores indicating higher exposure to ESG risks. We include ESG risk scores from two data providers: Sustainalytics and RepRisk. Sustainalytics introduced their ESG risk scores in 2018. RepRisk provides the RepRisk Index (RRI), which quantifies a company's reputational risk exposure to ESG issues, along with incident-level data that we aggregate to determine the number of negative ESG incidents per quarter.

The greenhouse gas (GHG) emissions data is obtained from Trucost.[10] We analyze both the (Scope 1) absolute emissions in CO_2 equivalent, and emission intensity, which is the absolute emission level scaled by total revenues.

For industry classification, we resort to SASB's Sustainable Industry Classification System

[10]Trucost incorporates self-disclosed information from annual reports, sustainability reports, filings with the U.S. Environmental Protection Agency (EPA), and other third-party datasets like the Carbon Disclosure Project (CDP). In cases where self-disclosed emissions are not available, Trucost estimates emissions based on their proprietary model, taking into account the input and output of firms' economic activities, and industry characteristics.

(SICS) in the main analysis, as used by, for instance, Grewal, Hauptmann and Serafeim (2021). Additionally, we incorporate the standard Fama-French 49 industries classification for a robustness check, and the primary results remain unchanged.

A key advantage of Morningstar data is that it provides benchmark index for each individual fund, with three common options: (i) the Morningstar Category index, (ii) the Modern Portfolio Theory index, and (iii) the Primary Prospectus Benchmark index. In our primary analysis, we use the Morningstar Category index, which is based precisely on a fund's holdings and investment style, and is widely used by academia and investors to assess performance and potential risks (Sensoy, 2009; Ma et al., 2019; Mateus, Mateus and Todorovic, 2019; Cohen et al., 2024). The comparison and robustness checks involving alternative benchmarks are detailed in Online Appendix Section I.

Morningstar Category classification categorizes equity funds based on market capitalization (large-cap, mid-cap, small-cap) and investment style (value, blend, growth). This system classifies equity funds into nine distinct categories, with each fund within a specific category assigned the corresponding Morningstar Category index as its benchmark.

We exclude fund-quarters with missing holding data, benchmark holding data, fund family information, or inconsistent benchmark across share classes within the same fund. Additionally, we exclude 3,756 fund-quarter observations where either the fund's or the benchmark's US equity holding is less than 50% of the total fund holdings.[11] This results in a final dataset comprising 120,415 fund-quarter observations from 3,849 unique funds between 2010 and 2022, with 516 funds (about 13%) classified as ESG funds. Among the ESG funds, 88% are active funds. Further details on the sample composition are provided in Panel A of Table 1.

According to the Morningstar Category classification, the nine categories and their corresponding benchmark indices are outlined in Panel B of Table 1. In our sample, about 64% of the funds are classified as large-cap funds, with the "large blend" category being the largest among the nine, accounting for over 30% of the total funds (over 50% of the ESG funds) and using the Russell 1000 Total Return Index as their benchmark. 16% of the funds are classified as mid-cap funds, while 20% are small-cap funds.

[11] The average holdings of US equity in our sample funds are 81.9%.

3 How Do ESG Funds Construct Lower-Emission Portfolios?

We examine how ESG funds select stocks and incorporate sustainability aspects into their portfolios. After outlining our empirical design, we analyze the holding deviations of ESG funds compared to a control group without ESG mandates. We then investigate whether ESG funds successfully construct lower-emission portfolios and how they accomplish this. Specifically, we assess the extent to which ESG funds shift holdings toward "green" and away from "brown" stocks. We further decompose this behavior into industry and stock-level selection, analyze the intensive and extensive margins of stock selection, and identify the fund characteristics associated with these allocations.

3.1 Measures and empirical design

Denote the total numbers of stocks by K and the total numbers of industries by N in the market. Label the set of all the stocks as $\mathcal{K} = \{1, 2, ..., K\}$. Each stock belongs to an industry, which belongs to the set of all the industries, $\mathcal{I} = \{I_1, I_2, ..., I_N\}$.

For any fund j, its quarterly stock holdings at time t is denoted by a vector $\boldsymbol{w}_{jt} = (w_{jt}^1, w_{jt}^2, ..., w_{jt}^K)^T$, where $w_{jt}^k = 0$ means that fund j does not have holdings in stock k at time t. We aggregate holdings to the industry level by taking the sum of all the stock holdings within the same industry, i.e., for any industry $i \in \mathcal{I}$, the industry-level holdings of fund j is denoted by $W_{jt}^i = \sum_{k \in i} w_{jt}^k$. Then we denote the quarterly industry-level holdings of fund j at time t by a vector $\boldsymbol{W}_{jt} = (W_{jt}^{I_1}, W_{jt}^{I_2}, ..., W_{jt}^{I_N})^T$.

Correspondingly, we denote the stock-level holdings of the Morningstar Category benchmark index of fund j at time t by a vector $\overline{\boldsymbol{w}}_{jt} = (\overline{w}_{jt}^1, \overline{w}_{jt}^2, ..., \overline{w}_{jt}^K)^T$. Denote the industry-level holdings of the benchmark index at time t by a vector $\overline{\boldsymbol{W}}_{jt} = (\overline{W}_{jt}^{I_1}, \overline{W}_{jt}^{I_2}, ..., \overline{W}_{jt}^{I_N})^T$.

First, we aim to understand the extent to which ESG funds' holdings deviate from their otherwise identical non-ESG peers or appropriate benchmark indices. We compute the *holding deviation* as the average stock-level holding difference. For instance, for a fund j and its

comparison fund/benchmark l, the holding deviation at time t is calculated as

$$\Big(\sum_{k=1}^{K}\Big|w_{jt}^{k}-w_{lt}^{k}\Big|\Big)\Big/\sum_{k=1}^{K}\mathbb{1}_{\{w_{jt}^{k}\neq 0\}\cup\{w_{lt}^{k}\neq 0\}} \tag{1}$$

where the numerator is the sum of the absolute differences in each individual stock holding between fund j and l, and the denominator counts the total number of stocks that appear in either fund j's holdings or fund l's holdings.

Next, to measure any ESG performance, for instance, GHG emissions, ESG scores, ESG risk scores, we calculate the value-weighted average performance based on quarter-end holdings. Denote the stock-level ESG performance at time t by a vector $\boldsymbol{s}_t = (s_t^1, s_t^2, ..., s_t^K)^T$. This is shared by all the funds as well as the benchmark index. We also measure the industry-level ESG performance of fund j at time t by a vector of value-weighted average ESG performance of firms within the same industry, denoted by a vector $\boldsymbol{S}_{jt} = (S_{jt}^{I_1}, S_{jt}^{I_2}, ..., S_{jt}^{I_N})^T$, where $S_{jt}^{i} = \sum_{k\in i} s_t^k w_{jt}^k / W_{jt}^i$ for any industry $i \in \mathcal{I}$. Correspondingly, we denote the industry-level ESG performance of the benchmark of fund j at time t by $\overline{\boldsymbol{S}}_{jt} = (\overline{S}_{jt}^{I_1}, \overline{S}_{jt}^{I_2}, ..., \overline{S}_{jt}^{I_N})^T$, where $\overline{S}_{jt}^{i} = \sum_{k\in i} s_t^k \overline{w}_{jt}^k / \overline{W}^i_{jt}$. When calculating portfolio-level ESG performance, we always restrict the sample to fund-quarter with at least 60% of the holdings data available.[12]

Overall ESG performance difference between ESG fund j and its benchmark index can be expressed as

$$\begin{aligned}\Delta_{jt} &= \boldsymbol{s}_t^T(\boldsymbol{w}_{jt}-\overline{\boldsymbol{w}}_{jt}) \qquad \text{(stock-level expression)}\\ &= \boldsymbol{S}_{jt}^T\boldsymbol{W}_{jt} - \overline{\boldsymbol{S}}_{jt}^T\overline{\boldsymbol{W}}_{jt} \quad \text{(industry-level expression)}\end{aligned} \tag{2}$$

We further decompose the performance difference into *industry selection* and *stock selection*. Industry selection captures deviations from benchmark industry weights, whereas stock selection isolates the effect of intra-industry stock picking. Mathematically, performance difference in equation (2) can be decomposed as

$$\begin{aligned}\Delta_{jt} &= \Delta_{jt}^{ind} + \Delta_{jt}^{stk}\\ &= \overline{\boldsymbol{S}}_{jt}^T(\boldsymbol{W}_{jt}-\overline{\boldsymbol{W}}_{jt}) + \boldsymbol{W}_{jt}^T(\boldsymbol{S}_{jt}-\overline{\boldsymbol{S}}_{jt})\end{aligned} \tag{3}$$

[12]This does not restrict measures like emissions or ESG scores. However, for metrics such as incident rate or certain ESG risk measures, it may result in some data loss due to missing values or uncovered sample periods of these metrics, as detailed in the relevant sections.

Another way of decomposition differentiates *extensive margin* and *intensive margin*, which is particularly relevant for the holdings of highly polluting companies. Extensive margin speaks for the decision of whether to hold the stock or not. It is computed as the sum of the weights of stocks that are held by the benchmark but not held by the fund, scaled by the sum of the weights of top 25 emitters. The weights are determined by the benchmark portfolio holdings. While intensive margin refers to the decision to underweight or overweight the top emitters relative to the benchmark, conditional on the stock being held. Mathematically,

$$\begin{aligned}
\%Extensive_{jt} &= \sum_{\substack{w_{jt}^k=0,\\ \overline{w}_{jt}^k\neq 0}} s_t^k \overline{w}_{jt}^k / \sum s_t^k \overline{w}_{jt}^k \\
\%Intensive_{jt}^{underweight} &= \sum_{\substack{w_{jt}^k\neq 0,\\ \overline{w}_{jt}^k\neq 0,\\ w_{jt}^k<\overline{w}_{jt}^k}} s_t^k \overline{w}_{jt}^k / \sum s_t^k \overline{w}_{jt}^k \\
\%Intensive_{jt}^{overweight} &= \sum_{\substack{w_{jt}^k\neq 0,\\ \overline{w}_{jt}^k\neq 0,\\ w_{jt}^k\geq\overline{w}_{jt}^k}} s_t^k \overline{w}_{jt}^k / \sum s_t^k \overline{w}_{jt}^k
\end{aligned} \tag{4}$$

where s_t^k equals 1 if firm k is one of the top 25 emitters by absolute emissions, 0 if otherwise.

For any ESG performance measure, we present (i) descriptive statistics that compare ESG funds, the entire sample of non-ESG funds, and their respective benchmark indices (BM), and (ii) regression analysis to provide detailed insights into the extent to which ESG funds diverge from matched non-ESG funds with respect to their benchmark-adjusted performance:

$$BM\text{-}adj\ ESG\ performance_{jt} = \beta_0 + \beta_1 \times ESG\ fund_j + \vec{\gamma}\cdot\vec{V}_{jt} + \tau_t + \phi_f + \psi_c + \epsilon_{jt} \tag{5}$$

$$\begin{aligned}
BM\text{-}adj\ ESG\ performance_{jt} = \beta_0 + \beta_1 \times ESG\ fund_j + \beta_2 \times ESG\ fund_j \times Active_j \\
+ \beta_3 \times Non\text{-}ESG\ fund_j \times Active_j + \vec{\gamma}\cdot\vec{V}_{jt} + \tau_t + \phi_f + \psi_c + \epsilon_{jt}
\end{aligned} \tag{6}$$

where in regression (5), we focus on β_1 that measures the difference between ESG and non-ESG funds, and in regression (6), we focus on β_2 (β_3) that explains the difference between active and index funds within ESG (non-ESG) funds. Benchmark-adjusted performance refers to the difference in performance for a specific measure between funds and their benchmark

indices, $\vec{V}_{jt}$ refers to standard control variables including ln(TNA), quarterly return and management fees, and τ_t denotes year-quarter fixed effect, ϕ_f denotes fund family fixed effect, ψ_c denotes fund category fixed effect. Incorporating these fixed effects enables us to isolate and examine the nuanced performance dynamics of ESG funds in a robust manner: we are able to control for temporal market-wide fluctuations and to eliminate biases that may arise from comparing funds with inherently different risk and return profiles. More uniquely, the inclusion of fund family fixed effects allows us to isolate within-family variation, controlling for shared management styles, resources, and strategic objectives that can influence fund performance.

3.2 Holding deviation

We aim to determine the extent to which ESG funds deviate from their otherwise identical and comparable portfolios. On average, all funds—whether ESG or non-ESG, active or index—hold much fewer stocks than their benchmark indices; however, the number of stocks held by ESG funds is much more comparable to that held by non-ESG funds within the same category (shown in Table E.1 in Online Appendix Section E).

Therefore, we match each ESG fund with a non-ESG fund that: (i) shares the same Morningstar Category, (ii) is of the same type (active or index fund) as the ESG fund, (iii) has the closest average Morningstar star ratings (based on the three-year lagged return), and (iv) has the closest AUM. The matching process is conducted on an exclusive basis. After matching, for instance, within the "large blend" category—where 48% of our ESG active funds and 83% of our ESG index funds are classified, ESG active funds hold an average of 140 individual stocks, whilst the matched non-ESG active funds hold an average of 130 individual stocks. Recognizing that substantial differences in stock holdings can occur even among funds within the same category, we compare the average stock holdings of all ESG funds in a category to those of all matched non-ESG funds. This approach helps to mitigate the impact of individual funds or extreme cases. The measures detailed in Section 3.1 can be readily extended to incorporate this comparison.

In Column (1) and (4) of Table 2, we present the total absolute differences in stock holdings between the average ESG funds and their matched non-ESG counterparts and the average

absolute holding deviation (calculated by scaling the total deviation by the number of stocks as in equation (1)), respectively. The results clearly demonstrate that the average holding deviation is minimal—on average, 5 bps per stock. Specifically, the most important group—large blend ESG funds, whether active or passive—shows an average holding difference of only 1 bps per stock; whereas mid- and small-cap funds, which make up less than 20% of the active sample and 5% of the passive sample, can exhibit higher levels of deviation.

To assess the extent of deviation of ESG funds, we conduct a placebo test: we match the group of comparable non-ESG funds to their own closest non-ESG counterparts by performing again the same matching process—i.e., based on fund type, star rating, AUM, and Morningstar Category—then examine the deviation levels between these two groups of similar non-ESG funds. These deviation levels, shown in Column (2) and (5) of Table 2, serve as a reference. By calculating the "abnormal deviation" (by taking the difference between Column (1) and (2), or between Column (3) and (4)), we find that the deviations between similar non-ESG funds are quite similar to those between ESG funds and their comparable non-ESG counterparts (on average an abnormal deviation of 1 bps per stock). This suggests that ESG funds have only marginal deviation in holdings.

Our findings are not irreconcilable with those of Pastor et al. (2025). While Pastor et al. (2025) investigate a specific type of divergence by isolating the portion of portfolio weight differences directly attributable to ESG characteristics, our approach begins by identifying general tracking error and bridge the gap in Section 3.4 and 3.5 by explicitly analyzing the contribution of underweight positions in brown stocks and sectors to this general deviation.

3.3 Do ESG funds build lower-emission portfolios?

Do ESG funds outperform their comparable benchmarks in terms of GHG (Scope 1) emissions, part of the "E" in ESG, and to what extent?

This section investigates the extent to which ESG funds outperform comparable benchmarks on GHG (Scope 1) emissions. Driven by advances in measurability and mandatory reporting, fund carbon footprints face intense regulatory scrutiny. Green funds, for example, must often explicitly report their portfolio's weighted-average carbon intensity (WACI) (Robertson and Sanga, 2023). Global regulatory focus is also intensifying: in May 2022, the

SEC requested enhanced carbon footprint and WACI disclosures for ESG funds, while similar mandates are active or anticipated in jurisdictions including Europe, Hong Kong, China, and Japan.

We find that ESG funds do construct less polluting portfolios: Panel A of Table 3 and Table 4 uncover notable and statistically significant outperformance in the emissions of ESG funds—their portfolios emit approximately 35.9% less GHG emissions and have around 25.6% lower emission intensity compared to their corresponding benchmark indices assigned by Morningstar Category classification. Furthermore, ESG index funds exhibit higher emission levels and intensity compared to ESG active funds. The gap between ESG index funds and their benchmarks is also smaller, though both types of funds outperform their respective benchmarks, as shown in Panel A: ESG active funds exhibit a 38.5% reduction in absolute emissions compared to their benchmark indices, whereas ESG index funds show only a 21.1% reduction. This discrepancy remains consistent when considering emission intensity.

We also compare ESG funds to their non-ESG peers within the same Morningstar Category, as detailed in Panel B of Table 3 and 4. Non-ESG funds exhibit higher benchmark-adjusted emission levels and intensity than ESG funds, whether or not we include fixed effects or controls (as seen in columns (1)-(3)). However, non-ESG funds, particularly non-ESG active funds, also construct portfolios with lower emission levels and intensity compared to their benchmarks.

In summary, ESG funds consistently construct portfolios with significantly lower emissions, regardless of the comparable benchmarks used for comparison. Our evidence also suggests that mutual funds (or institutional investors) in general tend to hold greener portfolios than the market, which is consistent with the findings of Atta-Darkua et al. (2023) and Pastor et al. (2025).

3.4 Avoiding top emitters: Extensive vs intensive margin

How do ESG funds manage to select portfolios that achieve lower emission levels? We show that more than 90% of the outperformance in emissions is achieved by avoiding investments in the top 25 emitters. These companies constitute less than 2% adjustments of ESG funds' holdings, as shown in Panel A of Table 5, yet they account for more than 50% of the total

absolute emissions from 2010 to 2022. We find that ESG funds hold a significant 38.4% fewer top emitters—based on absolute emissions—compared to their benchmark indices. Notably, 35% of ESG funds do not hold any of these companies at all, as illustrated in Figure 1. When considering top emitters sorted by emission intensity, all the results remain consistent, as demonstrated by Table E.2 in Online Appendix Section E.

Another important insight from Panel A of Table 5 is that, when funds avoid top emitters, the reduction in emissions predominantly stems from extensive margin (on average 72.6% for ESG funds) rather than intensive margin, measured using equation (4). When examining the heterogeneity of this "top-emitters-avoidance" strategy between active and index funds, though both funds tend to hold significantly lower amount of top emitters, ESG active funds unsurprisingly exhibit a higher percentage of extensive margin avoidance compared to index funds. For top emitters by absolute emissions (by emission intensity), 38.9% (64.6%) of ESG active funds do not hold any of these top-emitting companies, compared to just 4.5% (19.8%) of ESG index funds. This discrepancy can be attributed to the investment principle of index funds, which typically have strict diversification requirements and cannot completely divest from some top emitters, especially when they belong to the same industry.

Interestingly, non-ESG funds also tend to eliminate extremely polluting companies from their portfolios, albeit to a lesser extent compared to their ESG counterparts. For non-ESG funds, the proportion of funds avoiding top emitters is about 10% lower compared to ESG funds. However, most of these reductions are achieved by non-ESG active funds, while non-ESG index funds make little effort to hold fewer top emitters. This is evident from the variable $Non\text{-}ESG\ fund \times Active$ in Panel B of Tables 5 and E.2. This indicates that at least non-ESG active funds are also taking steps to reduce their environmental impact, although not as significantly as ESG funds.

Overall, our finding suggests that these reduced holdings of top emitting profiles indeed correspond to meaningfully and substantially lower emissions; excluding these top emitters, all funds—whether ESG or non-ESG, active or index—fail to differ from their benchmarks, as intuitively shown by Figure 2.

To further investigate how and to what extent avoiding top emitters contributes to emission reductions, we focus on ESG funds that specifically use divestment strategies—those

who consistently avoid top-emitting profiles at the extensive margin. Within our sample, approximately 36.5% of fund-quarter observations do not include any of these top emitters. If we define funds with more than 80% of fund-quarters holding zero top emitters as consistent users of divestment strategies, then 136 out of 516 ESG funds (26.4%) consistently divest both cross-sectionally and over time, of which 133 are ESG active funds.

We present the comparison results between ESG funds that employ divestment strategies and those that do not in Panel C of Table 5. As perhaps expected, ESG funds that consistently adopt divestment strategies achieve significantly lower emissions than those that do not: consistent users of divestment strategies are able to achieve a significant 86.2% lower absolute emission (3343 metric tons CO_2 less) and 57.5% lower emission intensity (70 metric tons CO_2 per total revenues in million USD less).[13]

An important remaining question relates to the type of firms ESG funds tend to avoid, and the relative importance of these firms in index construction. We display the firms that have ever been listed as top 25 emitters throughout our sample period in Figure 3, with Panel A identifying the top 25 emitters based on absolute emissions, and Panel B determining the top 25 emitters based on emission intensity.

