

Do Sustainable Risks Matter? Environmental, Social, and Governance Risk Pricing and Capital Allocation in British Pension Markets

Yu Liu*

California State University San Bernardino

ABSTRACT

This study examines the associations between ESG risk exposure, risk-adjusted performance, and investor flows among British pooled pension funds. Using monthly observations from June 2016 to June 2024, I find that these associations differ across ESG dimensions and between high- and relatively low-ESG-risk funds. In the relatively low-risk subsample, greater social and governance risk exposure is associated with higher abnormal returns, whereas environmental risk is negatively associated with performance. Higher social risk exposure is also associated with lower fund flows in that subsample. These findings are consistent with both the neglected-firm mechanism and the doing-well-while-doing-good hypothesis. Because ESG exposure and performance are measured contemporaneously in the principal specifications, the estimates should be interpreted as conditional associations rather than causal effects. The study therefore shows that disaggregated ESG risk measures contain information related to British pension-fund returns and capital allocation, while leaving causal identification and changes in ESG pricing over time for further analysis.

Keywords: ESG risk exposure; British pension funds; fund performance; investor flows

JEL Classification: G11; G23; Q56; M14

* Department of Accounting & Finance, Jack H. Brown College of Business and Public Administration, California State University, San Bernardino, USA. Email: yu.liu@csusb.edu

I. Introduction

Recent developments in sustainable finance have intensified an important debate in investment management: are ESG characteristics associated with risk-adjusted performance, and do these associations differ across environmental, social, and governance risks? ESG integration has become common among institutional investors, particularly pension funds, but the empirical evidence remains mixed. Traditional asset-pricing theory compensates investors for systematic financial risks. Nonfinancial risks, including climate exposure, governance failures, labor controversies, and reputational crises, may nevertheless be related to firm value and portfolio resilience (Krueger, Sautner, and Starks, 2020; Bolton and Kacperczyk, 2021). The empirical question examined here is whether fund-level ESG risk exposure is conditionally associated with abnormal returns and capital flows after conventional risk factors are taken into account.

The debate has become particularly relevant for pension funds, which operate with exceptionally long investment horizons and therefore face heightened exposure to sustainability-related risks. Unlike short-term investors, pension funds must account for climate transition risks, demographic instability, social inequality, and governance failures that may affect portfolio performance over decades rather than quarters. As a result, ESG integration is increasingly viewed not merely as an ethical preference but as a core component of fiduciary responsibility and long-term risk management (Sparkes and Cowton, 2004; OECD, 2017).

Regulatory reforms in the United Kingdom have further accelerated this transition. Since 2000, British occupational pension schemes have been required to disclose in their Statement of Investment Principles (SIP) the extent to which social, environmental, and ethical considerations are incorporated into investment decisions (Solomon, Solomon, and Norton, 2002). More recently, amendments introduced under the Pension Protection Fund (Pensionable Service) and Occupational Pension Schemes regulations, alongside guidance from The Pensions Regulator (TPR), strengthened trustees' obligations to consider financially material ESG risks, including climate-related risks, over the short, medium, and long term. In 2021, Britain became one of the first countries to mandate climate-related disclosures aligned with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) for large pension schemes, requiring trustees to report governance structures, scenario analysis, risk management processes, and climate metrics associated with their portfolios. Furthermore, the Department for Work and Pensions (DWP) clarified that financially material ESG factors must be considered within fiduciary duties, reinforcing the position that sustainability risks are integral to prudent pension fund management rather than optional ethical concerns. Consequently, British pension funds provide an ideal setting for examining whether ESG risks influence portfolio performance and investor capital allocation decisions.

Although prior research has documented growing investor demand for sustainable assets, important uncertainties remain regarding the mechanisms through which ESG factors affect asset prices and fund flows. Earlier studies on socially responsible investment (SRI) funds largely focused on ethical screening and comparative performance relative to conventional portfolios (Bauer, Koedijk, and Otten, 2005; Renneboog, Ter Horst, and Zhang, 2011). Subsequent research demonstrated that investors increasingly direct capital toward funds with stronger sustainability profiles. For example, Bollen (2007) shows that socially responsible funds benefit from greater investor loyalty, while Hartzmark and Sussman (2019) find that sustainability ratings significantly influence mutual fund flows. More recent studies further suggest that ESG preferences can affect firms' cost of capital and market valuation (Pastor, Stambaugh, and Taylor, 2021; Pedersen, Fitzgibbons, and Pomorski, 2021).

Despite this growing literature, relatively little is known about how individual ESG risk pillars influence pension fund performance and investor behavior. Most existing studies rely on composite ESG scores, implicitly assuming that environmental, social, and governance factors exert similar effects on investment outcomes. However, emerging evidence suggests that these dimensions may operate through fundamentally different economic channels. Environmental risks are often linked to carbon exposure, climate regulation, and transition costs (Bolton and Kacperczyk, 2021), whereas governance risks are associated with agency conflicts, transparency failures, and executive misconduct. Social risks, meanwhile, influence labor productivity, stakeholder trust, and corporate reputation (Bouslah et al., 2013; Dumitrescu and Zakriya, 2021). Ignoring these distinctions may conceal important dynamics in how investors interpret and price ESG-related information.

Examining the individual ESG pillars is therefore important because an aggregate ESG score may combine effects that differ in both magnitude and direction. For example, the adverse performance consequences of environmental risk may be offset by a return premium associated with neglected firms exposed to social or governance risks. A statistically weak relationship based on an aggregate score could consequently be interpreted as evidence that ESG risk is unimportant, even when individual ESG risks are materially priced. Disaggregating ESG risk allows me to determine whether the apparent absence of an overall effect reflects genuine irrelevance or the cancellation of economically meaningful pillar-specific effects. Similarly, the effect of additional ESG risk may depend on a fund's existing risk profile: moderate exposure may be manageable within an otherwise low-risk portfolio but may signal persistent vulnerability within an already high-risk portfolio. Comparing the two groups therefore reveals relationships that a single full-sample estimate may obscure. These tests are also useful to pension trustees and fund managers because they identify which ESG risks are financially material and whether their implications depend on a fund's overall sustainability profile.

This study addresses these gaps by examining the associations between ESG risk exposure, performance, and fund flows among British pooled pension funds. Using monthly data from 41 British pension funds between June 2016 and June 2024, I investigate whether ESG risks remain economically relevant after controlling for conventional market risk factors through the CAPM, Carhart four-factor, and Fama-French five-factor models. The findings indicate that ESG risk exposure is indeed priced by the market. Even after accounting for traditional financial risk factors, the abnormal returns of pension funds remain significantly affected by unmanaged ESG risks embedded within portfolio holdings.

More importantly, the results reveal substantial differences across ESG dimensions and across funds with varying levels of sustainability risk. Within low-ESG-risk portfolios, social and governance risks are positively related to fund alpha, whereas environmental risk exposure negatively affects performance. In contrast, among high-ESG-risk funds, most ESG risk measures exhibit negative relationships with abnormal returns. These findings provide evidence consistent with the “doing well while doing good” hypothesis proposed by Hamilton, Jo, and Statman (1993), but the contemporaneous design does not distinguish among those mechanisms causally.

The findings also support the “neglected firm effect” introduced by Arbel, Carvell, and Strebel (1983) and later extended by Merton (1987). Firms avoided by norm-constrained institutional investors may experience lower investor attention and depressed valuations, thereby generating higher expected returns. In the ESG context, companies with elevated sustainability risks may temporarily outperform because socially conscious investors systematically avoid them. At the same time, the evidence aligns closely with the equilibrium framework developed by Pástor,

Stambaugh, and Taylor (2021), which predicts that investors with strong ESG preferences are willing to pay a premium for green assets, reducing their expected returns. However, when ESG concerns intensify unexpectedly—such as during climate shocks or regulatory tightening—sustainable assets may outperform conventional investments through repricing effects.

ESG risk measures are also associated with pension fund flows. In the relatively low-risk group, greater social risk exposure is associated with lower flows. Moderate environmental risk is positively associated with flows in some specifications. These conditional patterns suggest that capital allocation varies with both the ESG dimension and the fund's broader risk profile; they do not establish that ESG exposure caused the observed flows.

This study contributes to the sustainable-finance and pension-fund literature by separately examining environmental, social, and governance risks rather than relying only on an aggregate measure. Existing studies typically employ composite ESG scores at annual or quarterly frequencies. For instance, Alda (2020, 2021) investigates ESG integration in British pension funds using aggregate sustainability indicators, while much of the broader ESG literature focuses on overall ratings rather than disaggregated ESG dimensions. Because environmental practices, labor relations, stakeholder engagement, and governance structures may operate through different channels (Bouslah et al., 2013; Dumitrescu and Zakriya, 2021). By utilizing monthly ESG risk data, this study provides one of the first high-frequency analyses of how individual ESG pillars influence pension fund performance. The findings reveal that environmental, social, and governance risks are not priced uniformly. Instead, each pillar exhibits a distinct relationship with risk-adjusted abnormal returns, highlighting the importance of examining ESG dimensions separately rather than treating sustainability risk as a single homogeneous construct.

Second, this study extends the literature by linking ESG risk exposure to investor capital flows within pension fund markets. While prior research demonstrates that investors increasingly prefer sustainable investment products (Bollen, 2007; Hartzmark and Sussman, 2019), limited evidence exists regarding how individual ESG risk dimensions shape investor allocation decisions in pension funds. The results show that pension fund investors actively respond to published ESG risk information, particularly social risk exposure. Funds associated with stronger social risk management attract significantly greater capital inflows, suggesting that institutional investors increasingly perceive social sustainability as financially material. Furthermore, I uncover asymmetric investor responses to ESG risks depending on prior fund performance and overall sustainability profiles.

Third, this study introduces a novel perspective by treating ESG exposure itself as a distinct risk factor within pension fund markets. Existing research has largely focused on comparing socially responsible investment (SRI) funds with conventional portfolios, often using fund labels or sustainability classifications as proxies for ESG integration. In contrast, this analysis examines whether unmanaged ESG risk embedded within portfolio holdings affects both performance and investor flows after controlling for traditional financial risk factors. The robustness tests further demonstrate that ESG risk exposure contains information beyond conventional SRI classifications, indicating that investors respond directly to underlying sustainability risks rather than simply to ethical fund labels. To the best of my knowledge, this aspect remains largely unexplored in the pension fund literature.

More broadly, the findings provide important insights into the evolving role of sustainability preferences in financial markets. The evidence suggests that investors in the British pension market increasingly view ESG risks as financially material rather than merely ethical considerations. By influencing both abnormal returns and fund flows, ESG risk exposure appears to shape investment

behavior, asset pricing, and capital allocation decisions in meaningful ways. These results reinforce the growing argument that sustainable investing is no longer a peripheral investment strategy but has become an integral component of long-term portfolio management and fiduciary responsibility.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature and develops the research hypotheses. Section 3 outlines the data and empirical methodology. Section 4 presents and discusses the empirical findings. Finally, Section 5 concludes the study and discusses important implications for practitioners, regulators, and policymakers.

II. Literature Review and Hypothesis Development

2.1. Sustainable Investing and Pension Funds

Pension funds have become central participants in the transition toward sustainable finance. Due to their exceptionally long investment horizons, pension funds are particularly exposed to sustainability-related risks such as climate transition costs, labor market instability, demographic change, and governance failures. Consequently, ESG integration is increasingly viewed as consistent with fiduciary duty and long-term value preservation (Sparkes and Cowton, 2004; OECD, 2017).

The United Kingdom has played a leading role in institutionalizing ESG integration within pension finance. Since 2000, British pension trustees have been required to disclose how social, environmental, and ethical considerations are incorporated into their Statements of Investment Principles (Solomon, Solomon, and Norton, 2002). More recently, regulatory reforms aligned with the Task Force on Climate-related Financial Disclosures (TCFD) strengthened trustees' obligations to consider climate-related financial risks within investment decision-making processes. These developments reflect growing recognition that sustainability risks can materially influence portfolio performance and long-term retirement outcomes.

Existing literature examining pension funds and sustainable investing has primarily focused on fiduciary obligations, ethical investment preferences, and the adoption of ESG strategies by institutional investors (Hoepner, Rezac, and Siegl, 2011; Hoepner and Schopohl, 2020; Alda, 2020, 2021). Another stream of research investigates the comparative performance and investor flows of SRI funds relative to conventional investment products (Bauer, Koedijk, and Otten, 2005; Bollen, 2007; Renneboog, Ter Horst, and Zhang, 2011; Dai et al., 2022). More recently, Alda (2020, 2021) examines ESG scores among British pensions using composite sustainability indicators and lower-frequency data.

Despite this growing body of research, several important limitations remain unresolved. First, most prior studies rely on aggregate ESG scores, implicitly assuming that environmental, social, and governance dimensions exert similar effects on investment outcomes. However, ESG pillars may influence firm performance through distinct economic channels. Environmental risks are often associated with carbon intensity, transition risk, and climate regulation, whereas governance failures may create agency conflicts and reputational instability. Social risks, meanwhile, can affect labor productivity, stakeholder trust, and operational continuity. Prior evidence suggests that different dimensions of ESG performance may therefore produce heterogeneous effects on firm risk and stock returns (Bouslah et al., 2013; Dumitrescu and Zakriya, 2021).

Second, much of the existing literature relies on annual or quarterly observations, potentially overlooking short-term adjustments in investor behavior and portfolio allocation. High-frequency ESG analysis may provide deeper insight into how sustainability risks interact with financial

market dynamics, particularly during periods of uncertainty and regulatory change. Third, relatively little research examines ESG risk exposure itself—as opposed to ESG labels or SRI classifications—as a distinct pricing factor affecting pension fund performance and investor flows.

This study addresses these gaps by examining the conditional associations of ESG risk exposure with risk-adjusted returns and capital flows in the British pooled pension-fund market using monthly data from 2016 to 2024. In addition, distinguishing among ESG pillars and across ESG-risk regimes is important for both theory and practice. A composite ESG score may conceal offsetting effects because environmental, social, and governance risks arise through different economic channels and need not be priced uniformly. Similarly, imposing a single linear relationship across all funds may obscure differences between manageable ESG exposure within an otherwise low-risk portfolio and additional exposure within an already high-risk portfolio. Identifying these differences helps clarify when ESG risk represents a priced source of financial risk, when it reflects investor preferences, and which forms of ESG exposure are most relevant to pension trustees' portfolio and risk-management decisions.

2.2. ESG Risk and Pension Fund Performance

A central debate within sustainable finance concerns whether ESG considerations improve or reduce financial performance. Hamilton, Jo, and Statman (1993) propose three competing hypotheses regarding the relationship between socially responsible investing and expected returns. The first “no difference” hypothesis suggests that socially responsible and conventional portfolios should generate similar risk-adjusted returns, implying that ESG characteristics are not priced by financial markets. The second “compensation” hypothesis argues that socially responsible portfolios may underperform because ethical screening restricts diversification opportunities. In contrast, the third “signaling” hypothesis proposes that socially responsible investments may outperform because firms with stronger ESG profiles possess superior management quality, stronger stakeholder relationships, and lower long-term risk exposure.

More recent studies provide additional theoretical explanations for these dynamics. Pástor, Stambaugh, and Taylor (2021) develop an equilibrium model in which investors derive utility from holding sustainable assets. In their framework, investors are willing to pay a premium for green firms, thereby reducing the expected returns of sustainable assets. However, unexpected increases in ESG concerns—such as climate shocks or regulatory tightening—can cause sustainable assets to outperform conventional investments through repricing effects. Similarly, Pedersen, Fitzgibbons, and Pomorski (2021) argue that ESG investing can improve portfolio efficiency when sustainability risks are financially material.

At the same time, another strand of literature suggests that firms neglected by norm-constrained investors may generate higher expected returns. The “neglected firm effect” proposed by Arbel, Carvell, and Strebel (1983) and extended by Merton (1987) argues that stocks avoided by institutional investors receive lower market attention, experience depressed valuations, and therefore offer higher expected returns as compensation for limited investor demand and reduced information efficiency. In the ESG context, companies with elevated sustainability risks may temporarily outperform because socially conscious investors avoid holding them.

The competing theories imply different empirical patterns. Pension funds with higher unmanaged ESG risks may therefore offer different expected returns relative to funds with stronger sustainability profiles. Furthermore, environmental, social, and governance risks may affect performance through different channels. Testing these relationships separately allows me to determine whether the limited evidence obtained from aggregate ESG scores reflects an absence

of ESG pricing or instead masks offsetting effects across the individual ESG pillars. This distinction is important because pension trustees cannot manage “ESG” as a single homogeneous exposure; they must identify which underlying risks affect portfolio performance. Accordingly, I propose the following hypothesis:

H1. ESG risk exposure is associated with risk-adjusted abnormal returns in the British pension-fund market, and the associations may differ across ESG dimensions.

2.3. ESG Risk and Pension Fund Flows

In addition to influencing expected returns, ESG characteristics may also shape investor capital allocation decisions. Prior studies show that investors increasingly prefer sustainable investment products and respond strongly to ESG ratings and sustainability disclosures. Bollen (2007) demonstrates that socially responsible funds benefit from stronger investor loyalty, while Hartzmark and Sussman (2019) show that investors allocate significantly more capital toward highly rated sustainable funds. Their findings suggest that sustainability functions as a valued investment attribute capable of influencing investor behavior.

Institutional investors, particularly pension funds, are likely to exhibit even stronger sensitivity to ESG information because of fiduciary obligations, reputational concerns, and long-term investment horizons. If pension investors perceive ESG exposure as a material source of financial risk, they may dynamically reallocate capital toward funds associated with stronger sustainability characteristics and lower unmanaged ESG risks.

However, investor responses may not be uniform across ESG dimensions. For example, investors may react more strongly to social controversies or governance failures than to moderate environmental risks, particularly when overall sustainability exposure remains low. These behavioral patterns may also vary depending on prior fund performance and market conditions. Hence, I formulate the second hypothesis:

H2. ESG risk exposure is associated with pension-fund flows, with investors allocating more capital to funds with lower ESG risks and stronger sustainability profiles.

2.4. Heterogeneity Across High- and Low-ESG-Risk Funds

Recent evidence indicates that investor responses to sustainability information are not uniform across all funds but instead depend heavily on a fund’s existing ESG profile. Hartzmark and Sussman (2019) show that investor flow reactions are significantly stronger for funds with extremely high or low sustainability ratings, suggesting that ESG preferences influence investment decisions in a nonlinear and asymmetric manner. This implies that investors may evaluate ESG risks differently depending on the broader sustainability characteristics of a portfolio.