The list of top emitters fluctuates on a quarterly basis, featuring in total 42 firms based on absolute emissions and 63 based on emission intensity. However, a handful of major emitting companies consistently appear on the list, such as ArcelorMittal, ExxonMobil, Southern Company, Berkshire Hathaway, etc, primarily energy and utility companies.[14] Among the list measured by absolute emissions, the majority are from polluting industries, with 45.2% from utilities, 19.0% from oil and gases, 11.9% from transportation, 4% from steel works, while the remaining 6% are from non-polluting industries.

One potential concern is that if ESG funds tend to avoid these top emitters, it may compromise their diversification and lead to a significant tracking error. Therefore, we further assess the overlap between the top-emitting companies and the primary components of

[13]It is also likely that this subsample of divestment ESG funds demonstrates different return and risk profiles compared to other ESG funds. Our analysis indicates that these divestment funds tend to have similar returns but are somewhat less diversified, with the details presented in Table E.9 in Online Appendix Section E.

[14]Berkshire Hathaway has high emissions primarily due to its subsidiaries, many of which operate in industries with significant carbon footprints, such as Berkshire Hathaway Energy (owning companies like PacifiCorp, BHE Pipeline Group, MidAmerican Energy, Nevada Utilities, etc) and BNSF Railway.

major indices, particularly, the top 25 firms with the largest market capitalizations as they are primary contributors to index returns (the top 25 components by market capitalization account for more than half of the total weight in the S&P 500). The results can be found in Figure D.1 in Online Appendix Section D. Intriguingly, only four companies appear on both the top emitting list and the top market capitalization list when measured by absolute emissions: Berkshire Hathaway, ExxonMobil, Chevron, and ConocoPhillips. When assessed by emission intensity, none of the firms on the top emitting list are included in the top market capitalization list. This observation can be further linked to the financial performance and risk profiles of ESG funds compared to their benchmarks, as will be detailed in Section 5.

3.5 Avoiding polluting industries: Across vs within industry selection

Top emitters are likely concentrated within a few specific industries. This observation leads us to explore two distinct, yet not mutually exclusive, strategies that funds may employ to reduce holdings of high emission profiles: one involves selecting industries to reduce exposure to certain sectors, while the other focuses on selecting individual firms within industries based on their ESG characteristics.

As shown in Panel A of Table 6, compared to their benchmarks, ESG funds on average hold 14.8% less of polluting industries, including coal, oil and gas, mining, utilities, transportation, etc.[15] Within ESG funds, ESG active funds hold fewer polluting industries (16.1% less) compared to ESG index funds (5.9% less). As shown in Panel B, the benchmark-adjusted holdings of polluting industries are also significantly lower for ESG funds compared to their non-ESG counterparts.

The analysis also reveals distinct strategies employed by different types of ESG funds: for ESG active funds, 57.0% of the reduction in emission intensity comes from across-industry selection, whereas for ESG index funds, 82.2% of the reduction comes from within-industry stock selection, as can be seen from Panel A of Table 4, when we decompose the performance

[15]SICS offers varying levels of granularity. The industry classification used in this table is the SICS 77 Industry Classification for a more precise definition of polluting industries. However, the results remain robust when using the SICS 38 Industry Classification or the FF 49 Industry Classification.

difference using equation (3) and scaled by the difference. The results are consistently statistically significant and become even more pronounced when fixed effects and controls are added, with ESG index funds utilizing over 50% less industry-level selection compared to ESG active funds, as demonstrated in the regressions specified in Panel C of Table 4.[16] Note that we focus on the subsample of fund-quarter observations with lower emissions than their benchmarks to identify the outperformance segment and its sources; while the results remain robust in the full sample analysis.[17]

The result that ESG index funds perform selection in a more granular way (de-weighting the brownest firm within each industry) than ESG active funds (simply de-weighting the brownest industries) may seem, at first glance, surprising. However, consistent with Section 3.4, this difference in essence reflects the expectation that index funds are subject to more stringent diversification requirements, leading them to maintain more balanced portfolios and avoid entirely eliminating polluting industries. This pattern is also evident among non-ESG funds, where non-ESG active funds engage in significantly more across-industry selection than their index counterparts.

Moreover, our results pattern persists across various definitions and granularities of industry classifications. The finer the industry classifications (e.g., transitioning from SICS 11-Sector, 38-Subsector, 77-Industry Classification), the greater the general level of within-industry selection observed across all types of funds. Nevertheless, the relative distinction between active and index funds remains unchanged, both at the cross section and over time.

In summary, ESG funds nearly replicate the portfolios of their otherwise identical counterparts, with minimal deviations in holdings. Despite this similarity, they are able to construct portfolios with substantially lower emissions. This is because most of the emission reduction stems from adjustments involving less than 2% of their holdings comprising the top 25 emitters. Additionally, ESG active funds tend to select specific industries and count more on extensive-margin strategies, whereas ESG index funds tend to select individual firms within

[16]The results for absolute emissions follow a similar pattern, albeit less strongly: as shown in Table 3, for ESG active funds, 43.1% of the reduction in absolute emissions comes from across-industry selection, while for ESG index funds, 71.6% of the reduction is due to within-industry stock selection.

[17]In the across/within-industry selection analysis, we focus on fund-quarter observations with lower emissions than their benchmarks to avoid abnormal values, such as negative or above 100% figures. While the full sample analysis shows the combined contributions of across- and within-industry selection still sum to 100%, some negative values appear, indicating that for certain funds, this selection can actually increase emissions.

each industry.

A potential concern regarding our findings is that fund managers might strategically adjust holdings immediately prior to disclosure dates to artificially inflate portfolio-level ESG performance, particularly active funds (Parise and Rubin, 2025; An, Huang, Lou, Wen and Xu, 2025; Chen, Chen and You, 2024). If such "green window dressing" is prevalent, relying solely on quarter-end snapshots would overestimate a fund's true ESG selection behavior. To address this, we adopt the methodology of Parise and Rubin (2025) to estimate an *ESG beta*. If a fund engages in window dressing, it must temporarily overweight ESG assets just before the reporting deadline, leading to a spike in its ESG beta relative to normal periods.

The results, summarized in Table E.3 in Online Appendix Section E, suggest that active ESG funds in our sample exhibit ESG betas that are 0.053 lower during the pre-disclosure window relative to the baseline control period. When we restrict our analysis to the overlapping sample of US-domiciled funds and further partition by domicile, we observe that US-domiciled ESG funds display a significantly positive ESG beta difference of 0.122 in the pre-disclosure window, consistent with Parise and Rubin (2025). In contrast, the overall negative difference is predominantly driven by EU-domiciled funds, which appear less prone to window dressing, suggesting a stricter adherence to ESG mandates compared to their US counterparts. This nuanced distinction underscores that, on the whole, green window dressing is unlikely to account for the selection behavior we documented.

4 Quantifying ESG Funds' Greenness

Emission terms, analyzed in Section 3.3, are not the only aspect we consider; we also assess other E and S metrics, including ESG ratings, ESG risk exposure, board diversity, and employee safety. Overall, we show that companies selected by ESG funds generally have lower emissions and less ESG-related risk exposure. However, they do not differ much in terms of their ESG scores and social aspects.

4.1 ESG scores

Firm-level ESG scores, also referred to as ESG impact scores, are frequently employed by both professionals and scholars to evaluate a company's positive contributions to E, S, and G aspects, despite ongoing controversies regarding how they are being measured. Hence, we examine whether ESG funds outperform their comparable funds in terms of ESG score measures, and to what extent. To make sure our results are robust and account for any discrepancies, we use both individual ESG scores and a combined ESG score, i.e., the average of the existing ESG scores including MSCI, Refinitiv, KLD, S&P Global, and Sustainalytics. We aggregate firm-level ESG scores to the portfolio level using a weighted average.

We begin by examining the overall score that integrates E, S, and G components. The results of combined ESG scores are presented in Table 7. ESG funds tend to select stocks with slightly higher and statistically significant ESG scores compared to both their benchmark indices (Panel A) and non-ESG peers within the same Morningstar Category (Panel B). The difference is more pronounced when compared to non-ESG peers, with the gap reaching approximately 1%, corresponding to about 19% of a standard deviation in the scores. Findings remain consistent across ESG scores from various rating agencies, as detailed in Table E.4 in Online Appendix Section E. Therefore, despite a significant discrepancy and low correlation among various rating providers (Berg et al., 2022), using combined ESG scores does not mask individual score-level differences.

Surprisingly, ESG index funds exhibit consistently and significantly higher benchmark-adjusted ESG scores compared to ESG active funds, as shown in columns (4) and (5) of Panel B in Table 7. This difference naturally becomes less pronounced in column (6) when controls are included, owing to the high collinearity of the management fees variable. Relative to their respective benchmark indices, ESG index funds achieve a significant 3.3% higher score, whereas ESG active funds barely match their benchmarks. Additionally, a similar pattern persists among different types of non-ESG funds: while non-ESG funds consistently underperform benchmark indices across all five rating agencies, this underperformance is primarily driven by non-ESG active funds.

The modest positive difference in portfolio scores between ESG funds and their benchmarks also extends to both pure Environmental (E) and pure Social (S) scores. The combined

E score, which averages all available E scores, is detailed in Table 8. While the average difference between ESG funds and their benchmarks is small, ESG index funds achieve a significant 4.5% higher combined E score compared to its corresponding benchmark indices as well as ESG active funds, mirroring the same pattern observed with the overall ESG scores. For a robustness check of the E score from each individual rating provider, see Table E.6 in Online Appendix Section E.

To understand the discrepancy between the emission results and the E score outcomes, as well as the economic significance of the differences in these scores, we review the characteristics of the underlying ESG scores in Online Appendix Section G and propose multiple explanations. First, we have demonstrated that ESG funds deviate only marginally from their otherwise identical non-ESG counterparts by divesting from the top 25 emitters. While the emission distribution is heavily tailed and concentrated within specific industries—allowing small holding deviations to reduce emissions substantially, the distribution of ESG scores across industries, in contrast, exhibits limited variation. This supports our finding that any outperformance in scores primarily stems from within-industry selection rather than across-industry selection, as indicated in Panel A of Table 7. Second, four of the five rating providers incorporate industry adjustment through assigning different weights to sub-components based on industry characteristics, diminishing the economic interpretability of cross-industry score comparisons. Lastly, these ESG scores typically include a broad set of factors beyond tangible outcomes like emissions, such as disclosure, risk, opportunities, and compensation (Berg et al., 2022). As a result, utility companies may be ranked higher than banks and technology companies, for example, by Sustainalytics ESG and E scores.

Given these considerations, it is unsurprising that ESG funds show only modest outperformance in ESG scores. If anything, our analysis reveals that ESG index funds consistently attain the highest ESG and E scores across categories. Therefore, if emissions are the primary measure of climate impact, it follows that ESG impact scores may not serve as accurate proxies for climate risk. Consequently, studies that evaluate the greenness of ESG funds based solely on these scores are, at the very least, inadequate.

4.2 ESG risk exposure

Investing in ESG funds should be associated with lower exposure to ESG risks—related to adverse events such as climate change, social unrest, and governance failure. We utilize two primary sources to measure ESG risk: Morningstar Sustainalytics and RepRisk.[18]

Morningstar Sustainalytics offers a firm-level ESG risk score, which models the "issue beta" for each predetermined material ESG issues plus additional idiosyncratic risk exposure (the score has only been available since 2018, resulting in a smaller number of observations). RepRisk, on the other hand, specifically measures negative ESG incidents and sentiment using textual analysis from newspapers and social media. The RepRisk Index (RRI) captures the firm-level reputational risk exposure to ESG issues, with a smaller number indicating lower risk. RepRisk also tracks the occurrence of incidents, which we aggregate to the quarterly number of ESG incidents. A review of characteristics of ESG risk scores is provided in Online Appendix Section G.

The results are summarized in Table 9. Compared to the benchmark indices, ESG funds outperform in terms of both Sustainalytics risk score and RepRisk RRI measures, by having a significant 4.1% lower risk score (Panel A), and a significant 7.2% less RRI and a significant 19.2% smaller likelihood of ESG incidents per quarter (Panel B). When examining the two RepRisk measures, the majority of these outperformances can be attributed to ESG active funds, which primarily achieve this through within-industry selection, as shown in Panel B. Across all categories, non-ESG index funds have the highest ESG risk exposure.

Moreover, as evident in Panel C, ESG funds consistently and significantly exhibit lower benchmark-adjusted ESG risk exposure compared to their non-ESG peers within the same Morningstar Category, whether assessed by the Sustainalytics risk score (Columns (1)-(2)) or RepRisk measures (Columns (3)-(6)). As anticipated, the widely-used fund-level MorningStar "globe" rating, which aggregates Sustainalytics risk scores, also reveals a robust and notable difference, with ESG funds scoring 0.71 points higher than their non-ESG counterparts.

To summarize, we find superior performance of ESG funds in managing ESG-related risks, both in comparison to their benchmark indices and their comparable non-ESG counterparts,

[18] Papers utilizing the RepRisk measures include Houston, Lin, Shan and Shen (2022), Gantchev, Giannetti and Li (2022), Derrien, Krueger, Landier and Yao (2025), and Duan, Li and Michaely (2023).

with this advantage being more pronounced relative to ESG impact scores. Any outperformance in ESG impact scores primarily stems from ESG index funds, whereas the reduced ESG risk exposure is mainly attributable to ESG active funds. Given that the outperformance in ESG risk measures exceeds that in impact scores but is less than the emission reductions achieved through top emitter avoidance, we investigate the extent to which avoiding these top emitters explains the variation in ESG risk assessments. Specifically, we calculate the proportion of ESG risk difference between funds and benchmarks that can be attributed to avoiding top emitters. We find that avoiding top emitters explains approximately 57.8% of the variation in Sustainalytics risk score and 43.5% in RRI, underscoring the significant role that top emitter avoidance plays in reducing ESG risk exposure.

Additionally, we examine the performance of ESG funds along social dimensions, with detailed results available in Online Appendix Section H. Overall, ESG funds show little difference from their benchmarks in terms of board diversity and employee safety.

5 The Costs for Greenness

Another important aspect is whether ESG funds have to compromise their expected returns or risk profiles to achieve their ESG objectives. We analyze the associated costs from various perspectives, including funds' financial performance, diversification, portfolio return volatility, CAPM beta, and exposure to macroeconomic risks.

5.1 Alphas and fees

The relationship between ESG performance and financial performance has been extensively studied, yet the results remain inconclusive. This largely stems from differences in how ESG and financial performance are measured. For example, Gantchev et al. (2024) identify sustainability-driven trades by funds nearing a globe rating upgrade and demonstrate that these trades can impair financial performance. Kim and Yoon (2023) find no significant change in fund returns following PRI signing.

We consider various measures of risk premium (excess return) and alphas (CAPM, 4-factor, and 6-factor alpha). We examine net of fee return, i.e., the net return after accounting

for operating expenses and management fees that investors have to pay. We follow Morningstar's definitions for these calculations: net-of-fee risk premium is determined by taking the change in accumulation unit value (AUV) during the period and dividing it by the starting AUV, minus risk-free rate.[19] The alphas are calculated as the risk-adjusted excess return based on factor models for which the beta is estimated based on previous 60-month returns, requiring at least 36 months of the return data available for estimation. The results of CAPM alpha and 6-factor alpha are presented in Table 10, while the remaining measures are deferred to Table E.8.

As can be seen from Panel A of Table 10, for full-sample analysis, ESG funds outperform their benchmark indices with respect to CAPM alpha (2.5bps/month) and 6-factor alpha (16.7bps/month). However, when comparing benchmark-adjusted returns between ESG funds and their non-ESG peers within the same Morningstar Category, the outperformance disappears across all alpha measures, especially when adding controls and fixed effects.

Within ESG funds, ESG index funds outperform on average, with a significant 25bps higher monthly CAPM alpha and a significant 33bps higher monthly 6-factor alpha, as detailed in Panel A. This pattern persists across all the alpha and risk-premium measures. This distinction between index and active funds also extends to non-ESG fund samples, based on the inspection of the interaction term $non\text{-}ESG\ fund \times Active$ in Panel B. In fact, non-ESG active funds consistently underperform their benchmarks after fees, regardless of the alpha measures employed.

The underperformance of ESG active funds can partly be attributed to the higher management fees they charge in comparison to both ESG index funds and non-ESG active funds. Detailed information on management fees and expense ratios is provided in Table 11. ESG active funds tend to have average management fees that are 0.50% higher than those of ESG index funds and 0.16% higher than those of non-ESG active funds.

These results suggest that, on average, ESG funds can construct portfolios with lower climate impact and climate risk without compromising their financial returns. This is particularly true for ESG index funds, as they outperform their benchmarks in terms of all return

[19] AUVs are recommended to be used instead of net asset values (NAVs) because the AUV more accurately reflects the actual returns passed on to an investor. AUV takes into account a subaccount's fund expense ratio and all insurance expenses.

measures.

5.2 Diversification and systematic risk exposure

ESG fund strategies can influence not only their financial performance but also their risk profiles. In this section, we begin by exploring how these funds' selection influences portfolio diversification and, consequently, impacts the resulting standard risks of their portfolio, as measured by portfolio return volatility. Furthermore, we analyze the systematic risk exposure and other macroeconomic risk exposure associated with ESG funds.

To measure portfolio diversification, consistent with existing literature, we employ two metrics: the number of stocks held by the fund (Evans and Archer, 1968; Goetzmann and Kumar, 2008; Wu and Westerholm, 2024) and industry concentration (Kacperczyk et al., 2005; Ceccarelli, Ramelli and Wagner, 2024).[20] The results for both metrics are presented in Panel A of Table 12.

ESG funds demonstrate significantly more concentrated portfolio holdings in comparison to their benchmark indices, with the number of stocks held by these funds amounting to only 17% of those held by the indices.[21] Certainly, this concentration is primarily driven by the sub-sample of ESG active funds; but even for ESG index funds who are supposed to track some indices, the number of stocks held by them is less than 50% of that in the benchmark indices. Additionally, the average industry concentration of ESG funds is twice as large as that of their benchmark indices.

Non-ESG funds, on the other hand, hold a slightly larger number of stocks, especially non-ESG index funds, which tend to hold about 70% of the benchmark portfolio. However, on average, non-ESG funds also hold fewer than their benchmark indices. Additionally, non-ESG funds exhibit higher industry concentration compared to ESG funds, even when excluding industry-concentrated non-ESG outlier funds (the median industry concentration

[20] Kacperczyk et al. (2005) assign each stock held by a mutual fund to one of 10 industries. They define a measure of industry concentration as the sum of the squared deviations of the value weights for each of the 10 different industries held by a mutual fund relative to the industry weights of the total stock market.

[21] Note that although benchmark indices are nominally composed of exactly 1,000 or 2,000 stocks, in practice, particularly when using ETFs with the same name to approximate the benchmark indices, the average number of stocks in the indices is generally lower, averaging 772 stocks across the nine indices. The number of stocks can also vary due to periodic rebalancing and changes in market conditions.

for non-ESG funds is 1.36% higher than that for ESG funds).

The ultimate portfolio risk measure we focus on is portfolio return volatility—calculated as the standard deviation of monthly/quarterly returns. Interestingly, even though ESG funds hold much less diversified portfolios compared to their benchmark indices, their portfolio return volatility is only modestly higher than that of their benchmarks, with a monthly standard deviation of 4.76% versus 4.56%, though statistically significant, as shown in Panel B of Table 12. These results suggest that the overall impact on portfolio risk is relatively limited. As expected, the portfolio return volatility of non-ESG funds is even less affected, showing very similar volatility to their benchmarks, both monthly and quarterly.

Furthermore, index funds consistently exhibit lower portfolio return volatility compared to active funds, regardless of whether they are ESG or non-ESG funds. This suggests that the broader diversification of index funds contributes to more stable performance over time, compared to their active counterparts. As a supplementary analysis, we conducted a matched sample regression separately comparing ESG active funds with non-ESG active funds. The results indicate that ESG active funds experience a 0.34% higher monthly volatility and statistically significant at the 1% significance level, similar to the patterns observed in Ceccarelli et al. (2024).

Overall, ESG funds tend to hold fewer stocks and exhibit higher industry concentration. However, this does not necessarily result in much increase in portfolio risk on average; if anything, at the margin, ESG active funds have somewhat higher portfolio risk as compared to non-ESG counterparts.

We further examine the systematic risk of ESG funds by investigating their CAPM beta, with the results presented in Table 13. As shown in Panel A, ESG funds exhibit an average beta of 0.907 post fees, while their benchmark indices have a beta of 1.003 post fees, with this difference being statistically significant. However, ESG funds do not seem to differ from their comparable non-ESG counterparts in terms of benchmark-adjusted beta, both economically and statistically. This holds true particularly when controls and fixed effects are included, as detailed in Panel B.

These findings at least indicate that ESG funds are not more exposed to systematic risk than their comparable funds or indices. In fact, they appear less sensitive to market fluctu-

ations when compared to benchmark indices, potentially providing a more stable investment option for investors seeking exposure to sustainable and environmentally responsible assets without incurring excessive risk.

Finally, if ESG funds reduce portfolio emissions by steering clear of major polluters and environmentally harmful industries, it often results in a smaller investment in utility and energy sector companies, which may reduce their capability to benefit from increases in energy prices.

We thus examine their exposure to macroeconomic risks, such as inflation, which is closely linked to energy prices. Using the approach outlined by Fang et al. (2025), we construct inflation shock variable at monthly level by estimating the unexpected components of inflation with a vector autoregression (VAR) model. This VAR model incorporates headline, core, food, and energy inflation, along with the risk-free rate and the log price-dividend ratio of the aggregate stock market portfolio. We then assess each fund's and benchmark's exposure to these inflation shocks by regressing their monthly excess returns against the inflation shocks.

The results are reported in Table 14. In the first specification (Column (1) to (3)), we use the headline inflation shock as a risk factor, while in the second specification (Column (4) to (6)), we include core and energy inflation shocks jointly as risk factors. ESG funds exhibit significantly lower in-sample headline and energy betas compared to both their benchmarks and non-ESG funds.

This finding suggests that ESG funds are less exposed to energy shocks, in other words, somewhat less effective as a hedge against energy-driven inflation shocks, aligning with our expectations. In quantitative terms, during months when energy inflation shocks exceed 30% (the top 1/6 quantile of our sample), ESG funds show an annualized excess return that is 6.71% lower than that of non-ESG funds; Conversely, in the bottom 1/6 quantile, when energy prices fall, ESG funds outperform their non-ESG counterparts by an annualized excess return of 3.97%. That is to say, during the period of heightened energy inflation, for instance, in 2022, non-ESG funds and benchmarks, which typically have greater exposure to energy sector stocks, were able to benefit from the surge in energy prices. In contrast, ESG funds were less able to take advantage of this value inflation, underscoring the limitations of their strategies in capitalizing on energy-driven inflation shocks. Nevertheless, ESG funds generally

outperform non-ESG funds except during these periods of high energy inflation shocks, and therefore, the average return pattern aligns with our findings throughout the entire sample period.

6 Conclusions

Conditional on the fact that ESG mutual funds mostly do selection rather than treatment, in this paper, we conduct a systematic analysis of ESG funds' strategies, environmental and social performances, and costs through the lens of stock selection. To assess their performances, we argue that the most appropriate benchmark would be their otherwise identical portfolio that rating agencies and asset managers themselves use for comparison. In the main body of the paper, we use the benchmark indices suggested by the Morningstar Category classification and similar non-ESG funds within the same Morningstar Category as reference points.

Overall, their selection process can be regarded as relatively superficial and narrow in scope. First, over 90% of this environmental performance is achieved by selectively avoiding a very small subgroup of top emitting profiles. On average, 35% of ESG funds do not hold any companies from this subgroup, highlighting a reliance on extensive-margin selection. Second, ESG funds tend to hold nearly identical portfolios compared to similar non-ESG counterparts, with an average holding deviation of 5 basis points per stock—a level comparable to the differences observed between two similar groups of non-ESG funds. Therefore, it is unsurprising to expect their financial performance closely mirroring that of their benchmark indices and similar non-ESG counterparts, and their impact limited on portfolio companies' ESG improvements, attention to environmental and social issues, or cost of capital.

Upon quantifying their greenness and costs, we conclude that ESG funds construct portfolios with 36% less absolute emissions and 26% lower emission intensity compared to their benchmarks, while imposing minimal additional costs on investors' net returns and volatility. Moreover, ESG funds' portfolios are less exposed to ESG-related risks compared to both indices and comparable non-ESG funds. However, ESG funds do not outperform much in terms of primary ESG scores and charge relatively higher management fees. They are also less

effective as a hedge against some macroeconomic risk factors, such as energy-driven inflation.

We further categorize ESG funds into ESG active and ESG index sub-samples to explore their distinct strategies and performances. Interestingly, ESG active funds tend to emphasize industry-level selection, whereas ESG index funds focus more on stock-level selection, likely due to the diversification requirements inherent in index investing. Furthermore, ESG active funds, on average, underperform ESG index funds in terms of main ESG scores, alphas, diversification, and portfolio risk within our sample period.

In a nutshell, although ESG funds are making strides in creating greener portfolios, their efforts are regrettably limited. After all, these funds do not significantly engage in reducing firms' carbon footprints, and their selection strategies are only likely influential on at most a very small subset of firms. Consequently, an avenue for future theoretical and empirical research is to investigate the broader societal impact of mutual funds' actions in relation to environmental sustainability.

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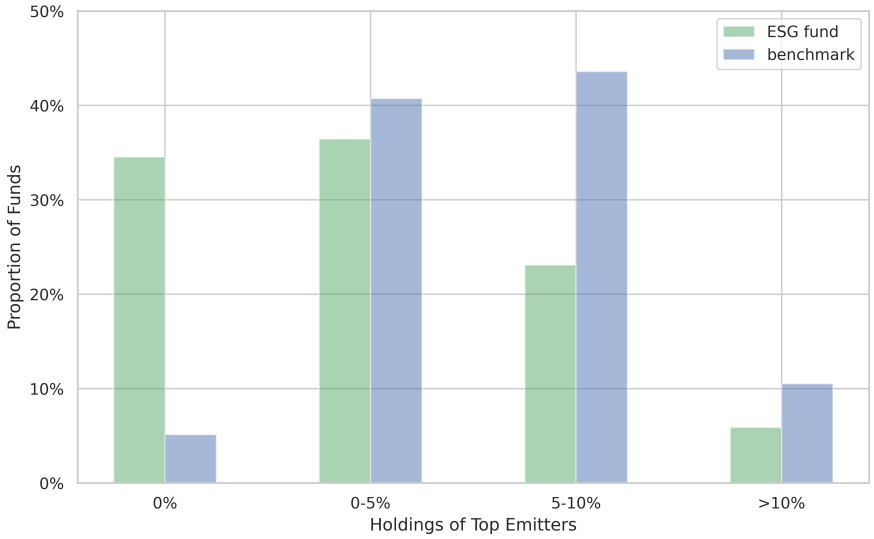
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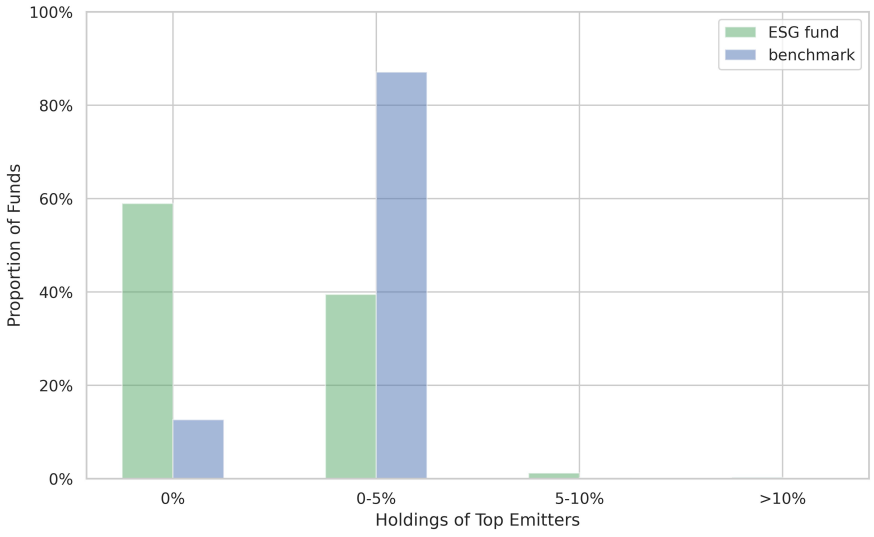
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A Figures

Figure 1: *Holdings of top 25 emitters.* This figure shows the distributions of the holdings of top 25 emitters for ESG funds and their benchmark indices. The green bar represents ESG funds, and the blue bar represents their benchmark indices. Panel A considers top 25 emitters by absolute GHG (Scope 1) emissions, and Panel B considers top 25 emitters by emission intensity.

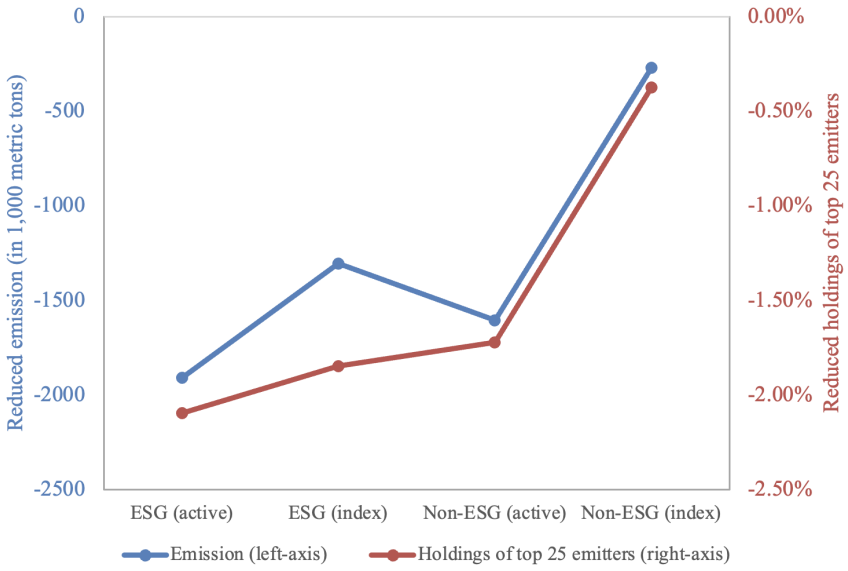


(A) Top emitters by absolute emission

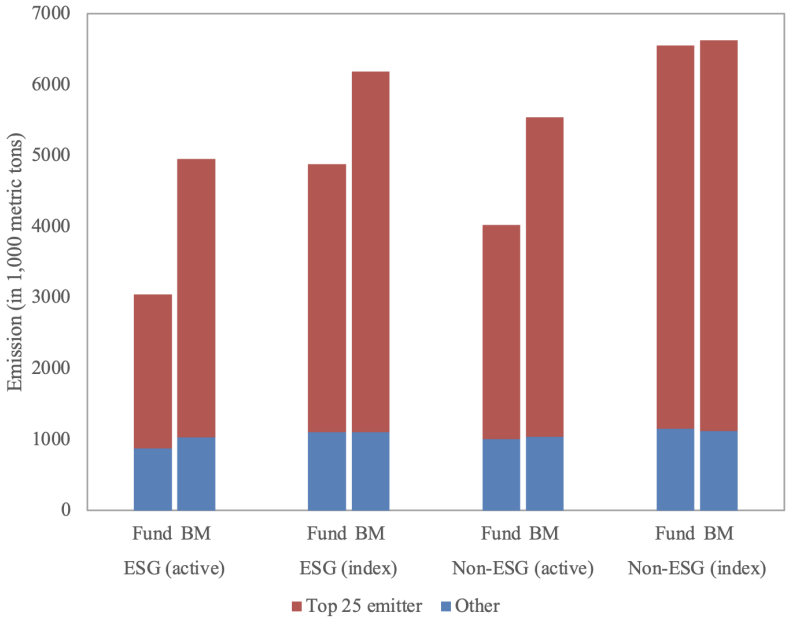


(B) Top emitters by emission intensity

Figure 2: *ESG funds' strategy: avoidance of top emitters.* Panel A displays the differences in holdings and emissions between ESG funds and their non-ESG counterparts. Panel B breaks down the portfolio-level emissions into those from top 25 emitters and those from other firms for ESG funds and their matched non-ESG counterparts relative to their benchmark indices. In the visualization, red areas indicate emissions attributable to the top 25 emitters, while blue areas correspond to emissions attributable to the remaining firms.

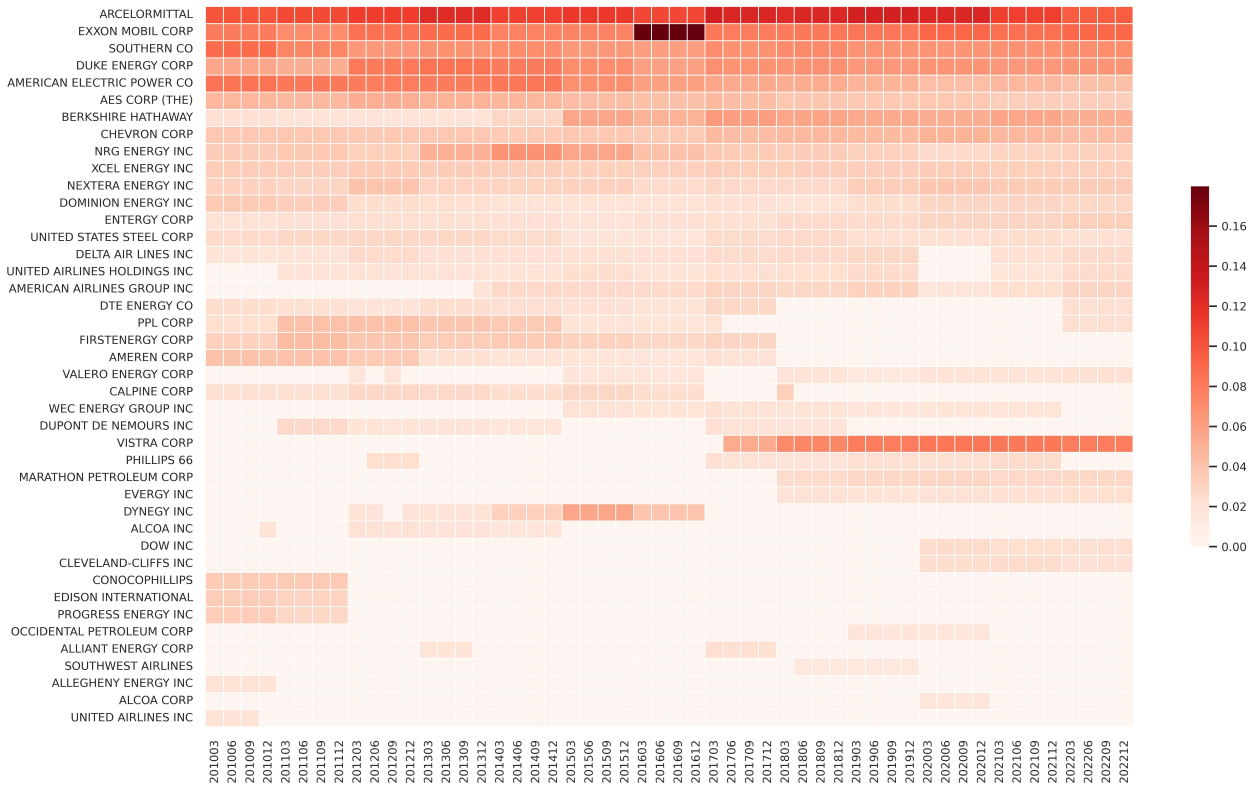


(A) Reduced emissions and holdings of top emitters (fund-benchmark)



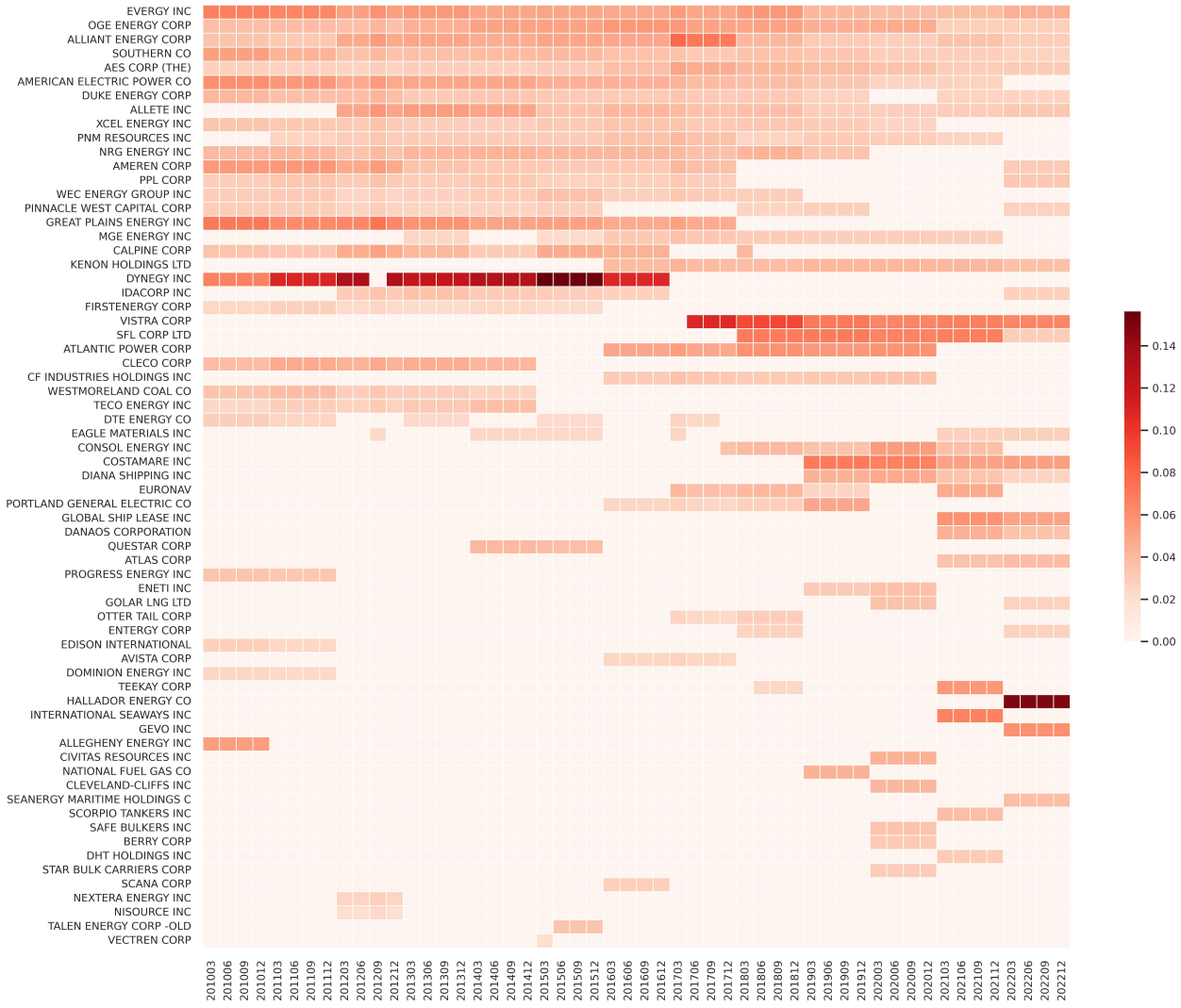
(B) Decomposition of emissions

Figure 3: *Firms ever listed as top 25 emitters.* This visual representation displays the top 25 emitters for each quarter. The vertical axis represents all the companies that have ever been among the top 25 emitters at any quarter between 2010 and 2022. Each cell in the figure represents the status of a specific company for a particular quarter. The color of the cell indicates the emissions level, with the lightest shades indicating that the company was not among the top 25 emitters in that quarter (accounting for zero emission in the total emission of that quarter), and darker shades representing higher emissions (the value in each cell represents the proportion of the company's emissions compared to the total emissions of the top 25 emitters in that particular quarter). The vertical axis is arranged according to the frequency with which companies appear in the top 25 emitters throughout the sample period. Panel A focuses on the top 25 emitters based on absolute GHG (Scope 1) emissions, while Panel B focuses on the top 25 emitters based on emission intensity.[22]



(A) Top emitters by absolute emission

[22]In Panel A, ExxonMobil's emission level in 2016 is abnormally high, which can be partly due to the November 2016 fire at Baton Rouge Refinery. The fire was caused by an explosion on a sulfuric-acid alkylation unit that made octane-boosting components of gasoline in the sprawling Baton Rouge refinery and chemical plant.



(B) Top emitters by emission intensity

B Tables

Table 1: *Sample composition.* This table presents a sample breakdown of our fund and fund holding data, sourced from Morningstar, covering the period from 2010 to 2022. For funds with multiple share classes, their holdings are consolidated into a single entity. Panel A outlines the criteria used to construct our sample. Panel B decomposes our sample according to different Morningstar Categories.