In particular, moderate ESG risks may be interpreted differently when embedded within otherwise sustainable portfolios than when they arise in funds already characterized by elevated ESG exposure. For instance, investors may tolerate a relatively higher level of environmental risk in low-ESG-risk funds if they anticipate superior future returns or view such risks as manageable within an otherwise sustainable portfolio. In contrast, persistently high ESG risk exposure may trigger investor concern regarding reputational damage, long-term sustainability, and financial vulnerability, thereby leading to capital withdrawals.

Taken together, these arguments suggest that the effects of ESG risk exposure on pension fund performance and capital allocation may depend on a fund’s existing sustainability profile. This test is useful because a pooled full-sample estimate can conceal economically meaningful relationships when the marginal effect of ESG risk changes across risk regimes. Distinguishing between high-

and low-risk funds therefore provides a more accurate assessment of where ESG exposure is rewarded, penalized, or tolerated by investors. Therefore, I raise the final hypothesis:

H3. The associations of ESG risk exposure with pension fund performance and fund flows differ significantly between high-ESG-risk and relatively low-ESG-risk funds.

II. Data Sample and Methodology

3.1. Data

To examine whether ESG risk exposure affects pension fund performance and investor capital allocation, I construct a monthly panel dataset of Britain-domiciled pooled pension funds obtained from Morningstar Direct. The sample period spans from June 2016 to June 2024, beginning with the introduction of Morningstar's sustainability rating data and covering a period characterized by substantial growth in sustainable investing, increasing regulatory intervention, and heightened investor attention to ESG-related risks.

To minimize survivorship bias, both active and inactive pension funds are included in the sample. I exclude passive index funds and portfolios lacking ESG risk information because the analysis focuses on actively managed funds with observable sustainability-risk exposure. In addition, only pension funds with at least 50% of their assets invested in equities are retained, ensuring meaningful exposure to firm-level ESG risks embedded within portfolio holdings.

A key feature of the dataset is the availability of detailed ESG risk measures at the fund level. Morningstar Direct provides four categories of ESG risk indicators: an overall ESG risk score, alongside separate environmental, social, and governance risk scores. These measures capture the degree of unmanaged ESG risk associated with the underlying securities held within each portfolio after accounting for risks already mitigated by firms' sustainability management practices. Consequently, the scores reflect residual ESG vulnerabilities rather than simple ESG reputational ratings.

This distinction is particularly important for this empirical analysis. Rather than examining whether investors prefer funds labelled as "green" or socially responsible, this study investigates whether investors price unmanaged ESG risk exposure itself. To further distinguish sustainability preferences from ESG risk exposure, I also collect Morningstar sustainable investment attributes to identify socially responsible investment (SRI) funds. Morningstar classifies funds using both positive screening criteria ("sustainable investment") and exclusion-based screening approaches ("employs exclusions"). This allows me to later assess whether ESG risk exposure contains incremental information beyond conventional SRI classifications.

3.2. Measuring Pension Fund Performance

This empirical analysis focuses on two key dimensions of pension fund behavior: risk-adjusted performance and investor fund flows. To evaluate performance, I estimate abnormal returns (alpha) using three widely adopted asset pricing frameworks: the Capital Asset Pricing Model (CAPM), the Carhart four-factor model, and the Fama-French five-factor model. These models allow me to determine whether ESG risk exposure affects pension fund returns after controlling for traditional systematic risk factors priced in financial markets.

The CAPM specification is expressed as:

$$R_{i,t} - R_{rf,t} = \alpha + \beta_M (R_{M,t} - R_{rf,t}) + \varepsilon_{i,t} \quad (1)$$

where $R_{i,t}$ represents the monthly return of pension fund i , $R_{rf,t}$ denotes the risk-free rate, and $R_{M,t}$ is the market return. Fund returns are calculated at the portfolio level by aggregating share-class returns using lagged total net asset weights. The British one-year Treasury yield obtained from the Bank of England is used as the risk-free rate, while the FTSE 100 total return index serves as the proxy for the British equity market return.

To account for broader sources of systematic risk, I also estimate the Carhart (1997) four-factor model:

$$R_{i,t} - R_{rf,t} = \alpha + \beta_M (R_{M,t} - R_{rf,t}) + \beta_{SMB} SMB_t + \beta_{HML} HML_t + \beta_{WML} WML_t + \varepsilon_{i,t} \quad (2)$$

and the Fama-French (2015) five-factor model:

$$R_{i,t} - R_{rf,t} = \alpha + \beta_M (R_{M,t} - R_{rf,t}) + \beta_{SMB} SMB_t + \beta_{HML} HML_t + \beta_{RMW} RMW_t + \beta_{CMA} CMA_t + \varepsilon_{i,t} \quad (3)$$

I estimate the models using rolling five-year monthly windows and obtain CAPM, Carhart four-factor, and Fama-French five-factor alpha measures. These alphas serve as proxies for risk-adjusted pension-fund performance. Their subsequent relation to ESG exposure remains observational; factor adjustment does not by itself identify a causal ESG effect.

3.3. Measuring Investor Fund Flows

To capture investor capital allocation behavior, I construct a pension fund flow measure following the approach proposed by Sirri and Tufano (1998). Fund flows are defined as the net growth in a fund's total assets beyond the increase attributable to portfolio returns alone. In other words, this measure isolates the effects of investor contributions and withdrawals from changes caused by asset appreciation. Formally, pension fund flow is calculated as follows:

$$Fund\ Flow_{i,t} = \frac{NA_{i,t} - NA_{i,t-1}(1 + R_{i,t})}{NA_{i,t-1}} \quad (4)$$

where $NA_{i,t}$ denotes the total net assets of pension fund i at time t . The term $NA_{i,t-1}(1 + R_{i,t})$ captures the hypothetical growth in fund assets if no new investor inflows or outflows occurred and all returns were fully reinvested¹.

This standard measure estimates net external contributions and withdrawals as the portion of asset growth not explained by the fund's simple return. It therefore provides an outcome with which to examine whether capital allocation is conditionally associated with ESG risk exposure. It may also contain measurement error when assets change for reasons not captured by returns, so the flow regressions are not interpreted as direct causal responses by individual beneficiaries.

3.4. Descriptive Statistics and ESG Risk Distribution

Table 1 presents descriptive statistics for the key variables used in the study. The final dataset contains 2,282 monthly fund-level observations over the sample period. Fund Flow measures the percentage net growth in total net assets after adjusting for asset appreciation, while Fund Monthly

¹ $R_{i,t}$ is the fund's reported monthly return during month t . Following Sirri and Tufano (1998), the calculation assumes that investor flows occur at the end of the period.

Return captures the monthly return of British pooled pension funds. Return volatility is estimated using the standard deviation of monthly returns over the previous 12 months.

Table 1. Descriptive Statistics of British Pension Funds and ESG Risk Variables

Variables	Obs.	Mean	Median	Minimum	Maximum	Std Dev
Fund Monthly Return (%)	2,282	0.802	1.025	-17.738	22.426	3.924
Fund Flow (%)	2,282	-0.813	-0.927	-21.321	17.626	3.962
Return Volatility (%)	2,282	1.104	0.821	0.026	12.431	0.916
alpha - CAPM (%)	2,282	0.371	0.342	-0.424	1.256	0.284
alpha - Carhart Four Factor Model (%)	2,282	0.325	0.298	-0.347	1.113	0.272
alpha - FF Five Factor Model (%)	2,282	0.342	0.337	-0.702	1.231	0.291
Size	2,282	0.421	0.163	0.000	4.723	0.687
Fund Family Size	2,282	4.063	1.043	0.001	19.679	5.304
Fund Age	2,282	18.816	19.613	7.012	50.921	6.153
Environmental Risk Score	2,282	28.973	6.021	1.971	64.292	25.842
Social Risk Score	2,282	30.842	11.746	3.683	65.203	23.428
Governance Risk Score	2,282	29.342	9.026	3.018	60.926	23.315
Overall ESG Risk Score	2,282	35.346	26.106	17.048	58.919	13.674

This table presents summary statistics for the variables used in the study over the sample. Fund Monthly Return (%) represents the monthly fund return. Fund Flow (%) measures the net growth in fund assets, while Return Volatility (%) captures the volatility of monthly returns. Alpha - CAPM denotes the risk-adjusted abnormal return estimated using the Capital Asset Pricing Model (CAPM). Alpha - Carhart Four Factor and Alpha - FF Five Factor refer to the risk-adjusted abnormal returns estimated using the Carhart four-factor model and the Fama-French five-factor model, respectively. Size represents the total net assets of pension funds. Fund Family Size refers to the total net assets of a fund family. Fund Age measures the number of years since the fund's inception. Environmental Risk Score, Social Risk Score, Governance Risk Score, and Overall ESG Risk Score (each measured on a 0–100 scale) capture the extent to which a fund's economic value may be exposed to risks arising from environmental, social, corporate gov

The descriptive statistics reveal substantial variation in both fund performance and investor behavior during the sample period. The average monthly return of British pooled pension funds is 0.802%, whereas the mean monthly fund flow is negative at -0.813%. The negative average flow suggests that, on balance, investors withdrew capital from pension funds during parts of the sample period, likely reflecting heightened uncertainty and changing investment preferences. Return volatility averages 1.104%, although the distribution is highly right-skewed, indicating that some periods experienced exceptionally high volatility. This pattern is consistent with the severe market

disruptions observed during the COVID-19 pandemic and the subsequent market adjustment period.