Panel A. Sample selection

	Fund-quarter observations	Number of funds
US equity funds from Morningstar (2010-2022)	988,260	19,005
minus missing holding data	(360,177)	(1,822)
minus missing benchmark holding data	(38,559)	(157)
minus inconsistent benchmark across share classes	(8,664)	(254)
minus missing management firm	(644)	(14)
US equity funds with benchmark information	580,216	16,758
Aggregate share classes to fund level	124,171	3,914
minus US equity holding comprises less than 50% of fund holdings	(3,756)	(65)
US equity fund-quarter data	120,415	3,849
ESG funds	14,932	516
ESG active funds	13,080	452
ESG index funds	1,852	64
Non-ESG funds	105,483	3,333
Non-ESG active funds	94,903	3,014
Non-ESG index funds	10,580	319

Panel B. Morningstar Categories and benchmark indices

Category	Index	Fund-quarter observations	Number of funds	Percent (funds)
Large Value	Russell 1000 Value TR USD	18,215	558	14.5%
Large Blend	Russell 1000 TR USD	34,425	1,209	31.4%
Large Growth	Russell 1000 Growth TR USD	22,943	683	17.7%
Mid-Cap Value	Russell Mid Cap Value TR USD	1,244	102	2.7%
Mid-Cap Blend	Russell Mid Cap TR USD	7,782	250	6.5%
Mid-Cap Growth	Russell Mid Cap Growth TR USD	9,322	253	6.6%
Small Value	Russell 2000 Value TR USD	5,309	156	4.1%
Small Blend	Russell 2000 TR USD	12,069	375	9.7%
Small Growth	Russell 2000 Growth TR USD	9,106	263	6.8%
Total		120,415	3,849	100.0%

Table 2: *Holdings deviation.* This table presents (i) the holding deviations between ESG funds and their matched non-ESG funds within the same Morningstar Category, (ii) the holding deviations between matched non-ESG funds and their closest matching non-ESG peers within the same Morningstar Category, serving as a reference to measure the economic significance of ESG funds' deviation (placebo group), and (iii) the difference between (i) and (ii), definied as "abnormal deviation." The sum of absolute holding deviation (Column (1)-(3)) is calculated as the total of absolute differences in stock holdings between the average ESG funds and their matched non-ESG peers within the same Morningstar Category. The average absolute holding deviation (Column (4)-(6)) is obtained by scaling this sum by the total number of distinct stocks held by either the ESG or non-ESG funds. The table reports the average values across different category-quarter observations.

		Holding deviation (Sum)			Holding deviation (Avgerage)			No. of
	Category	ESG vs matched non-ESG	Placebo group	Abnormal deviation	ESG vs matched non-ESG	Placebo group	Abnormal deviation	ESG funds
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Active	Large value	56.69%	54.14%	2.56%	0.08%	0.07%	0.00%	50
	Large blend	34.34%	30.48%	3.86%	0.01%	0.01%	0.00%	217
	Large growth	48.84%	39.39%	9.45%	0.05%	0.03%	0.01%	96
	Mid value	182.44%	151.66%	30.78%	0.58%	0.52%	0.06%	4
	Mid blend	126.77%	104.98%	21.79%	0.05%	0.04%	0.01%	30
	Mid growth	151.67%	126.61%	25.06%	0.29%	0.21%	0.08%	12
	Small value	194.62%	176.94%	17.68%	0.99%	0.81%	0.18%	2
	Small blend	106.71%	98.88%	7.82%	0.06%	0.04%	0.02%	39
	Small growth	188.55%	169.71%	18.85%	0.72%	0.60%	0.11%	2
Index	Large value	71.05%	62.57%	8.48%	0.09%	0.09%	0.01%	4
	Large blend	27.83%	12.14%	15.69%	0.01%	0.00%	0.01%	53
	Large growth	53.28%	52.35%	0.93%	0.07%	0.09%	-0.03%	4
	Mid blend	93.16%	84.95%	8.21%	0.15%	0.13%	0.01%	1
	Small blend	150.81%	129.61%	21.20%	0.09%	0.08%	0.01%	1
	Small growth	158.72%	170.00%	-11.28%	0.73%	0.17%	0.57%	1
Weighted average		55.49%	47.32%	8.17%	0.05%	0.04%	0.01%	

Table 3: *GHG (Scope 1) absolute emission.* This table shows the portfolio-level Scope 1 GHG absolute emission of ESG funds. In Panel A, "Diff%" is calculated by scaling the average difference of portfolio-level value-weighted absolute emission between funds and benchmark indices using the average benchmarks' absolute emission. For the subsample of fund-quarters with lower portfolio-level emissions than the benchmarks, these differences are further broken down into across-industry and within-industry selection, based on the SICS 38-Subsector Classification. In Panel B, the dependent variable is the benchmark-adjusted portfolio-level absolute emission. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. In Panel C, the regression specification features

$$Across\text{-}industry\ selection_{jt} = \beta_0 + \beta_1 \times Index\ fund_j + \vec{\gamma} \cdot \vec{V}_{jt} + \tau_t + \phi_f + \psi_c + \epsilon_{jt},$$

where "Across-industry selection" is the proportion of emission difference that is attributed to across-industry selection, "Index fund" is a dummy variable that equals one if the fund is an index fund, and zero otherwise. The analysis is based on the subsample of fund-quarters with lower portfolio-level emission than their benchmarks. Average values across fund-quarter observations are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	Absolute emission (full sample)				Obs with lower emission than benchmark	
	Fund	Benchmark	Diff%	Obs	Across ind	Within ind
ESG (all)	3,277	5,111	-35.9%***[23]	14,364	41.4%***	58.6%***
ESG (active)	3,046	4,956	-38.5%***	12,552	43.1%***	56.9%***
ESG (index)	4,880	6,185	-21.1%***	1,812	28.4%***	71.6%***
Non-ESG (all)	3,477	4,944	-29.7%***	94,021	55.8%***	44.2%***
Non-ESG (active)	3,287	4,894	-32.8%***	84,160	57.2%***	42.8%***
Non-ESG (index)	5,098	5,369	-5.0%***	9,861	37.2%***	62.8%***

Panel B. ESG funds vs non-ESG funds

	Absolute emission (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	-368**	-846***	-801***	-1034***	-1634***	-1953***
	(-2.564)	(-4.986)	(-4.716)	(-3.137)	(-3.808)	(-4.456)
ESG fund × Active				-605*	-264	451
				(-1.753)	(-0.685)	(1.025)
Non-ESG fund × Active				-1336***	-1139***	-810***
				(-11.448)	(-6.929)	(-3.873)
Ln(TNA)			-72***			-69***
			(-3.438)			(-3.277)
Quarterly return			-1419***			-1443***
			(-5.641)			(-5.686)
Management fee			-969***			-1002***
			(-4.116)			(-4.072)

Constant	-1466***	-1403***	826	-271***	-383***	1525***
	(-25.222)	(-38.196)	(1.616)	(-2.761)	(-2.596)	(3.114)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	108,385	108,352	104,952	108,385	108,352	104,952
Adj. R^2	0.001	0.440	0.443	0.013	0.430	0.434

Panel C. Across-industry selection

	Across-industry selection					
	ESG funds			Non-ESG funds		
Index fund	-0.147*	-0.179	-0.159	-0.201***	-0.254***	-0.300***
	(-1.8026)	(-1.3854)	(-0.8379)	(-3.1839)	(-3.0704)	(-3.1425)
Ln(TNA)			0.004			0.012
			(0.1591)			(1.2617)
Quarterly return			-0.865			-0.017
			(-1.6102)			(-0.0771)
Management fee			0.065			-0.099
			(0.3897)			(-0.9343)
Constant	0.431***	0.434***	0.301	0.572***	0.576***	0.397*
	(10.0457)	(14.5720)	(0.5026)	(34.6239)	(40.7859)	(1.7337)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	Yes	Yes	No	Yes	Yes
N	11,049	11,038	10,443	63,958	63,930	62,236
Adj. R^2	0.001	0.141	0.141	0.001	0.086	0.088

[23]The significance level is calculated based on the difference between the emission intensity of the funds and their benchmark indices.

Table 4: *GHG (Scope 1) emission intensity.* This table shows the portfolio-level Scope 1 GHG emission intensity of ESG funds. In Panel A, "Diff%" is calculated by scaling the average difference of portfolio-level value-weighted emission intensity between funds and benchmark indices using the average benchmarks' emission intensity. For the subsample of fund-quarters with lower portfolio-level emission intensity than the benchmarks, these differences are further broken down into across-industry and within-industry selection, based on the SICS 38-Subsector Classification. In Panel B, the dependent variable is the benchmark-adjusted portfolio-level emission intensity. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. In Panel C, the regression specification features

$$Across\text{-}industry\ selection_{jt} = \beta_0 + \beta_1 \times Index\ fund_j + \vec{\gamma} \cdot \vec{V}_{jt} + \tau_t + \phi_f + \psi_c + \epsilon_{jt},$$

where "Across-industry selection" is the proportion of emission intensity difference that is attributed to across-industry selection. The analysis is based on the subsample of fund-quarters with lower portfolio-level emission intensity than their benchmarks. "Index fund" is a dummy variable that equals one if the fund is an index fund, and zero otherwise. Average values across fund-quarter observations are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	Emission intensity (full sample)				Obs with lower emission than benchmark	
	Fund	Benchmark	Diff%	Obs	Across ind	Within ind
ESG (all)	104	139	-25.6%***	14,364	52.0%	48.0%
ESG (active)	100	138	-27.1%***	12,552	57.0%	43.0%
ESG (index)	126	149	-15.6%***	1,812	17.8%	82.2%
Non-ESG (all)	127	156	-19.0%***	94,021	76.6%	23.4%
Non-ESG (active)	123	155	-21.0%***	84,160	79.9%	20.1%
Non-ESG (index)	160	166	-3.1%***	9,861	41.6%	58.4%

Panel B. ESG funds vs non-ESG funds

	Emission intensity (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	-6	-18***	-18***	-18***	-28***	-32***
	(-1.408)	(-3.598)	(-3.440)	(-2.790)	(-2.664)	(-2.930)
ESG fund × Active				-14**	-9	1
				(-2.130)	(-0.912)	(0.069)
Non-ESG fund × Active				-28***	-19***	-15***
				(-6.040)	(-4.607)	(-2.887)
Ln(TNA)			-3***			-2***
			(-3.128)			(-2.982)
Quarterly return			-2			-2

			(-0.162)			(-0.180)
Management fee			-13*			-14**
			(-1.813)			(-1.980)
Constant	-30***	-28***	33*	-5	-11***	45**
	(-16.206)	(-21.591)	(1.896)	(-1.240)	(-2.891)	(2.544)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	108,385	108,352	104,952	108,385	108,352	104,952
Adj. R^2	0.000	0.328	0.328	0.005	0.326	0.326

Panel C. Across-industry selection

	Across-industry selection					
	ESG funds			Non-ESG funds		
Index fund	-0.392***	-0.537***	-0.511***	-0.383***	-0.510***	-0.437***
	(-4.2753)	(-4.1660)	(-2.8899)	(-7.1137)	(-7.6140)	(-5.4791)
Ln(TNA)			-0.026			-0.005
			(-1.0350)			(-0.5385)
Quarterly return			-0.472			0.381*
			(-0.8369)			(1.6907)
Management fee			0.007			0.214**
			(0.0454)			(2.4045)
Constant	0.570***	0.590***	1.127**	0.799***	0.810***	0.743***
	(13.6181)	(20.8154)	(2.0553)	(48.7358)	(57.8980)	(3.5933)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	Yes	Yes	No	Yes	Yes
N	10,378	10,367	9,779	61,206	61,167	59,396
Adj. R^2	0.005	0.147	0.149	0.003	0.072	0.072

Table 5: *Holdings of top 25 emitters by absolute emission.* This table shows the funds' holdings of top emitters by Scope 1 GHG emission. In Panel A, "Diff" is the difference in holdings of top emitters between funds and benchmark indices. "Diff%" is calculated by scaling the "Diff" using the average benchmarks' holdings of top emitters. These differences are further broken down into top emitters not held by funds, top emitters underweighted by funds, and top emitters overweighted by funds. In Panel B, the dependent variable is benchmark-adjusted holdings of top emitters. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. In Panel C, "Divestment" is a dummy variable that equals one if the fund does not hold any of the top 25 emitters for more than 80% of the quarters over the sample period, and zero otherwise. Average values across fund-quarter observations are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	Holdings of top 25 emitters (full sample)							
	Fund	Bench-mark	Diff	Diff%	Extensive margin	Intensive margin		Obs
						Underweight	Overweight	
ESG (all)	3.3%	5.4%	-2.1%	-38.4%***	72.6%***[24]	10.7%	16.7%	14,364
ESG (active)	3.1%	5.2%	-2.1%	-40.3%***	77.1%***	9.7%	13.2%	12,552
ESG (index)	4.8%	6.6%	-1.8%	-28.0%***	42.5%***	17.0%	40.6%	1,812
Non-ESG (all)	3.7%	5.2%	-1.6%	-30.2%***	68.3%***	12.4%	19.3%	94,021
Non-ESG (active)	3.5%	5.2%	-1.7%	-33.3%***	73.4%***	11.8%	14.8%	84,160
Non-ESG (index)	5.4%	5.8%	-0.4%	-6.5%***	28.5%***	17.1%	54.4%	9,861

Panel B. ESG funds vs non-ESG funds

	Holdings of top 25 emitters (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	-0.005***	-0.010***	-0.010***	-0.015***	-0.021***	-0.025***
	(-2.770)	(-4.878)	(-4.771)	(-3.994)	(-4.472)	(-5.131)
ESG fund × Active				-0.002	0.001	0.008*
				(-0.632)	(0.222)	(1.739)
Non-ESG fund × Active				-0.013***	-0.012***	-0.008***
				(-9.544)	(-6.313)	(-3.528)
Ln(TNA)			-0.001***			-0.001***
			(-3.048)			(-2.934)
Quarterly return			-0.015***			-0.015***
			(-5.349)			(-5.418)
Management fee			-0.010***			-0.011***
			(-3.944)			(-3.967)
Constant	-0.016***	-0.015***	0.008	-0.004***	-0.005***	0.015***
	(-22.847)	(-34.901)	(1.359)	(-3.143)	(-2.818)	(2.703)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	108,385	108,352	104,952	108,385	108,352	104,952
Adj. R^2	0.002	0.480	0.483	0.010	0.471	0.475

Panel C. Consistent users of divestment strategies

	Absolute emission			Emission intensity		
	(1)	(2)	(3)	(4)	(5)	(6)
Divestment	-3343***	-3342***	-434*	-70***	-68***	-35***
	(-22.300)	(-21.801)	(-1.803)	(-10.658)	(-10.067)	(-3.573)
Ln(TNA)		-13	10		-3	-2
		(-0.201)	(0.222)		(-1.071)	(-0.944)
Quarterly return		42	-424		-2	-50***
		(0.291)	(-1.068)		(-0.225)	(-3.125)
Management fee		-85	-898***		-6	-25**
		(-0.293)	(-2.768)		(-0.892)	(-2.494)
Constant	3880***	4229***	3904***	123***	181***	173***
	(26.414)	(2.935)	(3.881)	(26.823)	(3.407)	(4.514)
Quarter FE	No	No	Yes	No	No	Yes
Fund family FE	No	No	Yes	No	No	Yes
MS category × Active FE	No	No	Yes	No	No	Yes
N	14,932	14,060	14,052	14,932	14,060	14,052
Adj. R^2	0.166	0.166	0.622	0.063	0.070	0.490

[24]The significance level is calculated based on the difference between the extensive margin and the intensive margin.

Table 6: *Holdings of polluting industries.* This table shows the funds' holdings of polluting industries, according to SASB SICS 77-Industry Classification. In Panel A, "Diff%" is calculated by scaling the difference in holdings of polluting industries between funds and benchmark indices using the benchmarks' holdings of polluting industry. In Panel B, the dependent variable is the benchmark-adjusted holdings of polluting industries. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. Average values across fund-quarter observations are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. All the variables are computed using the quarter-end holdings data from Morningstar. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	Holdings of polluting industries (full sample)			
	Fund	Benchmark	Diff%	Obs
ESG (all)	10.9%	12.8%	-14.8%***	14,364
ESG (active)	10.7%	12.7%	-16.1%***	12,552
ESG (index)	12.7%	13.5%	-5.9%***	1,812
Non-ESG (all)	12.3%	13.7%	-10.5%***	94,021
Non-ESG (active)	12.1%	13.7%	-11.7%***	84,160
Non-ESG (index)	14.2%	14.2%	-0.6%**	9,861

Panel B. Polluting industries

	Holdings of SICS polluting industries (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	-0.004**	-0.009***	-0.010***	-0.007*	-0.015**	-0.021***
	(-2.008)	(-2.690)	(-2.825)	(-1.752)	(-2.236)	(-3.033)
ESG fund × Active				-0.012***	-0.004	0.010
				(-2.901)	(-0.607)	(1.371)
Non-ESG fund × Active				-0.015***	-0.010***	-0.003
				(-7.282)	(-4.181)	(-0.782)
Ln(TNA)			-0.001**			-0.001**
			(-2.269)			(-2.247)
Quarterly return			-0.001			-0.000
			(-0.118)			(-0.064)
Management fee			-0.019***			-0.021***
			(-4.142)			(-4.378)
Constant	-0.014***	-0.014***	0.020**	-0.001	-0.004**	0.023**
	(-14.974)	(-17.641)	(1.971)	(-0.438)	(-1.974)	(2.442)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	108,385	108,352	106,742	108,385	108,352	106,742
Adj. R^2	0.001	0.355	0.358	0.006	0.353	0.356

Table 7: *ESG scores.* This table shows the portfolio-level combined ESG scores. The sample is restricted to fund-quarters with at least 60% of holdings having available ESG scores from at least one of the raters, including KLD, MSCI, Refinitiv, S&P, and Sustainalytics. In Panel A, "Diff%" is calculated by scaling the average difference of portfolio-level value-weighted ESG scores between funds and benchmark indices using the average benchmarks' ESG score. For the subsample of fund-quarters with higher portfolio-level ESG scores than the benchmarks, these differences are further broken down into across-industry and within-industry selection, based on the SICS 38-Subsector Classification. In Panel B, the dependent variable is the benchmark-adjusted portfolio-level ESG scores. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. Average values across fund-quarter observations are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	ESG score (full sample)				Obs with higher ESG score than benchmark	
	Fund	Benchmark	Diff%	Obs	Across ind	Within ind
ESG (all)	51.96	51.72	0.5%***	14,929	-15.8%	115.8%
ESG (active)	51.59	51.56	0.1%	13,077	-20.5%	120.5%
ESG (index)	54.62	52.85	3.3%***	1,852	3.9%	96.1%
Non-ESG (all)	49.35	49.68	-0.7%***	105,205	-10.5%	110.5%
Non-ESG (active)	49.20	49.57	-0.7%***	94,625	-12.6%	112.6%
Non-ESG (index)	50.68	50.70	0.0%	10,580	4.2%	95.8%

Panel B. ESG funds vs non-ESG funds

	ESG score (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	0.573***	0.508***	0.544***	1.790***	1.196***	0.969***
	(4.203)	(2.847)	(2.972)	(5.082)	(3.656)	(2.726)
ESG fund × Active				-1.741***	-0.831***	-0.140
				(-4.873)	(-2.686)	(-0.393)
Non-ESG fund × Active				-0.343***	-0.052	0.346**
				(-2.622)	(-0.368)	(2.094)
Ln(TNA)			0.031			0.030
			(1.623)			(1.541)
Quarterly return			0.280			0.276
			(1.171)			(1.148)
Management fee			-1.168***			-1.036***
			(-5.996)			(-5.279)
Constant	-0.328***	-0.320***	-0.108	-0.020	-0.274**	-0.491
	(-7.639)	(-9.170)	(-0.252)	(-0.163)	(-2.111)	(-1.131)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	120,134	120,103	116,474	120,134	120,103	116,474
Adj. R^2	0.005	0.373	0.377	0.011	0.364	0.368

Table 8: *E scores.* This table shows the portfolio-level combined E scores. The sample is restricted to fund-quarters with at least 60% of holdings having emission data and available E scores from at least one of the rating agencies, including KLD, MSCI, Refinitiv, S&P, and Sustainalytics. In Panel A, "Diff%" is calculated by scaling the average difference of portfolio-level value-weighted E scores between funds and benchmark indices using the average benchmarks' E score. For the subsample of fund-quarters with higher portfolio-level E scores than the benchmarks, these differences are further broken down into across-industry and within-industry selection, based on the SICS 38-Subsector Classification. In Panel B, the dependent variable is the benchmark-adjusted portfolio-level E scores. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. Average values across fund-quarter observations are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	E score (full sample)				Obs with higher E score than benchmark	
	Fund	Benchmark	Diff%	Obs	Across ind	Within ind
ESG (all)	54.52	54.18	0.6%***	14,346	-12.9%	112.9%
ESG (active)	53.90	53.88	0.0%	12,537	-18.5%	118.5%
ESG (index)	58.80	56.25	4.5%***	1,809	10.6%	89.4%
Non-ESG (all)	50.04	50.57	-1.0%***	93,784	-10.9%	110.9%
Non-ESG (active)	49.80	50.37	-1.1%***	83,932	-13.5%	113.5%
Non-ESG (index)	52.12	52.27	-0.3%***	9,852	6.2%	93.8%