The three measures of risk-adjusted performance—CAPM alpha, Carhart four-factor alpha, and Fama-French five-factor alpha—are all positive on average, suggesting that British pooled pension funds generated abnormal returns even after controlling for conventional systematic risk factors. The average CAPM alpha is 0.371%, while the average Carhart four-factor alpha and Fama-French five-factor alpha are 0.325% and 0.342%, respectively. The consistency across these alternative asset-pricing models strengthens the evidence that pension funds, on average, delivered positive excess performance during the sample period.

The ESG risk variables provide additional insight into the sustainability characteristics of British pension fund portfolios. The average overall ESG risk score is 35.346, while the mean environmental, social, and governance risk scores are 28.973, 30.842, and 29.342, respectively. However, the distributions of these variables display considerable heterogeneity across funds, implying substantial differences in sustainability risk exposure among pension portfolios. Environmental and governance risks exhibit particularly wide dispersion, suggesting that while some funds have successfully reduced exposure to climate-related and governance-related vulnerabilities, others remain significantly exposed to unmanaged ESG risks despite the broader institutional movement toward sustainable investing².

Figure 1 offers further insight into the distribution of ESG risk within the sample. The histograms reveal a pronounced clustering pattern, with ESG scores concentrated within distinct high-risk and low-risk regions rather than following a smooth continuous distribution. Closer examination indicates that most high-risk observations occur before the summer of 2019, after which ESG risk scores decline sharply. This structural break coincides with major British pension regulatory reforms introduced in October 2019, which required trustees of occupational pension schemes to disclose explicitly how ESG considerations were incorporated into investment strategies and stewardship policies. The sharp reduction in ESG risk following these reforms suggests that pension funds responded actively to increasing regulatory pressure and growing investor demand for sustainable investment practices by adjusting portfolio allocation decisions and strengthening ESG integration³.

Motivated by this apparent structural shift, the sample is divided into two sustainability regimes: a high-ESG-risk subsample comprising funds with ESG risk scores above 30, and a low-ESG-risk subsample comprising funds with ESG scores below 30 on the 0–100 scale. According to Morningstar's ESG risk methodology, scores above 30 are classified as high or severe risk, scores between 20 and 30 indicate medium risk, and scores below 20 represent low or negligible risk. Given the observed distribution of ESG scores in the sample, the classification into high- and low-risk groups is consistent with the underlying characteristics of the data. This distinction is particularly important for the subsequent empirical analysis because the pricing of ESG risks and

² The ESG risk variables are highly correlated with one another, with pairwise correlations above 0.9. This indicates that funds exposed to one category of sustainability risk are often simultaneously exposed to broader ESG vulnerabilities. To avoid multicollinearity concerns and isolate the distinct effects of each ESG dimension, I estimate separate regression specifications for the overall ESG score and for each individual ESG pillar

³ Several developments may also have contributed to this transition, including strengthened regulatory expectations concerning financially material ESG considerations, improvements in ESG information and measurement, growing beneficiary attention to sustainability, and corresponding adjustments in pension-fund portfolios. Nevertheless, the descriptive evidence does not allow me to attribute the shift to any single regulatory event. I therefore interpret the clustered distribution as evidence of a broad change in the ESG environment and formally examine heterogeneity across the two risk regimes without making a causal claim regarding its source.

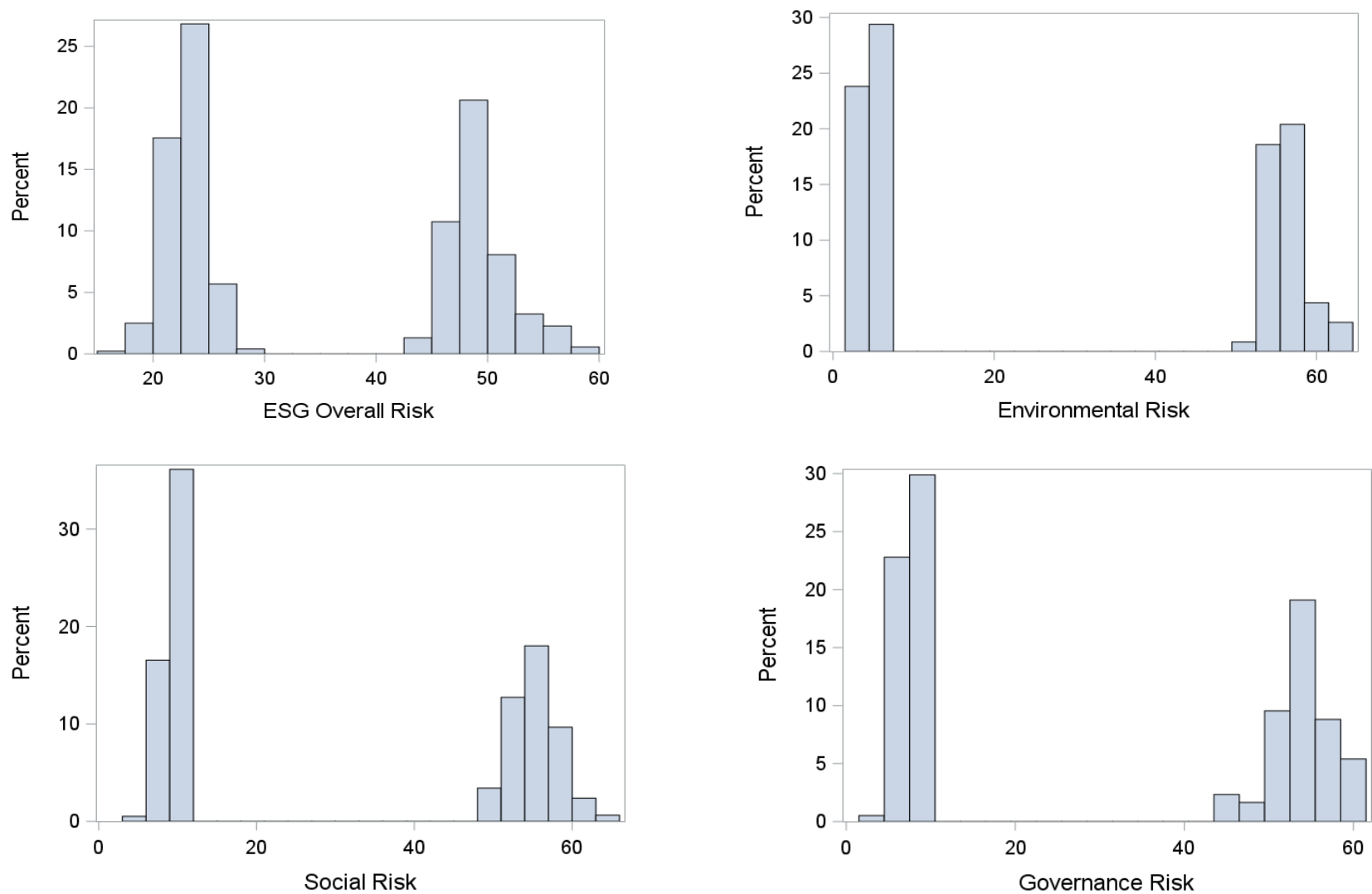
investor responses to sustainability information appear to vary substantially across these two regimes.

To provide preliminary evidence on the relationship between ESG risk exposure, pension fund performance, and investor capital flows, Figure 2 presents scatter plots and fitted regression lines for the full sample as well as for the high- and low-ESG-risk subsamples. The visual evidence indicates that the relationship between ESG risk and fund performance is not uniform across sustainability regimes. Depending on the ESG profile of the portfolio, both positive and negative associations emerge across the various ESG dimensions. Similarly, the relationship between ESG risk and investor flows differs considerably between the high- and low-risk subsamples, suggesting that investors interpret and respond to sustainability risks differently depending on the existing ESG characteristics of a fund.

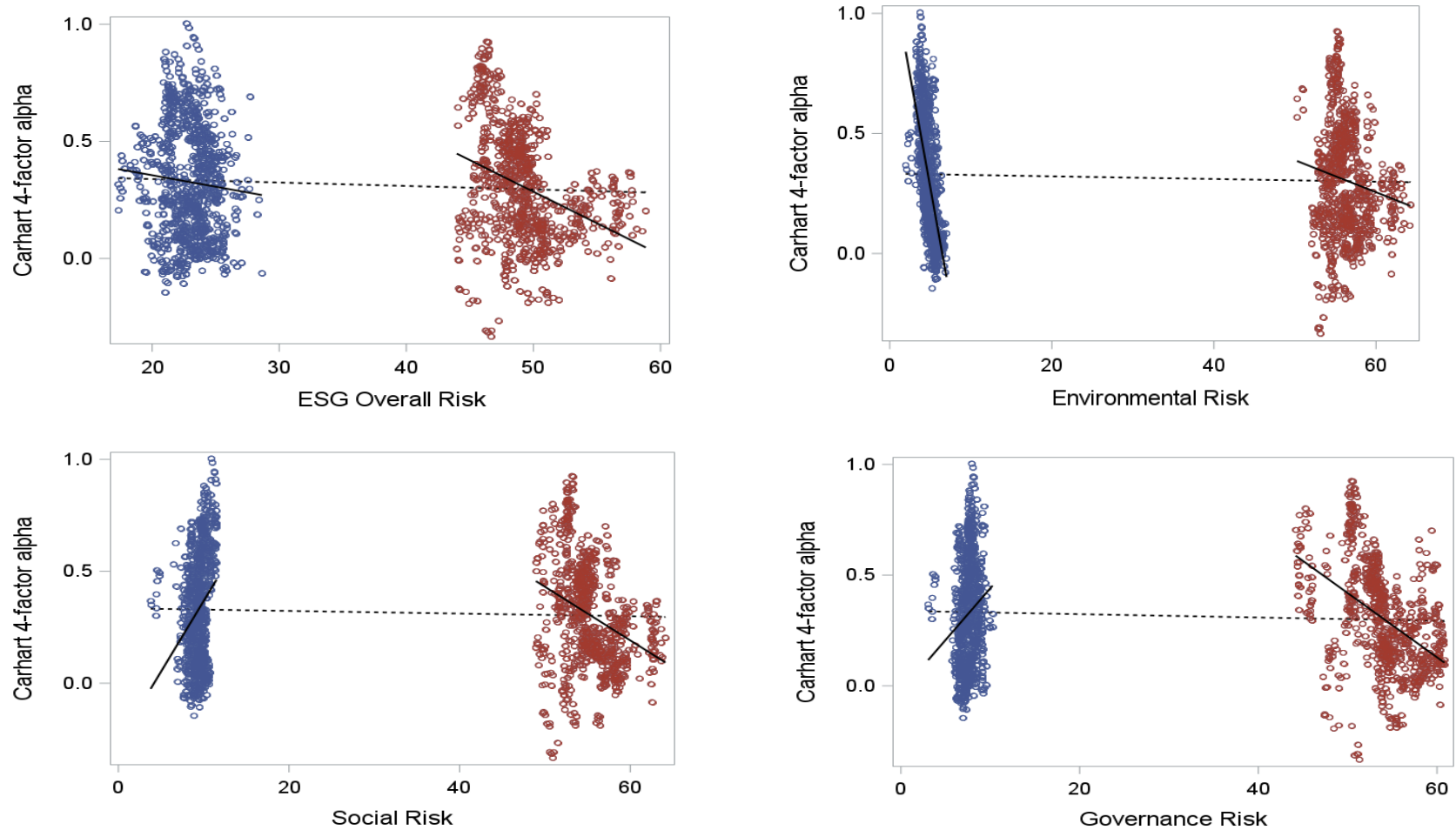
These preliminary findings support the central argument of the study: ESG risks do not affect all pension funds uniformly. Rather, both the pricing of ESG risk and investor reactions to sustainability information appear to be conditional on the broader ESG profile of the portfolio. This motivates the more detailed multivariate regression analysis conducted in the subsequent sections. They motivate the multivariate analysis but do not establish pricing, investor motives, or causal effects.

To further investigate the differences between the two ESG regimes, Table 2 reports the mean values and difference-in-means test results for fund characteristics, risk-adjusted performance measures, and the percentage allocation of portfolio equity holdings across economic sectors. The results indicate statistically significant differences between the high- and low-ESG-risk subsamples across most variables. In particular, funds with lower ESG risk scores—indicating stronger ESG risk management—attract significantly greater investor inflows and generate higher risk-adjusted returns, as measured by CAPM alpha and Carhart four-factor alpha.

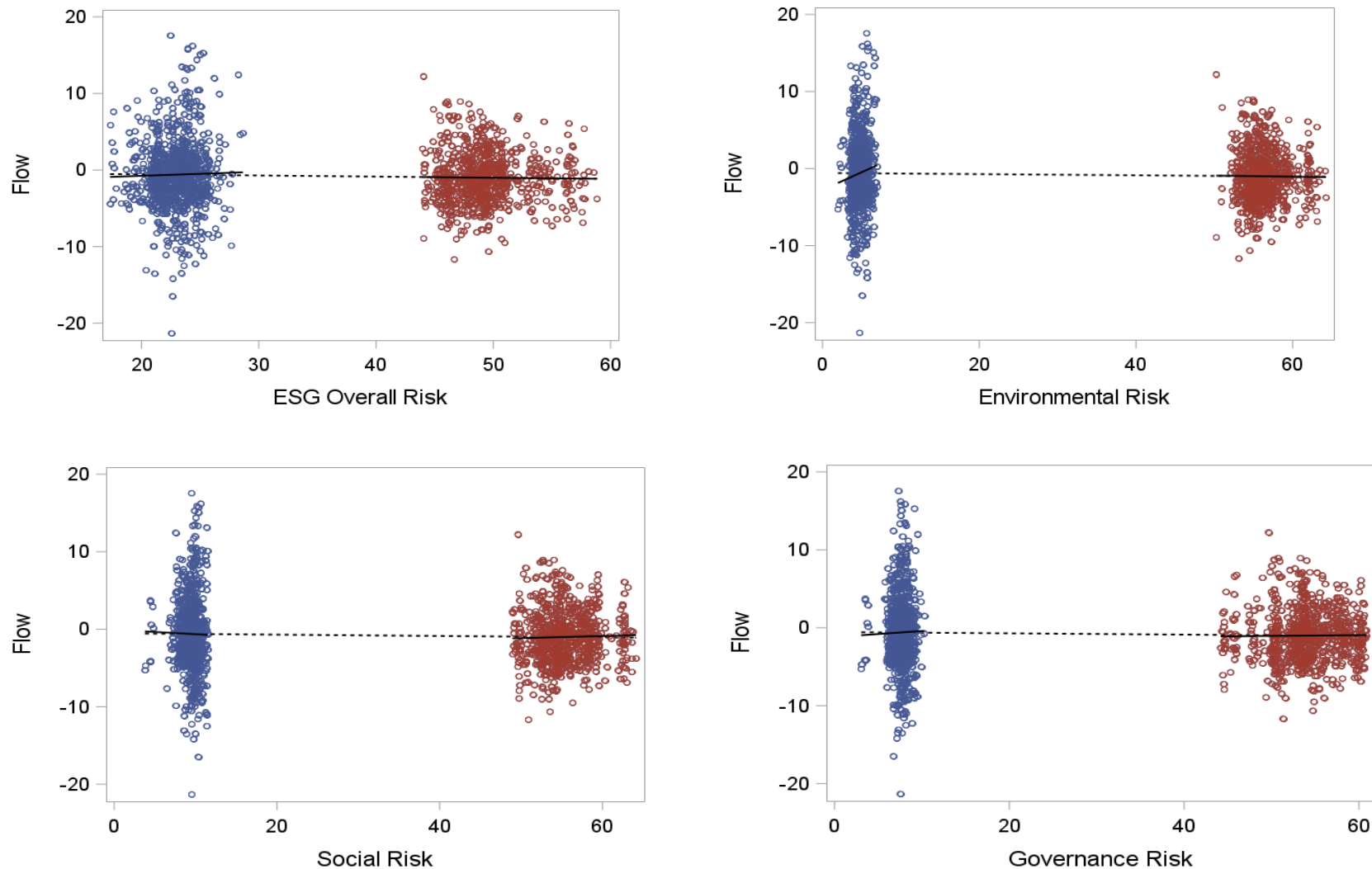
Sector allocation patterns also differ meaningfully across the two groups. Low-ESG-risk funds allocate a smaller proportion of their equity holdings to firms operating in the consumer cyclical, consumer defensive, energy, and financial services sectors. This finding suggests that firms within these industries are, on average, more exposed to unmanaged ESG risks. Consequently, pension funds seeking to reduce ESG risk exposure appear to adjust portfolio composition away from sectors that are traditionally associated with higher environmental, social, or governance vulnerabilities.

Figure 1. Distribution of ESG Risk Scores

This figure illustrates the distribution of the overall ESG risk score, as well as the environmental, social, and governance risk scores.

Figure 2. Full Sample and Clustered Samples by High vs. Low-Risk Scores.**Panel a. ESG Risk Scores vs. Carhart Four-Factor Alpha**

This figure presents scatter plots of risk-adjusted returns against ESG risk scores. In each graph below, the dashed OLS regression line represents the fitted relationship based on the full sample, while the solid OLS regression lines correspond to the high- and low-ESG risk subsamples. The left cluster represents the high-risk-score subsample, whereas the right cluster represents the low-risk-score subsample.

Panel b. ESG Risk Scores vs. Fund Flows

This figure presents scatter plots of pension fund flows against ESG risk scores. In each graph below, the dashed OLS regression line represents the fitted relationship based on the full sample, while the solid OLS regression lines correspond to the high- and low-ESG risk subsamples. The left cluster represents the high-risk-score subsample, whereas the right cluster represents the low-risk-score subsample.