Panel B. ESG funds vs non-ESG funds

	E score (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	0.872***	0.644**	0.676**	2.703***	2.009***	1.706***
	(4.183)	(2.318)	(2.353)	(5.667)	(4.116)	(3.173)
ESG fund × Active				-2.532***	-1.556***	-0.631
				(-5.380)	(-3.396)	(-1.160)
Non-ESG fund × Active				-0.427*	-0.019	0.526*
				(-1.808)	(-0.074)	(1.809)
Ln(TNA)			0.083**			0.080**
			(2.555)			(2.411)
Quarterly return			0.389			0.393
			(0.930)			(0.933)
Management fee			-1.673***			-1.424***
			(-5.126)			(-4.301)
Constant	-0.530***	-0.500***	-1.017	-0.149	-0.486**	-1.596**
	(-7.152)	(-8.305)	(-1.400)	(-0.667)	(-2.114)	(-2.140)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	108,130	108,096	104,701	108,130	108,096	104,701
Adj. R^2	0.004	0.359	0.362	0.009	0.347	0.350

Table 9: *ESG risk score.* This table shows the portfolio-level Sustainalytics risk score, Reprisk index and Reprisk incidents. In Panel A and B, "Diff%" is calculated by scaling the average difference of portfolio-level value-weighted ESG risk score between funds and benchmark indices using the average benchmarks' ESG risk score. For the subsample of fund-quarters with lower portfolio-level ESG risk score than the benchmarks, these differences are further broken down into across-industry and within-industry selection, based on the SICS 38-Subsector Classification. In Panel C, the dependent variable is the benchmark-adjusted portfolio-level ESG risk score. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. Average values across fund-quarter observations are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics of Sustainalytics risk score

	Sustainalytics risk score (full sample)				Obs with lower Sustainalytics risk score than benchmark	
	Fund	Benchmark	Diff%	Obs	Across ind	Within ind
ESG (all)	22.34	23.31	-4.1%***	6,643	31.9%	68.1%
ESG (active)	22.40	23.33	-4.0%***	5,783	30.3%	69.7%
ESG (index)	21.91	23.14	-5.3%***	860	39.9%	60.1%
Non-ESG (all)	24.37	24.59	-0.9%***	34,761	56.4%	43.6%
Non-ESG (active)	24.40	24.66	-1.1%***	30,775	58.8%	41.2%
Non-ESG (index)	24.12	24.08	0.2%**	3,986	39.7%	60.3%

Panel B. Descriptive statistics of Reprisk index and incidents

	Reprisk index and incidents (full sample)				Obs with lower RepRisk index (incidents) than benchmark	
	Fund	Benchmark	Diff%	Obs	Across ind	Within ind
Reprisk index						
ESG (all)	25.68	27.66	-7.2%***	11,203	42.8%	57.2%
ESG (active)	25.04	27.37	-8.5%***	9,787	42.7%	57.3%
ESG (index)	30.09	29.66	1.4%***	1,416	45.1%	54.9%
Reprisk incidents						
ESG (all)	6.07	7.51	-19.2%***	14,932	21.4%	78.6%
ESG (active)	5.77	7.38	-21.7%***	13,080	20.6%	79.4%
ESG (index)	8.18	8.47	-3.5%***	1,852	32.1%	67.9%

Panel C. ESG funds vs non-ESG funds

	Sustainalytics risk score		Reprisk index		Reprisk incidents	
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	-0.949***	-1.086***	-1.398***	-0.009	-0.834***	-0.554
	(-8.386)	(-4.703)	(-3.624)	(-0.015)	(-4.673)	(-1.482)
ESG fund × Active		-0.012		-2.228***		-0.966***
		(-0.055)		(-4.116)		(-2.768)
Non-ESG fund × Active		-0.173**		-0.670**		-0.643***
		(-2.036)		(-2.276)		(-4.386)
Ln(TNA)	0.004	0.003	0.077**	0.074**	0.030*	0.030*
	(0.231)	(0.222)	(2.359)	(2.221)	(1.801)	(1.815)

Quarterly return	-0.433**	-0.455***	-0.702	-0.769*	1.026***	1.011***
	(-2.458)	(-2.581)	(-1.617)	(-1.759)	(5.004)	(4.917)
Constant	-0.264	-0.108	-2.516***	-1.839**	-1.235***	-0.666*
	(-0.828)	(-0.323)	(-3.724)	(-2.428)	(-3.621)	(-1.741)
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund family FE	Yes	Yes	Yes	Yes	Yes	Yes
MS category FE	No	Yes	No	Yes	No	Yes
MS category × Active FE	Yes	No	Yes	No	Yes	No
N	40,555	40,555	97,936	97,936	117,052	117,052
Adj. R^2	0.499	0.495	0.344	0.331	0.335	0.327

Table 10: *Fund return.* This table shows the funds' return measured by CAPM alpha and 6-factor alpha. In Panel A, "Diff" is the difference of alpha between funds and benchmark indices. In Panel B, the dependent variable is the benchmark-adjusted CAPM alpha (Columns (1) to (4)) and 6-factor alpha (Columns (5) to (8)), same as "Diff" in Panel A. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. Average values of fund-months are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	CAPM alpha			6-factor alpha			
	Fund	Benchmark	Diff	Fund	Benchmark	Diff	Obs
ESG (all)	0.021%	-0.004%	0.025%**	0.167%	0.000%	0.167%***	27,771
ESG (active)	-0.012%	-0.006%	-0.007%	0.146%	0.001%	0.145%***	24,369
ESG (index)	0.262%	0.012%	0.250%***	0.322%	-0.008%	0.330%***	3,402
Non-ESG (all)	-0.145%	-0.097%	-0.049%***	-0.001%	0.004%	-0.005%	198,315
Non-ESG (active)	-0.156%	-0.100%	-0.056%***	-0.003%	0.005%	-0.008%**	178,240
Non-ESG (index)	-0.051%	-0.062%	0.011%	0.015%	-0.006%	0.022%**	20,075

Panel B. ESG funds vs Non-ESG funds

	CAPM alpha				6-factor alpha			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ESG fund	0.074***	0.008	0.239***	-0.000	0.172***	-0.008	0.308***	-0.075
	(4.497)	(0.437)	(6.359)	(-0.003)	(9.322)	(-0.437)	(6.717)	(-1.550)
ESG fund			-0.257***	-0.061			-0.185***	0.062
× Active			(-6.515)	(-1.468)			(-3.813)	(1.314)
Non-ESG fund			-0.066***	-0.068***			-0.029***	-0.010
× Active			(-5.386)	(-5.634)			(-2.589)	(-1.100)
Ln(TNA)		0.003		0.003		-0.009***		-0.009***
		(1.039)		(1.266)		(-4.227)		(-4.183)
Constant	-0.049***	-0.097*	0.011	-0.049	-0.005	0.213***	0.022**	0.219***
	(-10.061)	(-1.811)	(0.970)	(-0.863)	(-1.272)	(4.495)	(2.032)	(4.510)
Quarter FE	No	Yes	No	Yes	No	Yes	No	Yes
Fund family FE	No	Yes	No	Yes	No	Yes	No	Yes
MS category FE	No	No	No	Yes	No	No	No	Yes
MS category × Active FE	No	Yes	No	No	No	Yes	No	No
N	226,086	223,936	226,086	223,936	226,086	223,936	226,086	223,936
Adj. R^2	0.000	0.046	0.001	0.046	0.001	0.044	0.001	0.044

Table 11: *Fund fees.* This table shows a comparison between the management fees and net expense ratios of ESG/non-ESG funds and their benchmarks. Management fee refers to the most recently reported actual percentage deducted from a fund's average net assets to cover the investment's management costs. Net expense ratio is the percentage of fund assets allocated for operating expenses and management fees, as stated in the fund's audited annual report. It typically includes fees for accounting, administration, advising, auditing, board of directors, custodial, distribution (12b-1), legal, organizational, professional, registration, shareholder reporting, sub-advising, and transfer agency. However, it does not account for the fund's brokerage costs or any investor sales charges. The management fee is summarized at the fund level, while the net expense ratio is summarized at the fund-year level. For a comprehensive description of the variables, please refer to Appendix C.

	Management fees		Expense ratio	
	Mean	Obs	Mean	Obs
ESG (all)	0.91	508	1.20	9,181
ESG (active)	0.97	446	1.26	8,350
ESG (index)	0.47	62	0.59	831
Non-ESG (all)	0.76	3,320	1.09	90,145
Non-ESG (active)	0.81	3,004	1.16	81,129
Non-ESG (index)	0.29	316	0.46	9,016

Table 12: *Portfolio diversification and return volatility.* This table shows the funds' portfolio diversification and return volatility. In Panel A, portfolio diversification is measured using both the average number of stocks held at each quarter-end and industry concentration index as per Kacperczyk et al. (2005). In Panel B, monthly portfolio return volatility is measured using the standard deviation of a fund's monthly net returns across the sample period. Quarterly portfolio return volatility is measured using the standard deviation of a fund's US equity holding return based on its quarter-end holdings. The sample for return volatility is limited to funds with at least 12 monthly return observations and 4 quarterly return observations to compute standard deviation. Average values across funds observations are presented. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Portfolio diversification

	Number of stocks held			Industry concentration			
	Fund	Benchmark	Difference	Fund	Benchmark	Difference	Obs
ESG (all)	130	784	-654***	3.05%	1.54%	1.51%***	516
ESG (active)	98	780	-682***	3.32%	1.67%	1.65%***	452
ESG (index)	359	814	-454***	1.09%	0.58%	0.50%**	64
Non-ESG (all)	156	761	-605***	4.49%	2.29%	2.20%***	3,330
Non-ESG (active)	113	756	-643***	4.73%	2.40%	2.33%***	3,011
Non-ESG (index)	570	815	-245***	2.26%	1.30%	0.95%***	319

Panel B. Return volatility

	Monthly return volatility			Quarterly return volatility			
	Fund	Benchmark	Difference	Fund	Benchmark	Difference	Obs
ESG (all)	4.76%	4.56%	0.21%***	9.09%	8.55%	0.54%***	460
ESG (active)	4.81%	4.58%	0.23%***	9.20%	8.60%	0.61%***	405
ESG (index)	4.41%	4.35%	0.06%**	8.20%	8.17%	0.03%	55
Non-ESG (all)	4.92%	4.84%	0.08%***	9.11%	9.20%	-0.08%	3,182
Non-ESG (active)	4.93%	4.86%	0.07%***	9.14%	9.24%	-0.10%*	2,871
Non-ESG (index)	4.82%	4.67%	0.14%***	8.90%	8.76%	0.15%	311

Table 13: *Exposure to market risk.* This table shows the funds' exposure to market risk. In Panel A, "Diff" is the difference of CAPM-beta between funds and benchmark indices. In Panel B, the dependent variable is the benchmark-adjusted CAPM-beta (same as "Diff" in Panel A). "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. Average values of fund-months are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	CAPM beta			
	Fund	Benchmark	Diff	Obs
ESG (all)	0.907	1.003	-0.095***	27,771
ESG (active)	0.918	1.005	-0.086***	24,369
ESG (index)	0.831	0.988	-0.158***	3,402
Non-ESG (all)	0.998	1.035	-0.037***	198,315
Non-ESG (active)	0.999	1.037	-0.038***	178,240
Non-ESG (index)	0.988	1.013	-0.025***	20,075

Panel B. CAPM beta

	CAPM beta (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	-0.058***	0.012	0.011	-0.132***	0.033*	0.035*
	(-7.8757)	(1.4324)	(1.3141)	(-7.0956)	(1.8378)	(1.9061)
ESG fund × Active				0.071***	-0.017	-0.022
				(3.7612)	(-0.9626)	(-1.1955)
Non-ESG fund × Active				-0.012*	0.005	0.003
				(-1.7470)	(0.9545)	(0.4532)
Ln(TNA)			-0.001			-0.001
			(-0.7873)			(-0.8470)
Management fee			0.003			0.004
			(0.3214)			(0.3719)
Constant	-0.037***	-0.045***	-0.029	-0.026***	-0.050***	-0.031
	(-14.7091)	(-25.9868)	(-1.2463)	(-3.9424)	(-9.9015)	(-1.3286)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	226,528	226,527	223,375	226,528	226,527	223,375
Adj. R^2	0.020	0.546	0.542	0.024	0.544	0.541

Table 14: *Exposure to inflation shocks.* This table compares the exposure of ESG and non-ESG funds, as well as their benchmarks, to inflation shocks. Exposure to inflation shocks is measured by the in-sample beta, using inflation shocks as risk factors, indicating how much a fund's excess return varies with these shocks. The betas are estimated using the following regression:

$$r^e_{j,t} = \alpha_j + \beta^j_\pi \epsilon_{\pi,t} + u_{j,t},$$

where $r^e_{j,t}$ is the excess monthly return of fund j, $\epsilon_{\pi,t}$ is the shock to respective inflation. For a comprehensive description of the variables, please refer to Appendix C.

	Exposure to headline inflation shock			Exposure to energy inflation shock			
	(1)	(2)	(3)	(4)	(5)	(6)	
	Fund	Benchmark	Difference	Fund	Benchmark	Difference	Obs
ESG (all)	0.636	1.930	-1.293***	0.157	0.263	-0.105***	465
ESG (active)	0.644	1.930	-1.287***	0.158	0.264	-0.105***	409
ESG (index)	0.582	1.923	-1.341***	0.151	0.258	-0.107***	56
Non-ESG (all)	2.352	2.045	0.307***	0.261	0.284	-0.023***	3,229
Non-ESG (active)	2.402	2.045	0.357***	0.264	0.285	-0.021***	2,918
Non-ESG (index)	1.887	2.044	-0.156	0.232	0.277	-0.045***	311

C Online Appendix: Variable Definition

This table shows the definitions of all variables and their sources. CS stands for Compustat, MS stands for Morningstar, TR stands for Thomson Reuters. KLD stands for KLD stats, REF stands for Refinitiv, SP stands for S&P Global, SUS stands for Sustainalytics, RR stands for RepRisk, TC stands for Trucost, ISS stands for Institutional Shareholder Services, OSHA stands for Occupational Safety and Health Administration.

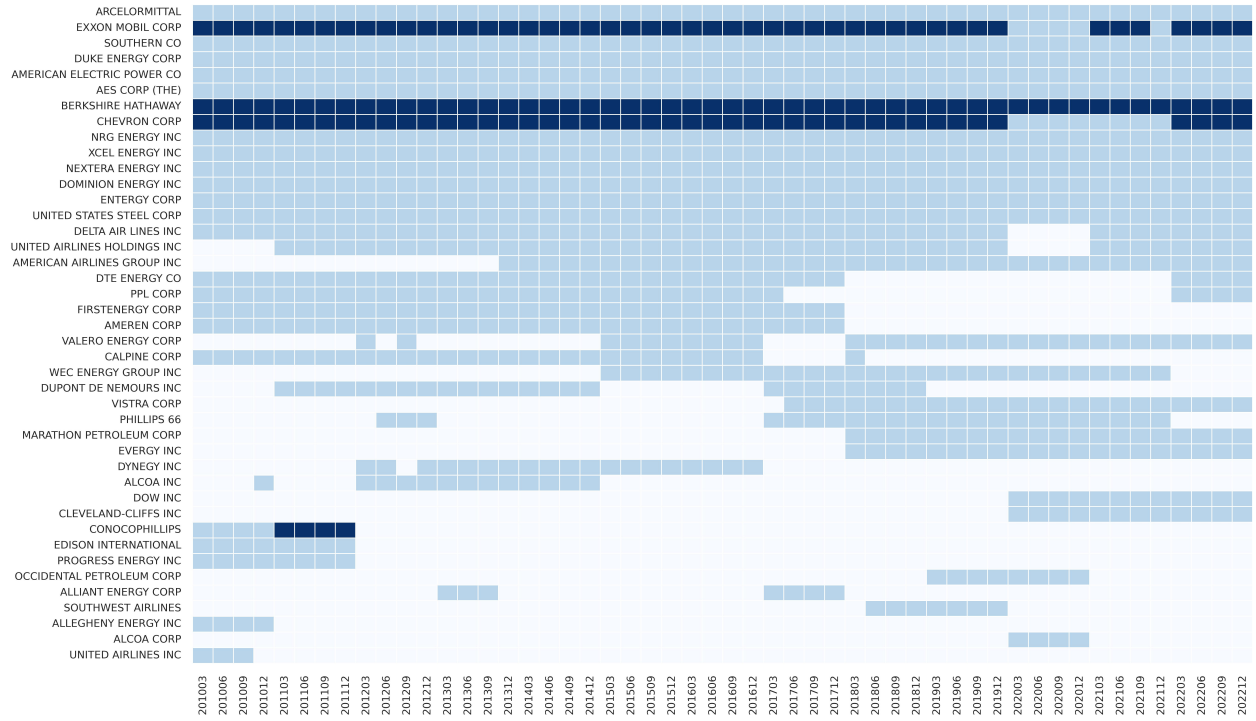
Variable	Definition	Source
KLD score	KLD ESG score is calculated as the average of the KLD environment category score, social category score and governance category score. While KLD has separate category for environment and corporate governance, the social category score is the average of the five KLD category scores that are related to S (employee relations, diversity, human right, community, product). The score for each category is computed as net score by subtracting concerns from strengths, where the strengths (concerns) is scaled by the maximum number of strengths (concerns) following Lins, Servaes and Tamayo (2017). The original score for each category ranges from -1 to 1, to make it comparable to other scores, we multiply it by 50 and plus 50. The adjusted score ranges from 0 to 100. Data available until 2019.	KLD
MSCI score	MSCI ESG score is the weighted average of the MSCI environmental pillar score, social pillar score, and governance pillar score. The weighting factor is provided by MSCI and indicates the relative importance of E, S and G for the firm (considering, for instance, its industry). The original value ranges from 0 to 10, to make it comparable to other scores, we multiply it by 10. Data available across all sample period.	MSCI
Refinitiv score	Refinitiv provides ESG score, environmental pillar score, social pillar score, and governance pillar score. The value ranges from 0 to 100. Data available across all sample period.	REF
S&P score	S&P provides ESG score, environmental score, social score and economic governance score. The value ranges from 0 to 100. Data available from 2013.	SP
Sustainalytics score	Sustainalytics provides ESG score, environment score, social score and governance score. The value ranges from 0 to 100. Data available until 2019.[25]	SUS
Sustainalytics risk score	Sustainalytics provides ESG risk score, and environmental, social, governance risk scores respectively. The value ranges from 0 (negligible risk) to 100 (severe risk). Data available from 2018.	SUS
RepRisk index	RepRisk index (RRI) is constructed based on a proprietary algorithm that quantifies a company's reputational risk exposure to ESG issues. The value ranges from 0 to 100. Data available across all sample period.	RR
RepRisk incident	The total number of ESG incidents the firm experienced in each quarter.	RR
GHG1 emission	Greenhouse gas emission from sources that are owned or controlled by the firm (Scope 1) in 1,000 metric tons CO2 equivalent.	TC

[25]Since 2018, Sustainalytics has altered its methodology to adopt a new ESG risk score.

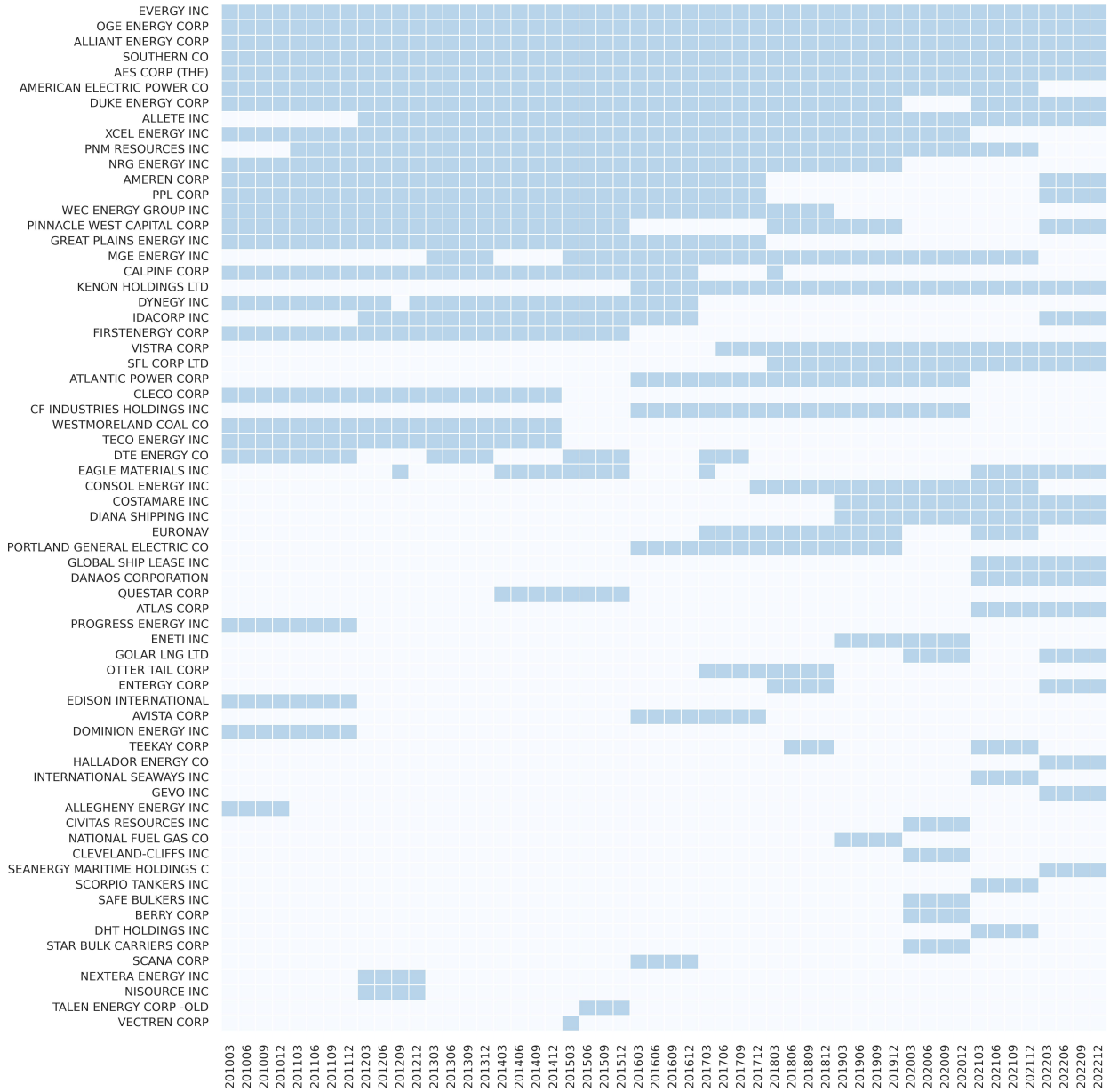
GHG1 intensity	Greenhouse gas emission from sources that are owned or controlled by the firm (Scope 1) in metric tons CO2 equivalent, scaled by total revenues in million USD.	TC
Board diversity	The average of the percentage of female directors on board and the percentage of non-white directors on board.	ISS
Incident rate	The sum of cases that result in days away from work or transfers and other recordable cases in a given year, divided by the number of hours worked by all employees, multiplied by 200,000 (Caskey and Ozel, 2017).	OSHA
Monthly net return	The change in accumulation unit value (AUV) during the period and dividing by the starting AUV. AUV takes into account fund expense ratio and all insurance expenses.	MS
Monthly return volatility	The standard deviation of a fund's monthly net returns over the sample period.	MS
Quarterly return volatility	The standard deviation of a fund's US equity holding return based on its quarter-end holdings and quarterly stock return.	MS
Number of stocks held	The average number of US stocks held by the funds at each quarter-end over the sample period.	MS
Industry concentration	The sum of the squared deviations of the value weights for each of the 10 industries held by the fund, relative to the industry weights of the total stock market, following Kacperczyk et al. (2005).	MS
Risk premium	Monthly net return minus risk free rate.	MS
4/6-factor alpha	The alpha computed based on rolling window estimates of factor beta. For each fund at month end, we use the previous 60 months to estimate the betas based on the 4/6-factor model, requiring at least 36 monthly returns available.	MS
CAPM alpha	The alpha computed based on rolling window estimates of factor beta. For each fund at month end, we use the previous 60 months to estimate the betas based on the CAPM, requiring at least 36 monthly returns available.	MS
CAPM beta	The beta estimated using the previous 60 months' return and based on the CAPM, requiring at least 36 monthly returns available.	MS
Management fee	Reported actual percentage that was deducted from an investment's average net assets to pay the investment's management.	MS
Expense ratio	The percentage of fund assets paid for operating expenses and management fees, according to fund's annual report.	MS
Polluting industry	The top 15 industries with highest Scope 1 GHG emission or intensity based on SASB SICS 77-industry. Polluting industries include coal operations, construction materials, iron & steel producers, oil & gas exploration & production, oil & gas midstream, oil & gas refining & marketing, agricultural products, electric utilities & power generators, gas utilities & distributors, waste management, pulp & paper products, chemicals, air freight & logistics, airlines, car rental & leasing, cruise lines, marine transportation, and rail transportation.	CS

D Online Appendix: Supplementary Figures

Figure D.1: *Overlapping of top 25 emitters and top 25 stocks by market cap.* This figure displays the top 25 emitters and their presence among the top 25 stocks by market capitalization. The vertical axis lists all companies that have ever been in the top 25 emitters during the sample period from 2010 to 2022. Each cell represents a company's status for a specific quarter. The lightest color indicates that the company is not among the top 25 emitters for that quarter. Light blue signifies that the company is among the top 25 emitters but not among the top 25 stocks by market capitalization. Dark blue indicates that the company is present in both the top 25 emitters and top 50 stocks by market capitalization lists. Panel A focuses on the top 25 emitters based on absolute GHG (Scope 1) emissions, while Panel B focuses on the top 25 emitters based on emission intensity.



(A) Top emitters by absolute emission



(B) Top emitters by emission intensity

E Online Appendix: Supplementary Tables

Table E.1: *Number of stocks held.* This table presents the average number of stocks held by ESG funds, their matched non-ESG peers, and their respective benchmark indices for each Morningstar Category.[26]

	Category	ESG funds	Non-ESG funds	Benchmarks	No. of ESG funds
Active	Large value	73	76	572	50
	Large blend	140	130	809	217
	Large growth	48	83	487	96
	Mid value	62	59	571	4
	Mid blend	70	445	627	30
	Mid growth	55	62	370	12
	Small value	254	97	1,063	2
	Small blend	115	107	1,564	39
	Small growth	83	195	958	2
Index	Large value	217	389	572	4
	Large blend	380	548	809	53
	Large growth	361	264	487	4
	Mid blend	559	300	627	1
	Small blend	433	1,612	1,564	1
	Small growth	210	119	958	1

[26]To obtain the holdings of benchmark indices, we initially extract their holdings using the benchmark ID. If the holdings are unavailable, typically due to inaccessible index constituents, we resort to using the holdings of ETFs that have the index as their primary prospectus index and contain the index name in their fund name. The chosen ETF must not be an inverse or leveraged ETF. If multiple ETFs meet these criteria, we use the holdings data of the one with the longest sample period and the largest total net assets, respectively.

Table E.2: *Holdings of top 25 emitters by emission intensity.* This table shows the funds' holdings of top emitters by Scope 1 GHG emission intensity. In Panel A, "Diff%" is calculated by scaling the average difference in holdings of top emitters between funds and benchmark indices using the average benchmarks' holdings of top emitters. These differences are further broken down into extensive margin and intensive margin. In Panel B, the dependent variable is the benchmark-adjusted holdings of top emitters. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. Average values across fund-quarter observations are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	Holdings of top 25 emitters (full sample)							
	Fund	Bench-mark	Diff	Diff%	Extensive margin	Intensive margin		Obs
						Underweight	Overweight	
ESG (all)	0.7%	1.1%	-0.4%	-38.5%***	84.0%***	3.2%	12.8%	14,364
ESG (active)	0.7%	1.1%	-0.5%	-40.9%***	89.3%***	2.7%	8.0%	12,552
ESG (index)	1.0%	1.2%	-0.3%	-23.1%***	50.9%	5.8%	43.2%	1,812
Non-ESG (all)	0.9%	1.2%	-0.4%	-30.5%***	75.6%***	5.9%	18.5%	94,021
Non-ESG (active)	0.8%	1.2%	-0.4%	-34.0%***	85.5%***	4.9%	9.6%	84,160
Non-ESG (index)	1.4%	1.4%	-0.0%	-3.0%***	19.2%***	11.6%	69.1%	9,861

Panel B. ESG funds vs non-ESG funds

	Holdings of top 25 emitters (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	-0.000	-0.002***	-0.002***	-0.002***	-0.004***	-0.004***
	(-0.733)	(-3.588)	(-3.235)	(-2.874)	(-2.949)	(-3.040)
ESG fund × Active				-0.002**	-0.001	-0.001
				(-2.005)	(-1.201)	(-0.395)
Non-ESG fund × Active				-0.004***	-0.003***	-0.003***
				(-5.976)	(-5.058)	(-3.682)
Ln(TNA)			-0.000***			-0.000***
			(-2.974)			(-2.790)
Quarterly return			0.001			0.001
			(0.948)			(0.951)
Management fee			-0.001			-0.001
			(-1.075)			(-1.255)
Constant	-0.004***	-0.004***	0.005*	-0.000	-0.001*	0.007**
	(-15.287)	(-19.786)	(1.730)	(-0.723)	(-1.937)	(2.456)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	108,385	108,352	104,952	108,385	108,352	104,952
Adj. R^2	0.000	0.277	0.280	0.004	0.276	0.278

Table E.3: *Green window dressing.* This table shows the average change in fund ESG exposure around portfolio disclosure dates. Panel A reports the average change in ESG exposure for active ESG funds in the 10 days before (or after) the disclosure date relative to the exposure in the entire month before disclosure, excluding the first and last trading days. Panel B reports the differences of average change in ESG exposure between active ESG funds and matched active non-ESG funds in the same domicile continent. The ESG betas are estimated using the following specification:

$$R_{i,t} = \alpha_{i,t} + \beta_{i,t}^{MKT} MKT_t + \beta_{i,t}^{ESG} ESG_t + \epsilon_{i,t},$$

where $R_{i,t}$ is the daily return of fund i on day t, MKT_t is the daily market return from the Kenneth R. French Data Library, and ESG_t is the daily return of the JNL/Morningstar U.S. Sustainability Index Fund.[27] *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. For a comprehensive description of the variables, please refer to Appendix C.

	Active funds		US-domiciled active funds		EU-domiciled active funds	
	Before disclosure	After disclosure	Before disclosure	After disclosure	Before disclosure	After disclosure
Panel A. ESG funds						
$\Delta\beta^{ESG}_{ESGfunds}$	-0.053**	-0.121***	0.122***	0.022	-0.102***	-0.160***
t-stats	(-2.053)	(-4.991)	(3.765)	(0.751)	(-3.198)	(-5.373)
Obs	6,558	6,555	1,423	1,421	5,135	5,134
Panel B. Matched ESG vs non-ESG funds						
$\Delta\beta^{ESG}_{ESGfunds-Non-ESGfunds}$	-0.133**	0.061	0.200***	0.153***	-0.236***	0.033
t-stats	(-2.129)	(1.089)	(2.861)	(2.711)	(-3.007)	(0.456)
Obs	2,044	2,042	485	485	1,559	1,557

[27] We utilize the daily return of this index fund as a proxy for the Morningstar U.S. Sustainability Total Return Index. Data availability for this proxy begins on April 25, 2017.

Table E.4: *Individual ESG scores.* This table shows the individual portfolio-level ESG scores from five rating agencies. The sample is restricted to fund-quarters with at least 60% of holdings having available ESG scores data from each of the rating agencies, including KLD, MSCI, Refinitiv, S&P, and Sustainalytics. In Panel A, "Diff%" is calculated by scaling the average difference of portfolio-level value-weighted ESG scores of each rating agency between funds and benchmark indices using the average benchmarks' ESG score. For the subsample of fund-quarters with higher portfolio-level ESG scores than the benchmarks, these differences are further broken down into across-industry and within-industry selection, based on the SICS 38-Subsector Classification. In Panel B, the dependent variable is the benchmark-adjusted portfolio-level MSCI ESG scores. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. Average values across fund-quarter observations are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

		ESG score (full sample)				Obs with higher ESG score than benchmark	
		Fund	Benchmark	Diff%	Obs	Across ind	Within ind
MSCI	ESG (all)	49.08	48.50	1.2%***	14,739	2.8%	97.2%
	ESG (active)	48.95	48.48	1.0%***	12,899	7.2%	92.8%
	ESG (index)	49.93	48.60	2.7%***	1,840	-17.2%	117.2%
	Non-ESG (all)	47.29	47.43	-0.3%***	100,519	9.9%	90.1%
	Non-ESG (active)	47.22	47.38	-0.3%***	90,233	14.9%	85.1%
	Non-ESG (index)	47.87	47.82	0.1%***	10,286	-21.4%	121.4%
REF	ESG (all)	63.38	63.88	-0.8%***	14,141	-32.9%	132.9%
	ESG (active)	62.71	63.55	-1.3%***	12,330	-40.0%	140.0%
	ESG (index)	67.92	66.17	2.6%***	1,811	-5.0%	105.0%
	Non-ESG (all)	58.81	59.58	-1.3%***	89,292	-25.9%	125.9%
	Non-ESG (active)	58.46	59.32	-1.4%***	79,766	-31.9%	131.9%
	Non-ESG (index)	61.71	61.84	-0.2%***	9,526	10.6%	89.4%
KLD	ESG (all)	52.78	52.67	0.2%***	10,015	-21.5%	121.5%
	ESG (active)	52.69	52.64	0.1%***	8,785	-27.4%	127.4%
	ESG (index)	53.38	52.89	0.9%***	1,230	4.5%	95.5%
	Non-ESG (all)	52.10	52.17	-0.1%***	80,205	-19.3%	119.3%
	Non-ESG (active)	52.07	52.13	-0.1%***	72,454	-19.9%	119.9%
	Non-ESG (index)	52.40	52.46	-0.1%***	7,751	-14.7%	114.7%
S&P	ESG (all)	40.31	39.63	1.7%***	11,990	-11.5%	111.5%
	ESG (active)	39.74	39.38	0.9%***	10,393	-15.5%	115.5%
	ESG (index)	44.04	41.25	6.7%***	1,597	5.5%	94.5%
	Non-ESG (all)	37.51	37.73	-0.6%***	68,637	-16.4%	116.4%
	Non-ESG (active)	37.31	37.56	-0.7%***	61,150	-19.6%	119.6%
	Non-ESG (index)	39.13	39.15	0.0%	7,487	4.3%	95.7%
SUS	ESG (all)	60.64	60.77	-0.2%***	8,447	-37.6%	137.6%
	ESG (active)	60.38	60.69	-0.5%***	7,337	-51.9%	151.9%
	ESG (index)	62.41	61.30	1.8%***	1,110	12.3%	87.7%
	Non-ESG (all)	59.76	60.19	-0.7%***	56,900	-53.2%	153.2%
	Non-ESG (active)	59.69	60.17	-0.8%***	50,752	-64.4%	164.4%
	Non-ESG (index)	60.36	60.39	0.0%	6,148	6.0%	94.0%

Panel B. ESG funds vs non-ESG funds (MSCI)

	MSCI ESG score (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	0.718***	1.026***	1.059***	1.276***	1.257***	1.209***
	(7.478)	(7.032)	(6.962)	(5.194)	(3.902)	(3.595)
ESG fund × Active				-0.855***	-0.520*	-0.297
				(-3.308)	(-1.685)	(-0.893)
Non-ESG fund × Active				-0.212***	-0.255***	-0.122
				(-3.284)	(-3.194)	(-1.267)
Ln(TNA)			0.005			0.006
			(0.460)			(0.523)
Quarterly return			0.458***			0.462***
			(2.736)			(2.745)
Management fee			-0.403***			-0.326***
			(-3.543)			(-2.815)
Constant	-0.142***	-0.182***	-0.013	0.048	0.047	0.024
	(-5.189)	(-7.887)	(-0.050)	(0.840)	(0.630)	(0.090)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	115,258	115,229	111,708	115,258	115,229	111,708
Adj. R^2	0.013	0.324	0.324	0.016	0.320	0.320

Table E.6: *Individual E scores.* This table shows the portfolio-level E scores from five rating agencies. The sample is restricted to fund-quarters with at least 60% of holdings having available E scores data from each of the rating agencies, including KLD, MSCI, Refinitiv, S&P, and Sustainalytics. In Panel A, "Diff%" is calculated by scaling the average difference of portfolio-level value-weighted E scores of each rating agency between funds and benchmark indices using the average benchmarks' E score. For the subsample of fund-quarters with higher portfolio-level E scores than the benchmarks, these differences are further broken down into across-industry and within-industry selection, based on the SICS 38-Subsector Classification. In Panel B, the dependent variable is the benchmark-adjusted portfolio-level MSCI E scores. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. Average values across fund-quarter observations are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

		E score (full sample)				Obs with higher E score than benchmark	
		Fund	Benchmark	Diff%	Obs	Across ind	Within ind
MSCI	ESG (all)	60.07	58.92	2.0%***	14,266	27.4%	72.6%
	ESG (active)	59.69	58.72	1.6%***	12,458	27.1%	72.9%
	ESG (index)	62.74	60.31	4.0%***	1,808	28.7%	71.3%
	Non-ESG (all)	55.71	55.85	-0.3%***	91,801	31.5%	68.5%
	Non-ESG (active)	55.58	55.71	-0.2%***	82,072	35.7%	64.3%
	Non-ESG (index)	56.79	57.03	-0.4%***	9,729	3.7%	96.3%
REF	ESG (all)	58.49	59.25	-1.3%***	14,004	-35.5%	135.5%
	ESG (active)	57.54	58.76	-2.1%***	12,196	-36.8%	136.8%
	ESG (index)	64.83	62.54	3.7%***	1,808	-30.7%	130.7%
	Non-ESG (all)	52.56	53.67	-2.1%***	87,817	-31.9%	131.9%
	Non-ESG (active)	52.08	53.30	-2.3%***	78,424	-39.6%	139.6%
	Non-ESG (index)	56.55	56.78	-0.4%***	9,393	13.8%	86.2%
KLD	ESG (all)	54.52	54.49	0.1%**	9,361	-9.4%	109.4%
	ESG (active)	54.41	54.46	-0.1%***	8,175	-6.7%	106.7%
	ESG (index)	55.33	54.71	1.1%***	1,186	-19.4%	119.4%
	Non-ESG (all)	53.96	54.11	-0.3%***	67,777	1.0%	99.0%
	Non-ESG (active)	53.93	54.09	-0.3%***	60,788	1.0%	99.0%
	Non-ESG (index)	54.22	54.27	-0.1%***	6,989	1.0%	99.0%
S&P	ESG (all)	41.62	41.14	1.1%***	11,981	-8.2%	108.2%
	ESG (active)	40.72	40.75	-0.1%	10,384	-13.3%	113.3%
	ESG (index)	47.44	43.70	8.6%***	1,597	12.1%	87.9%
	Non-ESG (all)	36.50	37.04	-1.5%***	68,478	-14.7%	114.7%
	Non-ESG (active)	36.12	36.73	-1.6%***	60,993	-17.8%	117.8%
	Non-ESG (index)	39.58	39.57	0.0%	7,485	4.9%	95.1%
SUS	ESG (all)	61.59	61.84	-0.4%***	8,408	-20.4%	120.4%
	ESG (active)	61.15	61.70	-0.9%***	7,298	-29.8%	129.8%
	ESG (index)	64.44	62.74	2.7%***	1,110	11.1%	88.9%
	Non-ESG (all)	59.83	60.45	-1.0%***	56,274	-14.6%	114.6%
	Non-ESG (active)	59.70	60.39	-1.1%***	50,301	-20.5%	120.5%
	Non-ESG (index)	60.95	60.96	0.0%	5,973	17.3%	82.7%

Panel B. ESG funds vs non-ESG funds (MSCI)

	MSCI E score (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	1.279***	1.074***	1.120***	2.628***	2.531***	2.585***
	(7.437)	(4.142)	(4.270)	(6.511)	(4.883)	(4.696)
ESG fund × Active				-1.445***	-1.603***	-1.504***
				(-3.602)	(-3.147)	(-2.633)
Non-ESG fund × Active				0.095	0.015	0.113
				(0.496)	(0.074)	(0.467)
Ln(TNA)			0.105***			0.105***
			(3.653)			(3.622)
Quarterly return			0.570			0.576
			(1.466)			(1.479)
Management fee			-0.386			-0.189
			(-1.298)			(-0.625)
Constant	-0.138**	-0.112**	-2.025***	-0.223	-0.130	-2.262***
	(-2.091)	(-2.038)	(-3.191)	(-1.254)	(-0.699)	(-3.501)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	115,258	115,229	111,708	115,258	115,229	111,708
Adj. R^2	0.008	0.275	0.279	0.010	0.271	0.274