IV. Empirical Analysis

4.1. ESG Risk Exposure and Pension Fund Performance

A central question in sustainable finance is whether ESG risks measures are related to risk-adjusted returns after conventional factors and observed fund characteristics are taken into account. If institutional investors perceive ESG exposure as a financially material risk factor, pension funds with higher unmanaged ESG risks should require higher expected returns as compensation for bearing additional sustainability-related uncertainty. Conversely, funds characterized by stronger ESG risk management may benefit from lower financing costs, greater investor demand, and more resilient portfolio performance. To examine this issue, I estimate the following baseline specification⁴ to measure that conditional association:

$$\alpha_{i,t} = a + \beta_1 ESG\ Risk\ Exposure_{i,t} + \gamma_1 Controls_{i,t-1} + \varepsilon_{i,t} \quad (5)$$

where $\alpha_{i,t}$ represents the risk-adjusted abnormal return of pension fund i at time t . ESG risk exposure is measured alternatively using the overall ESG risk score as well as the individual environmental, social, and governance risk scores. The model includes a set of control variables commonly used in pension fund and mutual fund performance studies, including lagged return volatility, fund size, fund age, family size, and manager turnover. Fund size is measured as the natural logarithm of total fund assets lagged by one month, while fund age captures the number of years since fund inception. Family size is defined as the one-month-lagged logarithm of the

Table 2. Comparison of Mean Fund Characteristics, Alphas, and Sector Allocations (% of Equity Assets). between High and Relatively Low ESG Risk Subsamples

	High ESG Risk Score	Relatively Low ESG Risk Score	H - L
Fund Characteristics			
Fund Flow (%)	-1.237	-0.624	-0.613***
Fund Monthly Return (%)	1.145	0.603	0.542***
Volatility	0.795	1.284	-0.489***
Size	0.489	0.364	0.125***
Fund Family Size	4.474	3.997	0.477
Fund Age	17.143	21.008	-3.865***
Abnormal Returns			
alpha - CAPM(%)	0.342	0.394	-0.052***
alpha - Carhart 4-Factor Model (%)	0.311	0.334	-0.023*
alpha - FF 5 Factor Model (%)	0.396	0.312	0.084***

⁴ I thank the anonymous reviewer for raising the concern about multicollinearity. Because the overall ESG risk score and its three components are highly correlated, I estimate them separately. The mean VIF is 1.12, and the maximum VIF is 2.17, both below 5, indicating that multicollinearity is not a material concern. I provide this clarification in a footnote in the revised manuscript.

Sector allocations**(% of Equity Assets)**

Basic Materials	5.909	6.263	-0.354***
Industrials	10.337	11.487	-1.150***
Technology	12.185	13.483	-1.298***
Communication Services	3.912	7.820	-3.908***
Consumer Discretionary	12.805	10.244	2.561***
Consumer Staples	9.465	8.518	0.947***
Energy	6.800	4.446	2.354***
Healthcare	10.366	11.487	-1.121***
Financial Services	19.822	15.877	3.944***
Real Estate	2.672	2.628	0.044
Utilities	2.204	2.803	-0.599***
# Obs.	1068	1214	

This table reports the mean values of variables for the high- and relatively low-ESG risk score subsamples. The variables include fund characteristics, performance alphas, and sector allocations. Variables in the Sector allocations category represent the percentage of a portfolio's equity assets invested in each sector. The final column presents the results of difference-in-means tests between the high- and relatively low ESG risk score subsamples. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

aggregate assets managed by all funds within the same fund family. To account for managerial instability, I include a manager turnover indicator equal to one when a pension fund experiences a change in portfolio manager during a given month and zero otherwise. All regressions incorporate year fixed effects and fund family fixed effects to control for time-specific shocks and unobserved heterogeneity across fund families. Robust standard errors are reported throughout the analysis.

Equation (5) is a contemporaneous conditional-association model. ESG exposure and alpha are measured in the same month, so β_1 may reflect reverse timing or their common dependence on portfolio composition. Lagged controls do not resolve this simultaneity. Accordingly, the coefficient is not interpreted as a causal effect. A lagged-ESG specification can establish temporal ordering, while causal inference would require an additional source of exogenous variation and clearly stated identifying assumptions.

Tables 3 and 4 report the contemporaneous estimates for the full sample and the two ESG-risk groups, using Carhart four-factor alpha as the primary performance measure. The full-sample regressions initially suggest a relatively weak relationship between overall ESG risk and pension fund alpha, with only marginal statistical significance. However, the high- and low-ESG-risk subsample analyses reveal substantially stronger and more systematic relationships between ESG risk exposure and abnormal performance.

At first glance, the apparent inconsistency between the full-sample and subsample results may seem puzzling. However, this pattern is largely driven by the clustered nature of ESG risk across funds. Specifically, the relationship between ESG risk and performance differs materially between low-risk and high-risk funds, causing the average full-sample effect to obscure important cross-sectional heterogeneity. To address this issue, I augment the baseline specification by introducing a low-risk dummy variable that captures differences between high- and low-ESG-risk funds. The modified specification is given as follows:

$$\alpha_{i,t} = a + \beta_1 ESG\ Risk_{i,t} + \beta_2 Low_{i,t} + \beta_3 Low_{i,t} \times ESG\ Risk_{i,t} + \gamma_1 Controls_{i,t-1} + \varepsilon_{i,t} \quad (6)$$

where $Low_{i,t}$ is a binary indicator equal to one for funds with ESG risk scores below 30 and zero otherwise⁵.

The results incorporating the low-risk interaction term are reported in Table 5. These findings, together with the subsample evidence in Table 4, reveal a more nuanced relationship between ESG risk exposure and pension fund performance. For high-ESG-risk funds, overall ESG risk, social risk, and governance risk are consistently negatively associated with abnormal returns. This suggests that investors penalize funds with elevated unmanaged ESG exposure, particularly when ESG risks become sufficiently large to threaten portfolio stability or future cash flows. In contrast, the relationship for low-ESG-risk funds differs substantially. Within the low-risk subsample, social and governance risk exposures exhibit a significantly positive association with fund alpha. This result suggests that, when the overall ESG risk profile of a portfolio is already well controlled, moderate exposure to social and governance risks may be perceived by investors as compensation for bearing additional nonfinancial uncertainty. In other words, once a fund maintains an overall low ESG risk profile, incremental exposure to certain social and governance dimensions may command a return premium. By comparison, environmental risk and overall ESG risk remain negatively related to abnormal returns even within the low-risk group, implying that environmental risk is treated differently by investors and may carry more immediate financial implications.

Table 3. ESG Risk and Abnormal Returns: Full-Sample Regression Results

Variables	(1)	(2)	(3)	(4)
Overall ESG Risk	-0.001* (-1.834)			
Environmental Risk		0.000 (0.304)		
Social Risk			0.000 (0.755)	
Governance Risk				0.000 (0.703)
Log size	0.010** (2.403)	0.010** (2.445)	0.011** (2.462)	0.010** (2.418)
Log Family size	0.010 (1.408)	0.012 (1.496)	0.012 (1.497)	0.015 (1.512)
Return Volatility	-0.019*** (-3.321)	-0.020*** (-3.334)	-0.021*** (-3.346)	-0.019*** (-3.329)
Log Fund age	-0.198*** (-5.428)	-0.195*** (-5.382)	-0.196*** (-5.395)	-0.196*** (-5.391)
Manager Turnover	-0.050 (-0.724)	-0.035 (-0.503)	-0.037 (-0.568)	-0.044 (-0.655)

⁵ Morningstar classifies ESG risk scores greater than 30 as indicating high to severe levels of ESG risk.

Constant	0.474* (1.884)	0.384 (1.565)	0.394 (1.582)	0.428* (1.806)
Year Fixed Effect	Yes	Yes	Yes	Yes
Fund Family Fixed Effect	Yes	Yes	Yes	Yes
Observations	2,282	2,282	2,282	2,282
R-sq	0.290	0.288	0.289	0.290

This table presents the regression results of Carhart Four-Factor Model alphas on ESG risk scores for the full sample. Robust t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

The economic magnitude of these effects in Table 4 is also substantial. Within the high-ESG-risk subsample, a one-standard-deviation increase in overall ESG risk, social risk, and governance risk corresponds to changes equivalent to 58.88%⁶, 115.31%, and 193.69% of the mean abnormal fund performance, respectively. Furthermore, within the low-ESG-risk subsample, a one-standard-deviation change in overall ESG risk and the environmental, social, and governance pillars corresponds to changes of 222.98%, 1383.08%, 519.08%, and 344.35% of mean abnormal performance, respectively. These magnitudes indicate that ESG risk exposures

³ For example, in the high-ESG-risk subsample, the economic magnitude for the overall ESG risk score is calculated as follows: $(0.014 \times 13.674) / 0.325 \times 100 = 58.88\%$, where 0.014 is the estimated coefficient of the overall ESG risk score from Table 4, 13.674 is the standard deviation of the overall ESG risk score and 0.325 is the mean Carhart four-factor alpha.