Table E.8: *Fund return with additional measures.* This table presents the funds' return measured by risk premium (excess return) and 4-factor alpha. In Panel A, "Diff" is the difference of risk premium/4-factor alpha between funds and benchmark indices. In Panel B, the dependent variable is the benchmark-adjusted risk premium (Columns (1) to (4)) and 4-factor alpha (Columns (5) to (8)), same as "Diff" in Panel A. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. Average values of fund-months are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	Risk premium				4-factor alpha			
	Fund	Benchmark	Diff	Obs	Fund	Benchmark	Diff	Obs
ESG (all)	0.860%	0.916%	-0.056%***	43,500	0.016%	-0.028%	0.043%***	27,771
ESG (active)	0.846%	0.919%	-0.074%***	38,145	-0.020%	-0.029%	0.009%	24,369
ESG (index)	0.963%	0.895%	0.068%**	5,355	0.270%	-0.020%	0.291%***	3,402
Non-ESG (all)	0.842%	0.930%	-0.088%***	308,354	-0.123%	-0.075%	-0.049%***	198,315
Non-ESG (active)	0.834%	0.930%	-0.096%***	277,749	-0.133%	-0.076%	-0.057%***	178,240
Non-ESG (index)	0.918%	0.929%	-0.011%	30,605	-0.043%	-0.062%	0.019%**	20,075

Panel B. ESG funds vs non-ESG funds

	Risk premium				4-factor alpha			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ESG fund	0.032***	0.040***	0.079***	0.063***	0.092***	0.004	0.272***	-0.017
	(3.416)	(3.195)	(4.223)	(2.920)	(5.610)	(0.248)	(6.862)	(-0.388)
ESG fund × Active			-0.142***	-0.086***			-0.282***	-0.052
			(-7.177)	(-4.384)			(-6.798)	(-1.224)
Non-ESG fund × Active			-0.085***	-0.059***			-0.076***	-0.074***
			(-10.982)	(-7.015)			(-6.609)	(-7.586)
Ln(TNA)		-0.004**		-0.004**		0.000		0.001
		(-2.511)		(-2.291)		(0.087)		(0.261)
Constant	-0.088***	-0.003	-0.011*	0.043	-0.049***	-0.044	0.019*	0.015
	(-25.234)	(-0.073)	(-1.649)	(1.200)	(-11.209)	(-0.936)	(1.829)	(0.305)
Quarter FE	No	Yes	No	Yes	No	Yes	No	Yes
Fund family FE	No	Yes	No	Yes	No	Yes	No	Yes
MS category FE	No	No	No	Yes	No	No	No	Yes
MS category × Active FE	No	Yes	No	No	No	Yes	No	No
N	351,854	347,837	351,854	347,837	226,086	223,936	226,086	223,936
Adj. R^2	0.000	0.052	0.000	0.052	0.000	0.047	0.001	0.047

Table E.9: *Performance of consistent users of divestment strategies.* This table compares the returns and diversification of ESG funds that (consistently) use divestment strategies to those that do not. In Panel A, the dependent variables are risk premium, CAPM alpha and 6-factor alpha. In Panel B, the dependent variables are monthly return volatility and industry concentration. "Divestment" is a dummy variable that equals one if the fund does not hold any of the top 25 emitters for more than 80% of the quarters over the sample period, and zero otherwise. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Returns

	Risk premium			CAPM alpha			6-factor alpha		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Divestment	-0.001***	-0.001***	0.001	-0.171***	-0.181***	0.088	-0.112***	-0.113***	0.050
	(-2.825)	(-3.059)	(1.628)	(-5.153)	(-5.545)	(1.543)	(-3.486)	(-3.492)	(1.388)
Ln(TNA)		0.000***	0.000		0.018***	0.005		-0.007	-0.002
		(4.255)	(0.168)		(2.666)	(0.340)		(-0.854)	(-0.197)
Constant	0.008***	0.002	0.007**	0.060***	-0.303**	-0.089	0.192***	0.334*	0.197
	(51.610)	(1.132)	(2.587)	(3.245)	(-2.091)	(-0.316)	(8.768)	(1.921)	(0.984)
Quarter FE	No	No	Yes	No	No	Yes	No	No	Yes
Fund family FE	No	No	Yes	No	No	Yes	No	No	Yes
MS category × Active FE	No	No	Yes	No	No	Yes	No	No	Yes
N	27,771	27,239	27,239	27,771	27,239	27,239	27,771	27,239	27,239
Adj. R^2	0.000	0.000	0.825	0.001	0.001	0.174	0.000	0.000	0.212

Panel B. Diversification

	Monthly return volatility			Industry concentration		
	(1)	(2)	(3)	(4)	(5)	(6)
Divestment	0.007***	0.006***	0.002	0.024***	0.024***	0.009*
	(6.128)	(5.967)	(1.403)	(7.517)	(6.953)	(1.813)
Ln(TNA)		-0.001***	-0.001***		-0.001*	0.000
		(-4.623)	(-3.990)		(-1.761)	(0.058)
Quarterly return		-0.126***	-0.219***		0.050	-0.153
		(-4.107)	(-5.611)		(0.851)	(-1.411)
Management fee		-0.003***	-0.001		0.008***	0.011***
		(-2.929)	(-0.676)		(3.852)	(2.693)
Constant	0.048***	0.075***	0.081***	0.024***	0.039***	0.020
	(87.902)	(15.847)	(13.201)	(17.540)	(2.904)	(1.125)
Fund family FE	No	No	Yes	No	No	Yes
MS category × Active FE	No	No	Yes	No	No	Yes
N	507	494	313	516	494	313
Adj. R^2	0.075	0.215	0.542	0.117	0.134	0.511

F Online Appendix: SEC Fund Disclosure Requirement

Summary of ESG Fund Disclosure Requirements

Fund Disclosure Requirement	ESG Integration Funds	ESG-Focused Funds	ESG Impact Funds
A description of how the fund incorporates ESG into investment selection and what factors it considers.	✓	✓	✓
A description of how the fund considers environmental factors and what data sources the fund may consider.	✓1	✓1	✓1
ESG Strategy Overview Table (see Appendix B)		✓	✓
Scope 1 & 2 carbon footprint		✓1	✓1
Scope 3 carbon footprint (by industry)		✓1	✓1
Weighted average carbon intensity		✓1	✓1
Number of total engagements2 and % related to ESG		✓3	✓3
% of ESG proposals supported		✓3	✓3
Impacts sought to achieve, key metrics to access progress, time horizon and relationship between return and impact.			✓1

[1]Only required if the fund considers environmental/GHG emissions factors as part of its investment strategy.

[2]Defined as "substantive discussion advocating for specific ESG goals to be accomplished over a time period, where progress toward meeting such goal is measurable, that is part of an ongoing dialogue regarding this goal."

[3]Only required if either proxy voting and/or engagement is used as a means of implementing the fund's ESG strategy.

G Online Appendix: Characteristics of ESG Impact and Risk Scores

In this section, we review the methods used to construct ESG impact and risk scores and thus their characteristics and distribution.

ESG impact scores

One intriguing observation is that, overall, the ESG impact scores exhibit a lack of industry variation. As illustrated in Panel A of Figure G.1 below, the cross-sectional industry average ESG score variations are minimal. For scores normalized to fall within the range of [0,100], the industry average KLD score varies between [48,53], the Sustainalytics score between [46,64], and the MSCI score between [26,52] (with the variation significantly decreasing when excluding the "FB.5: Tabacco" industry). If anything, Refinitiv and S&P scores display slightly larger variations, ranging between [30,65] and [15,44], respectively. The variation in E scores is also limited (Panel B), albeit slightly less severe. Note that we use industries defined by SASB SICS 38 Subsectors; the results remain similar, if not worse, when using the Fama-French 49 Industry Classification.

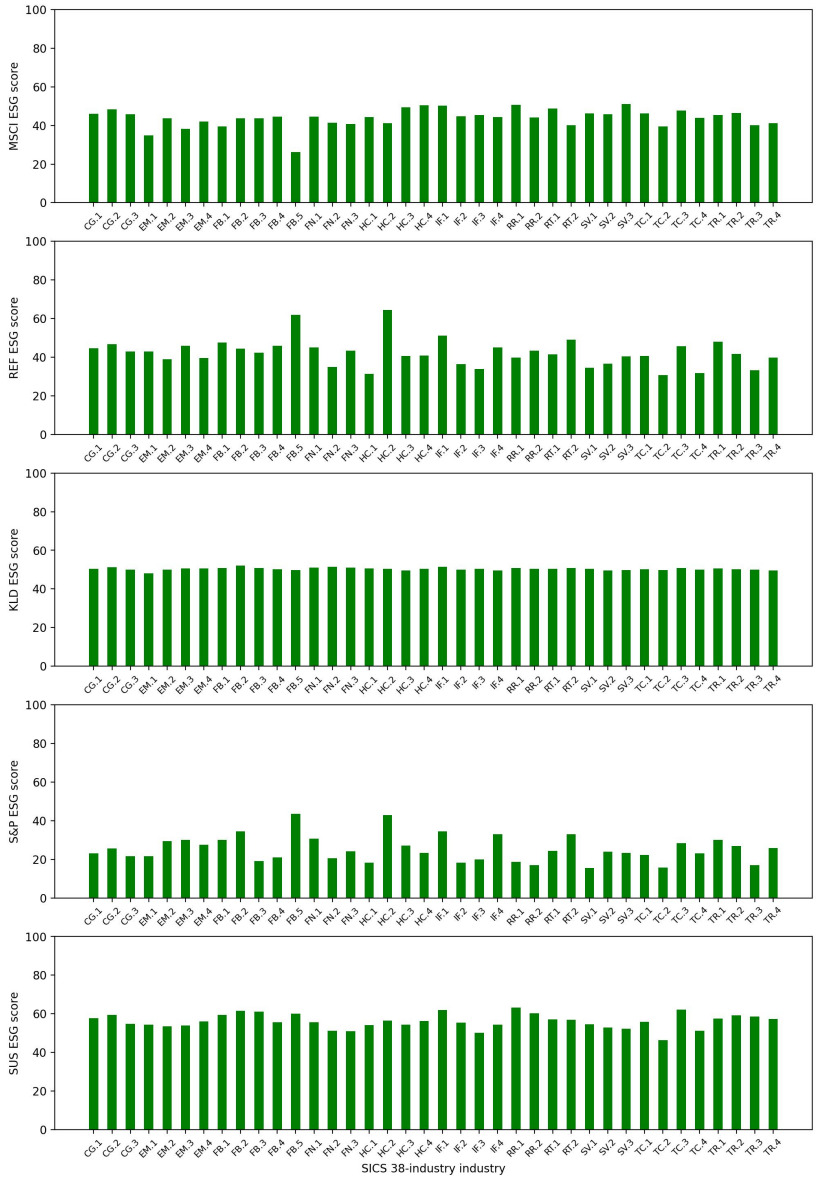
Moreover, among five ratings, four of them (Refinitiv, MSCI, S&P, and Sustainalytics) employ some industry adjustment: all the four ratings apply different weights to sub-components in the metrics for different industries; S&P and Refinitiv even apply industry-adjusted scores as a function of the performances of their peers. For the details of industry adjustment, refer to Panel A of Table G.1 below. Consequently, it is unsurprising that there is no considerable difference in outperformance in scores between ESG funds and their benchmarks, given the source scores do not exhibit much variation.

Another reason for the lack of substantial outperformance in scores, despite the outperformance in emission terms, is that the so-called ESG impact scores is not accurately measure real impact. Based on the evidence from data vendors, these comprehensive scores typically factor in not only real outcomes but also aspects like disclosure, risk, opportunity, compensation, etc. For the E scores, in addition to emissions, components like waste management, green technologies, and biodiversity are also included. In Panel B of Table G.1, we provide the detailed components considered by the data vendors when constructing the ratings and the associated weights for some main themes, nonetheless, the sub-scores of each detailed component are, in most of the cases, not provided.

ESG risk scores

As a comparison, the mitigation of ESG risk exposure for ESG funds is sizable and significant. This is partly driven by the much larger cross-sectional variation of ESG risk scores (measures) compared to ESG impact scores. As detailed in Panel C of Figure G.1, for scores normalized to fall within the range of [0,100], the industry average Sustainalytics risk score varies between [16,48], the RRI between [5,23]. The industry average number of ESG incidents varies between [0.07,1.76]. The variances are notably larger than ESG or E impact scores.

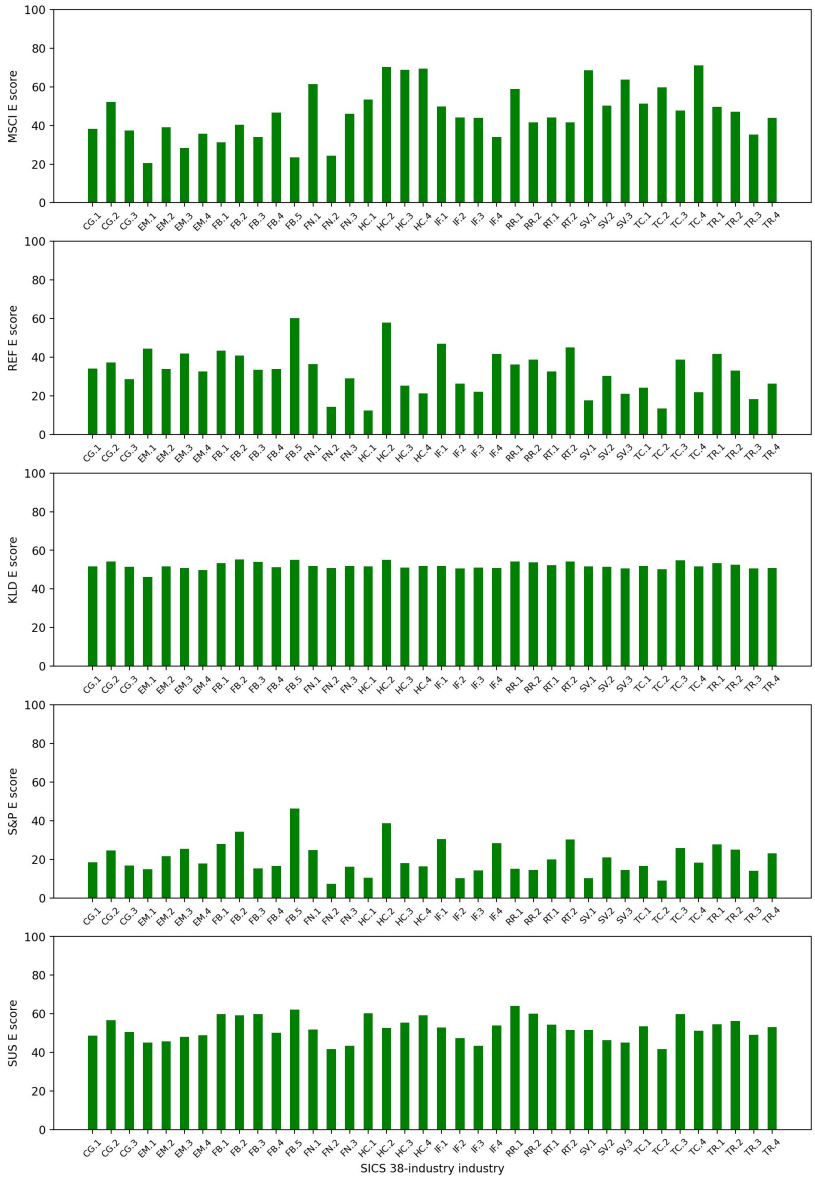
Figure G.1: *Industry variation of ESG scores and emissions.* This figure shows the average ESG scores, ESG risk scores, and emission across SICS 38 subsectors over the sample period from 2010 to 2022. Panel A and B show the distribution of industry average (equal-weighted) ESG and E scores from the five rating agencies. Panel C displays the distribution of industry average ESG risk measures. Panel D shows the industry average GHG emission.[28]



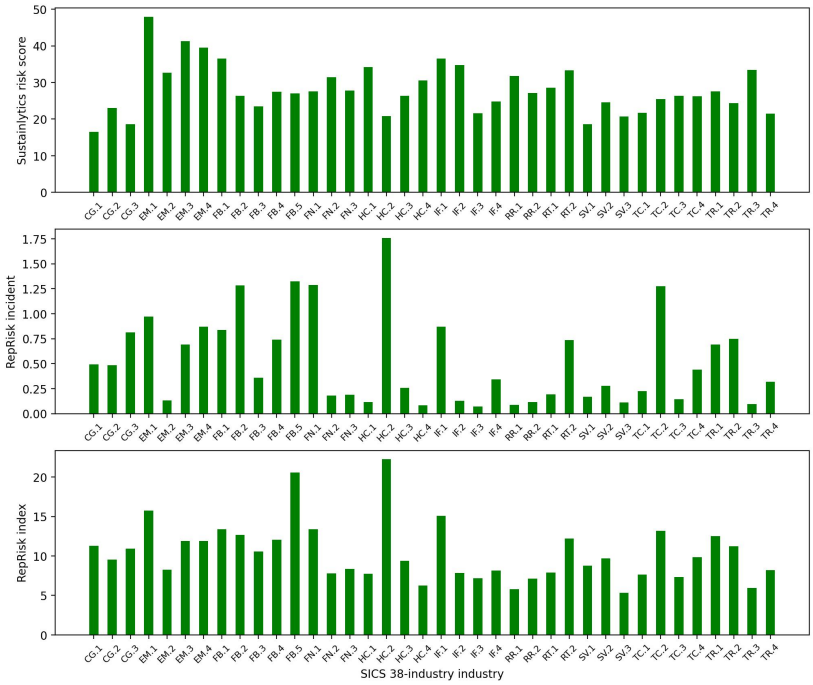
(A) ESG scores across industry

[28]As discussed in the main body of the paper, we present the Sustainalytics risk scores within the range of $[0, 50]$ in Panel C. Since a score above 40 indicates the most severe category, only 2% of the fund-quarter observations exceed a score of 50, and none of the industry averages surpass this threshold.

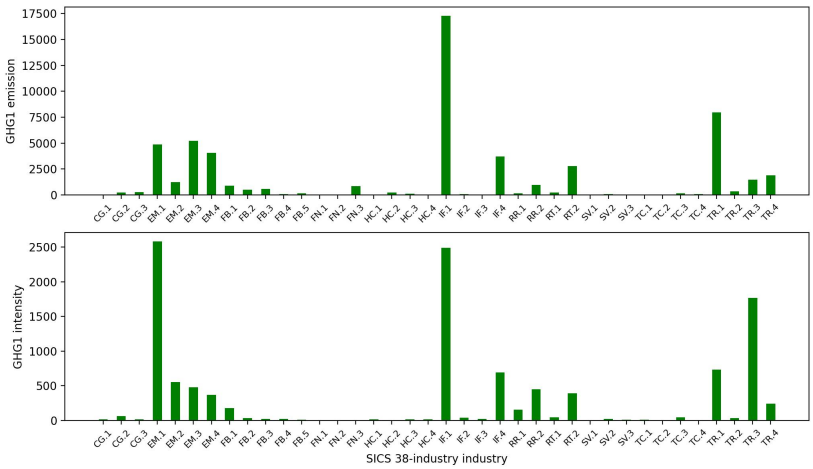
Panel B and D are based on the overlapping sample of E score and Trucost GHG emission data.



(B) E scores across industry



(C) ESG risk scores across industry



(D) GHG (Scope 1) emissions across industry

Table G.1: *Data vendors' ESG score methodologies.* This table details how various data vendors compute ESG scores. Panel A covers industry adjustments, while Panel B outlines the components considered and their associated weights.

Panel A. Industry adjustment

	Industry-specific weight	Industry-adjusted score
MSCI	Yes. Key Issue Weights are determined through a combination of two factors: (1) how much each industry contributes to the main externality connected to the issue as compared to other industries (for instance, how carbon-intensive the industry is relative to other industries) and (2) the time horizon within which the externality may materialize.	MSCI provides Final Industry-Adjusted Company Score, but we are using the unadjusted version in this study.
REF	Yes. The weight of environmental, social, and governance pillar scores vary across industries. Within in each pillar, the category weights of environmental and social pillar vary across industries depending on the materiality. The category weights of governance pillar are the same across industries, Management 67%, Shareholders 20%, CSR Strategy 13%, respectively.	Yes. Refinitiv uses percentile rank scoring to compute the category scores.[29] Environmental and social category scores compare firms within TRBC industry group, while governance category scores compare firms within the same country of incorporation.
KLD	No.	No.
S&P	Yes. The weight of environmental, social, and governance dimension score vary across industries.	Yes, S&P ESG score is a relative score that compares a company's performance in managing ESG risks, opportunities, and impacts to its peers within the same industry classification. S&P uses industry-specific normalization factors when normalizing some quantitative data.
SUS	Yes. Each industry has a customized weight matrix that defines the relative importance of each indicator and reflects the emphasis on key ESG issues per industry.	No.

[29] $Score = \frac{(No.\ of\ companies\ with\ a\ worse\ value + No.\ of\ companies\ with\ the\ same\ value\ as\ the\ current\ one/2)}{No.\ of\ companies\ with\ a\ value.}$

Panel B. Components and weights

	Component	Sub-score and Weights
MSCI	Environmental: • Climate change: Carbon emissions, Product carbon footprint, Climate change vulnerability, Financing environmental impact • Natural capital: Water stress, Biodiversity and land use, Raw material sourcing • Pollution and waste: Toxic emissions and waste, Packaging material and waste, Electronic waste • Environmental opportunities: Opportunities in clean tech, Opportunities in green building, Opportunities in renewable energy Social: • Human capital: Labor management, Health and safety, Human capital development, Supply chain labor standards • Product liability: Product safety and quality, Chemical safety, Privacy and data security, Consumer financial protection, Responsible investment, Health and demographic risk • Social opportunities: Opportunities in nutrition and health, Access to communications, Access to health care, and Access to finance Governance: • Corporate governance • Corporate behavior • Stakeholder opposition: Community relations, Controversial sourcing	Sub-scores of each theme and issue and their weights are provided.
REF	Environmental: • Emission: Emissions, Waste, Biodiversity, Environmental management systems • Innovation: Product innovation, Green revenues, research and development (R&D) and capital expenditures (CapEx) • Resource use: Water, Energy, Sustainable packaging, Environmental supply chain Social: • Community • Human rights • Product responsibility: Responsible marketing, Product quality, Data privacy • Workforce: Diversity and inclusion, Career development and training, Working conditions, Health and safety	Performance of data items are provided. It includes boolean data like policy human rights, and numeric data like total CO2 equivalent emissions to revenues.

REF Governance:

- CSR strategy: CSR strategy, ESG reporting and transparency
- Management: Structure (independence, diversity, committees)
- Shareholders: Shareholder rights, Takeover defense

KLD Environmental

Social:

- Employee relations
- Diversity
- Human right
- Community
- Product

Governance

Indicator variables for each strength and concern in each category are provided.

S&P Environmental:

- Food loss and waste
- Climate strategy
- Transition risk management
- Biodiversity, ecosystems and land use
- Waste management
- Water use and management
- Resource use and management

Social:

- Human capital management
- Human rights
- Labor relations
- Occupational health and safety
- Responsible marketing and labeling
- Community impact and relations
- Access and affordability
- Operational eco-efficiency and management

Governance

- Risk and crisis management
- Supply chain management
- Tax strategy
- Business ethics
- Corporate governance
- Customer relationship management
- Cyber security
- Product governance and excellence

Sub-scores and their weights are provided. Raw data include firms' answer to CSA question and data points from and beyond company documents.

SUS	Environmental: • Formal environmental policy, Environmental management system, External certification of EMS, Environmental fines and non-monetary sanctions, Participation in carbon disclosure project, Scope of corporate reporting on GHG emissions, Programmes and targets to redice GHG emissions from own operations, Programmes and targets to increase renewable energy use, Carbon intensity, Carbon intensity trend, % Primary energy use from renewables, Operations related controversies or incidents • Formal policy or programme on green procurement, Environmental supply chain incidents • Products and services related controversies or incidents Social: • Policy on freedom of association, Formal policy on the elimination of discrimination, Programmes to increase workforce diversity, Percentage of employees covered by collective bargaining agreements, Employee turnover rate, Top employer recognition, Employee related controversies or incidents • Scope of social supply chain standards, Supply chain monitoring system, Supply chain incidents • Customer related controversies or incidents • Activities in sensitive countries, Society and community related controversies or incidents • Guidelines for philanthropic activities and primary areas of support, Corporate foundation, Percent cash donations of NEBT Governance: • Policy on bribery and corruption, Whistleblower programmes, Signatory to UN global compact, Tax transparency, Business ethics related to controversies or incidents • CSR reporting quality, External verification of CSR reporting, Disclosure of directors' remuneration, Disclosure of directors' biographies, Oversight of ESG issues, Executive compensation tied to ESG performance, Board diversity, Separation of board chair and CEO role, Board independence, Audit committee independence, Non-audit fees relative to audit fees, Compensation committee independence, Governance related controversies or incidents • Policy on political involvement and contributions, Total value of political contributions or political spending, Public policy related controversies or incidents	Sub-scores and their weights are provided.

H Online Appendix: Social Measures

To supplement our findings, we explore ESG funds along social dimensions considering two important aspects: (i) board diversity (measured as the average percentage of females and nonwhites on the board) and (ii) employee safety (measured using the number of workplace incidents). The board composition data is sourced from ISS directors, while the workplace incident data comes from OSHA.

The coverage of OSHA incident dataset is rather limited, as OSHA only collects data from a portion of all private sector establishments in the US and the data is available since 2016. As a result, the data is only available for 5.7% of our firm-quarter sample, leading to 43% of the fund-quarter observations lacking holdings with available incident data. Due to the limited coverage, we remove the restriction of having 60% holding data available in this specific analysis. The total incident rate is computed as the sum of cases resulting in days away from work or transfers and other recordable cases in a given year, divided by the number of hours worked by all employees, and multiplied by 200,000, as per Caskey and Ozel (2017) below. In terms of industry distribution, consumer goods retail (primarily from "Multiline and Specialty Retailers & Distributors"), food (mainly "Processed Foods"), and air transportation rank as the top three industries with the highest average incident rates.

The results are presented in Tables H.1 and H.2, respectively. Overall, ESG funds do not appear to select firms with more diversified boards compared to their benchmark indices. If anything, ESG index funds have performed slightly better in this regard. However, the extent of this outperformance is marginal, with average percentage differences around 2%, as shown in Panel A of Table H.1 below. Similarly, non-ESG funds have less diversified boards compared to ESG funds within the same Morningstar Category, but this difference is again small, especially net of benchmark.

Regarding employee safety, presented in Table H.2 below, non-ESG funds notably underperform, especially non-ESG active funds. This is evident from Panel A when compared to their benchmarks and the variable $Non\text{-}ESG\ fund \times Active$ in Panel B when compared to similar ESG counterparts. Specifically, non-ESG active funds demonstrate a 1.5 times higher likelihood of incident rates than their benchmarks. Contrary to the emission results but consistent with the previously discussed ESG risk scores, for fund-quarters with better employee safety, the outperformance mainly stems from within-industry selection for active funds and across-industry selection for index funds.

In a nutshell, ESG funds select firms that exhibit better employee safety, especially when compared to their similar non-ESG counterparts; but only marginally better board diversity.

Table H.1: *Board diversity.* This table shows the portfolio-level board diversity. In Panel A, "Diff%" is calculated by scaling the average difference of portfolio-level value-weighted board diversity between funds and benchmark indices using the average benchmarks' board diversity. For the subsample of fund-quarters with lower portfolio-level board diversity than the benchmarks, these differences are further broken down into across-industry and within-industry selection, based on the SICS 38-Subsector Classification. Average values across fund-quarter observations are provided. In Panel B, the dependent variable is the benchmark-adjusted portfolio-level board diversity. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	Board diversity (full sample)				Obs with greater diversity than benchmark	
	Fund	Benchmark	Diff%	Obs	Across ind	Within ind
ESG (all)	24.1%	24.0%	0.2%***	14,021	4.5%	95.5%
ESG (active)	23.9%	24.0%	-0.1%**	12,172	-5.0%	105.0%
ESG (index)	25.0%	24.4%	2.3%***	1,849	41.3%	58.7%
Non-ESG (all)	22.3%	22.4%	-0.5%***	90,704	-26.2%	126.2%
Non-ESG (active)	22.2%	22.3%	-0.5%***	80,929	-32.1%	132.1%
Non-ESG (index)	22.9%	23.0%	-0.7%***	9,775	14.6%	85.4%

Panel B. ESG funds vs non-ESG funds

	Board diversity (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	0.002***	0.001	0.001	0.007***	0.005***	0.004**
	(2.758)	(1.046)	(1.100)	(6.480)	(3.215)	(2.324)
ESG fund × Active				-0.006***	-0.003**	-0.001
				(-5.160)	(-2.169)	(-0.344)
Non-ESG fund × Active				0.000	0.001**	0.003***
				(0.745)	(2.025)	(3.699)
Ln(TNA)			-0.000			-0.000
			(-0.650)			(-0.662)
Quarterly return			0.002			0.002
			(1.557)			(1.504)
Management fee			-0.005***			-0.004***
			(-5.030)			(-4.329)
Constant	-0.001***	-0.001***	0.004*	-0.002***	-0.002***	0.001
	(-5.138)	(-5.850)	(1.674)	(-2.823)	(-3.753)	(0.262)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	104,725	104,693	101,385	104,725	104,693	101,385
Adj. R^2	0.001	0.276	0.278	0.003	0.274	0.275

Table H.2: *Incident rate.* This table shows the portfolio-level incident rate. In Panel A, "Diff%" is calculated by scaling the average difference of portfolio-level value-weighted incident rate between funds and benchmark indices using the average benchmarks' incident rate. For the subsample of fund-quarters with lower portfolio-level incident rate than the benchmarks, these differences are further broken down into across-industry and within-industry selection, based on the SICS 38-Subsector Classification. In Panel B, the dependent variable is the benchmark-adjusted portfolio-level incident rate. "ESG" (or "non-ESG") is a dummy variable that equals one if the fund is an ESG (or non-ESG) fund, and zero otherwise. "Active" is a dummy variable that equals one if the fund is an active fund, and zero otherwise. Average values across fund-quarter observations are provided. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively, with standard errors clustered by fund. For a comprehensive description of the variables, please refer to Appendix C.

Panel A. Descriptive statistics

	Incident rate (full sample)				Obs with lower incident rate than benchmark	
	Fund	Benchmark	Diff%	Obs	Across ind	Within ind
ESG (all)	2.41	2.49	-3.1%	10,009	38.3%	61.7%
ESG (active)	2.45	2.52	-2.8%	8,691	29.0%	71.0%
ESG (index)	2.16	2.28	-4.9%***	1,318	96.5%	3.5%
Non-ESG (all)	4.16	2.88	44.8%***	58,506	25.9%	74.1%
Non-ESG (active)	4.37	2.91	50.2%***	52,093	21.9%	78.1%
Non-ESG (index)	2.47	2.59	-4.6%***	6,413	61.2%	38.8%

Panel B. ESG funds vs non-ESG funds

	Incident rate (fund-benchmark)					
	(1)	(2)	(3)	(4)	(5)	(6)
ESG fund	-1.364***	-0.344	-0.452	0.007	0.585	1.460
	(-3.506)	(-0.937)	(-1.196)	(0.088)	(1.092)	(1.601)
ESG fund × Active				0.040	-0.377	-2.921
				(0.325)	(-0.665)	(-1.511)
Non-ESG fund × Active				1.580***	0.687**	-0.769
				(3.693)	(2.129)	(-0.650)
Ln(TNA)			-0.375**			-0.350**
			(-2.425)			(-2.371)
Quarterly return			16.376**			16.374**
			(2.524)			(2.526)
Management fee			3.292			3.511
			(1.244)			(1.335)
Constant	1.287***	1.140***	6.234**	-0.119*	0.530	6.222**
	(3.417)	(4.531)	(2.249)	(-1.846)	(1.482)	(2.218)
Quarter FE	No	Yes	Yes	No	Yes	Yes
Fund family FE	No	Yes	Yes	No	Yes	Yes
MS category FE	No	No	No	No	Yes	Yes
MS category × Active FE	No	Yes	Yes	No	No	No
N	68,515	68,484	66,397	68,515	68,484	66,397
Adj. R^2	0.000	0.035	0.035	0.000	0.035	0.035

I Online Appendix: Alternative Benchmarks

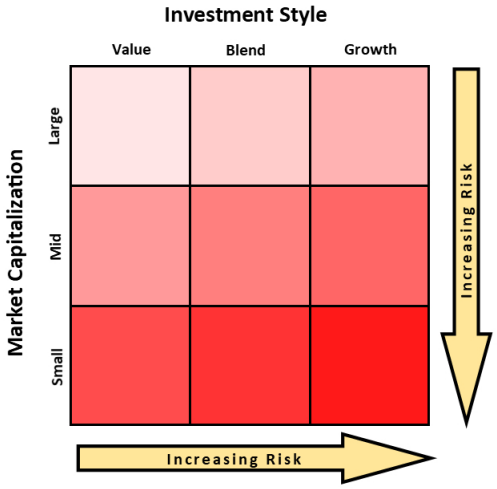
The main body of the paper utilizes the Morningstar Category index for the primary analysis for the following reasons: among the three benchmark choices provided by Morningstar, the Primary Prospectus Benchmark index is gathered from a fund's prospectus, yet the investment objective outlined in the prospectus often fails to accurately reflect the fund's actual investment strategy. Additionally, there is a notable number of missing values and a high concentration of uniform benchmarks in both the Modern Portfolio Theory index and the Primary Prospectus Benchmark index. However, these inconsistency and missing value issues are addressed by the Morningstar Category classification, established in 1996, which is based precisely on the funds' holdings. Table I.1 below provides a comparison of the definitions and coverage of the three benchmarks.

Table I.1: *Benchmark Indices.* This table presents a summarized comparison of three benchmark indices, encompassing both objective and subjective benchmarks.

	Morningstar Category Index	Modern Portfolio Theory Index	Primary Prospectus Benchmark
Definition	precisely based on fund holdings and used for Morningstar fund rating system	used for standard risk calculations, such as alpha, beta, R-squared	primary benchmark as stated in fund's prospectus
Source	objective	objective	subjective
Coverage	best	uniform benchmarks	missing benchmarks

Morningstar popularized the Morningstar Category classification tool by placing it alongside its mutual fund ratings system. It uses an equity style box to categorize equity funds, based on market capitalization (large-cap, mid-cap, small-cap) and investment style (value, blend, growth). The term "blend" refers to funds that hold stocks with both growth and value characteristics. Thus this system classifies equity funds into nine distinct categories, as illustrated in Figure I.1 below.

Figure I.1: *The Morningstar Category style box.*



In this appendix section, we demonstrate that our main findings remain largely robust when using alternative benchmarks, whether objective or subjective. Table I.2 below presents a comparison of all strategies and measures when ESG funds are evaluated against these alternative benchmarks.

Table I.2: *Alternative benchmark indices.* This table summarizes all the results based on three different benchmark indices, with the results that differ from our baseline framework highlighted in bold.

	Morningstar Category Index	Modern Portfolio Theory Index	Primary Prospectus Benchmark
Coverage	120,415 fund-quarter obs, 3,849 funds, 516 ESG funds, 3,333 non-ESG funds.	90,379 fund-quarter obs, 2,670 funds, 111 ESG funds, 2,559 non-ESG funds. **Around 3/4 funds have S&P 500 as their MPT benchmark and some other benchmarks lack holding information.**	86,044 fund-quarter obs, 2,643 funds, 242 ESG funds, 2,401 non-ESG funds.
Holding deviation	0.05% per stock between ESG funds and matched non-ESG funds for large-cap category, similar to 0.05% holding deviation between non-ESG funds with their closely matched non-ESG counterparts.	0.17% per stock between ESG funds and matched non-ESG funds for large-cap category, larger than 0.12% holding deviation between non-ESG funds with their closely matched non-ESG counterparts.	0.09% per stock between ESG funds and matched non-ESG funds for large-cap category, larger than 0.04% holding deviation between non-ESG funds with their closely matched non-ESG counterparts.
Holdings of top25 emitters (based on absolute emission)	The average holdings of top emitters by ESG funds is 3.3%, while the average holdings of top emitters by their benchmark is 5.4%.	The average holdings of top emitters by ESG funds is 2.2%, while the average holdings of top emitters by their benchmark is 7.5%.	The average holdings of top emitters by ESG funds is 3.0%, while the average holdings of top emitters by their benchmark is 6.1%.
	The difference mainly stems from extensive margin (top emitters not held by funds).		
Holdings of polluting industries	ESG funds hold less polluting industries compared to their benchmark and non-ESG funds.	ESG funds hold less polluting industries compared to their benchmark and non-ESG funds.	ESG funds hold less polluting industries compared to their benchmark and non-ESG funds.

Emissions	Portfolio-level absolute emission (emission intensity) of ESG funds is 35.9% (25.6%) lower compared to their benchmarks. ESG active funds do more across-industry selection, ESG index funds do more within-industry selection.	Portfolio-level absolute emission (emission intensity) of ESG funds is 69.5% (37.3%) lower compared to their benchmarks. ESG active funds do more across-industry selection, ESG index funds do more within-industry selection.	Portfolio-level absolute emission (emission intensity) of ESG funds is 50.3% (35.7%) lower compared to their benchmarks. For absolute emission, ESG active funds do more across-industry selection, ESG index funds do more within-industry selection. For emission intensity, active and index ESG funds appear to be similar.
ESG scores	Portfolio-level ESG scores of ESG funds are similar to their benchmark (the percentage difference is smaller than 5%).	Portfolio-level ESG scores of ESG funds are smaller than their benchmark. ESG active (index) funds have 6.4% (3.8%) lower scores compared to their benchmarks.	Portfolio-level ESG scores of ESG funds are similar to their benchmark (the percentage difference is smaller than 5%).
	ESG funds have higher ESG scores compared to non-ESG funds. ESG index funds achieve the highest scores among all categories.		
E scores	Similar to the patterns observed for ESG scores.		
ESG risk	ESG funds achieve 4.1% lower Sustainalytics risk scores, 7.2% lower RepRisk index, compared to their benchmarks.	ESG funds achieve 2.3% lower Sustainalytics risk scores, 32.9% lower RepRisk index, compared to their benchmarks.	ESG funds achieve 4.8% lower Sustainalytics risk scores, 12.5% lower RepRisk index, compared to their benchmarks.
Board diversity	ESG funds hold portfolios with similar board diversity compared to their benchmarks, slightly higher compared to non-ESG funds.	ESG funds hold portfolios with slightly lower board diversity compared to their benchmarks, slightly higher compared to non-ESG funds.	ESG funds hold portfolios with similar board diversity compared to their benchmarks and non-ESG funds.

Incident rate	ESG funds achieve lower OSHA incident rate compared to their benchmarks and non-ESG funds.	**ESG funds show higher incident rate compared to their benchmarks, lower incident rate compared to non-ESG funds.**	**ESG funds show higher incident rate compared to their benchmarks, lower incident rate compared to non-ESG funds.**
Portfolio diversification and return volatility	ESG funds hold portfolios with higher industry concentration and return volatility compared to their benchmarks.	ESG funds hold portfolios with higher industry concentration and return volatility compared to their benchmarks.	ESG funds hold portfolios with higher industry concentration and return volatility compared to their benchmarks.
Fund return	ESG funds exhibit a slight underperformance compared to their benchmark in terms of monthly risk premium (-5.6 bps/month), while outperform their benchmarks with respect to CAPM alpha (2.5 bps/month), 4-factor alpha (4.3 bps/month) and 6-factor alpha (16.7 bps/month). No significant difference in CAPM alpha, 4-factor alpha, or 6-factor alpha between ESG and non-ESG funds, when controls and FE are added.	**ESG funds underperform their benchmark in terms of monthly risk premium (-11.4 bps/month), CAPM alpha (-16.6 bps/month), 4-factor alpha (-11.8 bps/month) and 6-factor alpha (-5.2 bps/month). Significant outperformance in CAPM alpha and 4-factor alpha, yet no significant difference in 6-factor alpha between ESG and non-ESG funds, when controls and FE are added.**	**ESG funds underperform their benchmark in terms of monthly risk premium (-8.9 bps/month), CAPM alpha (-2.4 bps/month), 4-factor alpha (-1.6 bps/month), while outperform their benchmarks in terms of 6-factor alpha (5.9 bps/month).** No significant difference in CAPM alpha, 4-factor alpha, or 6-factor alpha between ESG and non-ESG funds, when controls and FE are added.
Exposure to market risk (beta)	ESG funds exhibit an average beta of 0.907, lower than their benchmarks (1.003) and similar to non-ESG funds.	**ESG funds exhibit an average beta of 0.996, higher than their benchmarks (0.959)** and similar to non-ESG funds.	ESG funds exhibit an average beta of 0.924, lower than their benchmarks (0.982) and similar to non-ESG funds.

Exposure to inflation shock	ESG funds exhibit lower exposure to energy inflation shock compared to both their benchmark and non-ESG funds.	**ESG funds exhibit higher exposure to energy inflation shock compared to their benchmark**, and lower compared to non-ESG funds.	ESG funds exhibit lower exposure to energy inflation shock compared to both their benchmark and non-ESG funds.