Table 4. ESG Risk and Abnormal Returns: Sub-Sample Regression Results

Variables	High ESG Risk Exposures				Relatively Low ESG Risk Exposures			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Overall ESG Risk	-0.014*** (-3.342)				-0.053*** (-9.742)			
Environmental Risk		0.005 (0.523)				-0.174*** (-18.437)		
Social Risk			-0.016*** (-3.457)				0.072*** (5.928)	
Governance Risk				-0.027*** (-7.625)				0.048*** (4.457)
Log size	0.021*** (3.516)	0.028*** (4.063)	0.019*** (3.058)	0.015** (2.446)	-0.002 (-0.354)	0.009* (1.858)	-0.007 (-1.214)	-0.005 (-0.767)
Log Family size	-0.112*** (-3.243)	-0.097*** (-2.949)	-0.105*** (-3.110)	-0.078** (-2.346)	0.001 (0.082)	0.034** (2.112)	0.036** (2.328)	0.015 (0.799)
Return Volatility	0.012 (0.367)	0.015 (0.379)	0.016 (0.405)	0.010 (0.254)	-0.019*** (-2.813)	-0.010** (-1.971)	-0.029*** (-5.438)	-0.024*** (-4.046)
Log Fund Age	-0.296*** (-6.507)	-0.319*** (-7.753)	-0.341*** (-7.164)	-0.268*** (-6.463)	-0.247*** (-5.846)	-0.121*** (-3.004)	-0.152*** (-3.944)	-0.151*** (-3.418)
Manager Turnover	-0.198* (-1.842)	-0.171* (-1.700)	-0.201* (-1.805)	-0.222* (-1.907)	0.023 (0.354)	-0.001 (-0.059)	0.057 (0.764)	0.028 (0.437)
Constant	3.622*** (4.735)	3.001*** (3.744)	3.502*** (4.647)	3.288*** (4.851)	1.235** (2.253)	0.343 (1.115)	-0.449 (-1.385)	0.357 (0.614)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund Family Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,068	1,068	1,068	1,068	1,214	1,214	1,214	1,214
R-sq	0.332	0.328	0.347	0.395	0.374	0.425	0.386	0.315

This table reports the regression results of Carhart Four-Factor Model alphas on ESG risk scores for the high-ESG-risk and low-ESG-risk subsamples. Robust t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

are economically meaningful determinants of pension fund performance rather than merely statistically significant predictors.

Taken together, the results suggest that investors distinguish between different ESG dimensions and evaluate them conditionally on the overall ESG risk environment of the fund. Environmental risk appears to be consistently penalized, whereas social and governance risks may generate compensation effects when the portfolio's aggregate ESG exposure remains low. This asymmetry likely reflects differences in how investors perceive the immediacy and financial materiality of individual ESG risks. Environmental risks, particularly climate-related risks, are increasingly viewed as systematic and long-term threats to firm value. Consequently, funds with greater environmental risk exposure may face lower valuations and weaker abnormal performance. Social and governance risks, however, may be interpreted differently when they occur within otherwise well-managed ESG portfolios, potentially reflecting exposure to undervalued or neglected firms.

These findings are broadly consistent with several theoretical and empirical strands in the sustainable finance literature. First, the positive relationship between social and governance risk exposures and abnormal returns among low-risk funds aligns with the “neglected firm effect” proposed by Arbel, Carvell, and Strebel (1983), Merton (1987), and Hong and Kacperczyk (2009). According to this argument, firms receiving lower investor attention or weaker institutional ownership may offer higher expected returns as compensation for limited information availability and restricted risk sharing. Pension funds with moderate exposure to social and governance risks may therefore benefit from holding undervalued assets that command higher risk premia.

Second, the negative relationship between environmental risk and fund performance supports the “doing well while doing good” hypothesis introduced by Hamilton et al. (1993). Firms with poor environmental practices may be more vulnerable to regulatory penalties, reputational damage, litigation risks, and adverse ESG-related news. Consequently, portfolios with higher environmental risk exposure experience lower abnormal returns as investors increasingly incorporate climate and sustainability concerns into asset pricing decisions.

The findings also closely align with the equilibrium model of sustainable investing developed by Pástor et al. (2021). In their framework, investors derive utility not only from financial returns but also from holding sustainable assets. As a result, investors are willing to pay higher prices for firms with superior ESG characteristics, thereby reducing the cost of capital for these firms. However, when ESG preferences strengthen unexpectedly—such as during periods of heightened climate awareness or tighter ESG disclosure requirements—green assets outperform brown assets. This mechanism provides a compelling explanation for the empirical results. The negative association between environmental risk and abnormal performance likely reflects increasing investor demand for environmentally responsible firms in the British pension market, particularly amid growing regulatory and societal emphasis on climate-related investing.

4.2. ESG Risk Exposures and Pension Fund Flows

Beyond portfolio performance, fund flows may covary with ESG characteristics if investors use sustainability information when allocating capital. If investors view ESG exposure as a meaningful indicator of long-term portfolio quality, funds with lower unmanaged ESG risks should attract greater inflows relative

Table 5: ESG Risk and Abnormal Returns: Controlling for Low-Risk Fund Clustering

Variables	(1)	(2)	(3)	(4)
Overall ESG Risk	-0.015*** (-2.825)			
Overall ESG Risk*LOW	-0.039*** (-5.912)			
Environmental Risk		0.003 (0.804)		
Environmental Risk*LOW		-0.170*** (-20.454)		
Social Risk			-0.022*** (-4.754)	
Social Risk*LOW			0.091*** (7.244)	
Governance Risk				-0.019*** (-8.655)
Governance Risk*LOW				0.070*** (6.826)
LOW	0.594*** (2.718)	1.118*** (4.246)	-1.347*** (-7.113)	-1.449*** (-8.626)
Log size	0.007** (2.068)	0.008** (2.101)	0.005 (1.019)	0.005 (1.188)
Log Family size	0.045* (1.805)	0.019 (1.555)	0.015 (1.441)	0.014 (1.383)
Return Volatility	-0.018*** (-2.847)	-0.011*** (-2.671)	-0.026*** (-4.921)	-0.025*** (-4.228)
Log Fund age	-0.251*** (-8.393)	-0.114** (-2.472)	-0.204*** (-6.582)	-0.201*** (-5.824)
Manager Turnover	-0.027 (-0.564)	-0.052 (-0.833)	-0.010 (-0.168)	-0.022 (-0.443)
Constant	1.524*** (3.487)	0.744 (0.448)	1.158*** (3.276)	1.545*** (3.574)
Year Fixed Effect	Yes	Yes	Yes	Yes
Fund Family Fixed Effect	Yes	Yes	Yes	Yes
Observations	2,282	2,282	2,282	2,282
R-sq	0.351	0.448	0.331	0.349

This table reports the regression results from the augmented ESG risk specification that incorporates a low-risk interaction term to distinguish between high- and low-ESG-risk pension funds. Robust t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

to funds with elevated sustainability vulnerabilities. To test this prediction, I estimate the following fund flow model following Renneboog et al. (2011):

$$\begin{aligned} Fund\ Flow_{i,t} = & a + \beta_1 ESG\ Risk_{i,t} + (\beta_2 R^+ + \beta_3 R^-) Return_{i,[t-1,t-12]} \\ & + (\beta_4 R^+ + \beta_5 R^-) Return_{i,[t-1,t-12]} \times ESG\ Risk_{i,t} + \gamma_1 Controls_{i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (7)$$

where $Fund\ Flow_{i,t}$ measures net investor inflows, as specified in Equation (4), while R^+ and R^- capture positive and negative past return effects over the previous 12 months. The interaction terms allow me to examine whether ESG risk exposure moderates investor responses to prior fund performance.

The results reported in Table 6 reveal that the relationship between ESG risks and fund flows varies substantially across sustainability regimes. In the full sample, ESG risk measures exhibit limited explanatory power for fund flows. However, once the sample is divided into high- and low-ESG-risk groups, several important patterns emerge.

For the high-ESG-risk subsample, fund flows become significantly more sensitive to overall ESG risk and environmental risk following periods of negative performance. This finding implies that investors react more strongly to ESG-related concerns when poorly performing funds also exhibit elevated ESG risk exposure. In particular, environmental risk appears to amplify investor withdrawals after negative returns, suggesting that investors may interpret weak environmental risk management as an additional signal of managerial inefficiency or heightened long-term financial vulnerability. Consequently, ESG risk acts as a reinforcing mechanism that intensifies the adverse effect of poor performance on investor capital allocation decisions.

In contrast, the low-ESG-risk subsample produces a markedly different pattern. I observe a significant positive association between environmental risk exposure and fund flows, alongside a significant negative relationship between social risk exposure and flows. The negative coefficient on social risk indicates that investors allocate more capital to low-ESG-risk funds whose portfolio companies maintain stronger social risk management practices. This finding is consistent with the notion that socially conscious institutional investors value firms that effectively manage labor relations, employee welfare, product responsibility, and broader stakeholder concerns. Moreover, the interaction results suggest that strong past positive returns partially mitigate investors' adverse reactions to social risk exposure. In other words, superior historical performance appears to offset some investor concerns regarding social risk, reducing the extent of capital outflows associated with higher social risk exposure.

The positive relationship between environmental risk and flows within the low-ESG-risk subsample is particularly noteworthy and warrants careful interpretation. Rather than indicating investor indifference toward environmental concerns, this result may reflect a relative-risk perspective among investors. When a fund already exhibits generally low ESG risk exposure, investors may tolerate moderate increases in environmental risk if they expect such exposure to generate superior risk-adjusted returns. For example, investors may perceive certain environmentally intensive industries as offering higher expected returns or diversification benefits, provided that overall ESG risks remain within acceptable bounds. Thus, once a fund satisfies a minimum threshold of ESG acceptability, investors may place greater emphasis on financial performance considerations than on marginal differences in environmental risk exposure.

Overall, the evidence from Table 6 demonstrates that investor responses to ESG risk are not uniform across the British pension fund market⁷. Instead, fund flows vary according to both the type and level of ESG risk exposure. Investors appear particularly sensitive to social risk within low-ESG-risk funds and to environmental risk within high-ESG-risk funds following poor performance. These findings suggest that ESG considerations are incorporated into capital allocation decisions in a conditional rather than absolute manner.

The results are broadly consistent with prior literature on institutional investors and socially responsible investing. Pension funds, as fiduciary institutions subject to regulatory oversight and public scrutiny, are often constrained by ethical and reputational considerations. Hong and Kacperczyk (2009) show that norm-constrained institutions such as pension funds are less likely to invest in “sin” stocks, while Fernando, Sharfman, and Uysal (2017) find that institutional investors avoid firms with high environmental risk exposure because such risks may threaten long-term shareholder value. Similarly, Hartzmark and Sussman (2019) demonstrate that U.S. mutual funds with stronger sustainability ratings attract significantly larger net inflows, indicating that investors increasingly view sustainability as a desirable fund characteristic. The findings extend this literature by showing that the relationship between ESG risk and investor flows is nonlinear and contingent upon the overall ESG profile of the fund. In particular, investors reward strong social risk management among low-risk funds, while demonstrating greater tolerance toward environmental risk once a fund’s aggregate ESG exposure is sufficiently low. This suggests that institutional investors do not simply avoid ESG risk altogether; rather, they balance ESG considerations against expected financial returns and differentiate between distinct dimensions of ESG risk when making allocation decisions.

⁷ I also divide the sample into periods before and after January 2021 and re-estimate the fund-flow regressions (I thank the anonymous reviewer for this helpful suggestion). The results are generally consistent with those reported in Table 6. Before 2021, ESG risk primarily affects fund flows by intensifying investors’ responses to poor prior performance, whereas after 2021, investors respond more directly and selectively to individual ESG dimensions, particularly social risk. This similarity reflects the temporal clustering of ESG exposure: high-risk observations are concentrated in the earlier years, while low-risk observations occur primarily in the later period. The detailed results are available upon request.

Table 6. ESG Risk Exposure and Pension Fund Flows

Variables	Full Sample				High ESG Risk Exposures				Relatively Low ESG Risk Exposures			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Overall ESG Risk	0.015 (0.143)				0.028 (0.454)				0.276 (1.501)			
Overall ESG Risk*R+	0.021 (0.118)				0.031 (1.147)				0.052 (0.446)			
Overall ESG Risk*R-	-0.049 (-1.157)				-0.403** (-1.997)				-0.029 (-0.347)			
Environmental Risk		-0.011 (-0.924)				-0.043 (-0.462)				0.587** (1.983)		
Environmental Risk*R+		0.047 (0.971)				0.081* (1.744)				0.024 (0.354)		
Environmental Risk*R-		-0.042 (-1.348)				-0.655*** (-2.596)				-0.475 (-0.389)		
Social Risk			-0.011 (-0.974)				0.004 (0.11)				-0.804** (-2.402)	
Social Risk*R+			0.007 (0.917)				0.050 (1.002)				0.408** (1.989)	
Social Risk*R-			-0.034 (-1.273)				-0.323 (-1.488)				-1.347* (-1.805)	
Governance Risk				-0.002 (-0.324)				0.054 (0.944)				-0.058 (-0.206)
Governance Risk*R+				0.011 (0.425)				0.008 (0.106)				0.269* (1.794)
Governance Risk*R-				0.009 (0.022)				-0.121 (-1.107)				0.104 (0.187)
R+	0.477 (1.694)	0.426 (1.627)	0.418 (1.612)	0.489* (1.863)	-0.845 (-0.370)	-3.522 (-1.024)	-1.977 (-0.742)	0.038 (0.024)	-0.408 (-0.157)	1.004 (1.352)	-2.452** (-2.053)	-0.804 (-0.746)
R-	3.588***	3.274***	3.118***	3.047***	18.135**	31.153**	26.442	8.018	0.241	5.877	11.275	0.785

	(3.012)	(2.914)	(2.875)	(2.839)	(2.003)	(2.127)	(1.513)	(0.754)	(0.005)	(0.728)	(1.419)	(0.107)
Log size	-0.108*	-0.106*	-0.110*	-0.106*	-0.165**	-0.148*	-0.147*	-0.148*	-0.094	-0.125	-0.094	-0.106
	(-1.824)	(-1.815)	(-1.837)	(-1.819)	(-1.983)	(-1.794)	(-1.768)	(-1.794)	(-0.852)	(-1.327)	(-1.105)	(-1.261)
Log Family size	0.034	0.042	0.035	0.038	0.721	0.657	0.701	0.684	0.542	0.443	0.326	0.457
	(0.152)	(0.150)	(0.155)	(0.156)	(1.577)	(1.494)	(1.582)	(1.411)	(1.118)	(0.847)	(0.679)	(0.872)
Return Volatility	2.015***	2.224***	2.187***	2.213***	4.143***	4.137***	4.114***	4.108***	1.757***	1.645***	1.843***	1.659***
	(12.524)	(12.783)	(12.646)	(12.749)	(9.644)	(9.407)	(9.348)	(9.571)	(10.488)	(10.904)	(10.874)	(10.221)
Log Fund age	0.434	0.328	0.341	0.325	0.587	0.704	0.712	0.521	0.975	0.318	0.658	0.701
	(0.980)	(0.942)	(0.951)	(0.917)	(0.698)	(0.784)	(0.751)	(0.674)	(1.308)	(0.519)	(0.983)	(1.016)
Manager Turnover	0.675	0.642	0.618	0.667	-0.304	-0.357	-0.337	-0.311	1.004	1.126	1.008	1.015
	(0.521)	(0.508)	(0.498)	(0.515)	(-0.218)	(-0.275)	(-0.272)	(-0.264)	(0.845)	(0.922)	(0.852)	(0.901)
Constant	-5.775	-5.124	-5.863	-4.995	-11.142*	-10.174*	-11.156*	-10.139*	-15.542*	-12.476*	-4.775	-6.408
	(-1.024)	(-0.986)	(-1.113)	(-0.952)	(-1.912)	(-1.900)	(-1.925)	(-1.878)	(-1.839)	(-1.786)	(-0.552)	(-1.114)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund Family Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,282	2,282	2,282	2,282	1,068	1,068	1,068	1,068	1,214	1,214	1,214	1,214
R-sq	0.294	0.285	0.276	0.297	0.312	0.310	0.307	0.304	0.282	0.285	0.279	0.280

This table presents the regression results of ESG risk scores on pension fund flows. R+ and R- denote positive and negative average returns over the previous 12 months, respectively. Robust t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively

4.3. ESG Risks During the COVID-19 Crisis

The COVID-19 pandemic generated one of the most severe episodes of financial uncertainty in recent history, making it a particularly useful setting for examining whether ESG risks become more financially relevant during periods of market stress. Prior studies document that the pandemic significantly affected investor sentiment, portfolio flows, and market volatility (Zhang, Hu, and Ji, 2020; Pástor and Vorsatz, 2020). To investigate whether the crisis altered the relationship between ESG risk exposure, pension fund performance, and investor capital allocation, I augment Models (5) and (7) by introducing a crisis dummy variable and its interaction with ESG risk measures. The variable $Pandemic_{i,t}$ is equal to one during the pandemic period from February 2020 to May 2020 and zero otherwise.

The estimation results for fund performance and fund flows are reported in Tables 7 and 8, respectively. Since the COVID-19 period largely overlaps with the low-ESG-risk regime that emerged after September 2019 following major British pension ESG regulatory reforms, I exclude the high-ESG-risk subsample from this analysis due to the limited number of observations during the crisis period.

The results reveal that overall ESG risk and environmental risk became more negatively associated with pension fund performance during the pandemic relative to the rest of the sample period. This finding suggests that investors penalize portfolios exposed to greater sustainability vulnerabilities, particularly environmental risks, during heightened market uncertainty. In contrast, the social and governance pillars exhibit a stronger positive relationship with fund performance during the crisis, implying that firms with stronger stakeholder management and governance structures were perceived as more resilient during the economic disruption.

The pandemic interactions for overall and environmental risk are positive in the fund-flow models. These flow interactions are consistent with continued capital reallocation toward funds with moderate ESG exposure during the crisis, but the model does not establish investor expectations or motives.

For the low-ESG-risk subsample, however, the relationships between ESG risk, fund performance, and investor flows remain broadly stable throughout the pandemic period. Aside from a marginally significant effect for social risk and a somewhat stronger positive association between overall ESG risk and fund flows, the core ESG-performance and ESG-flow relationships are largely unaffected by the crisis. This finding indicates that pension funds with relatively strong ESG profiles exhibited greater resilience during the pandemic, reinforcing the argument that effective ESG integration contributes to portfolio stability during periods of market stress and economic uncertainty.

Table 7. The Pandemic Shock and the Pricing of ESG Risk

Variables	Full Sample				Relatively Low ESG Risk Subsample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Overall ESG Risk	-0.001*				-0.048***			
	(-1.796)				(-8.759)			
Overall ESG Risk*Pandemic	-0.041***				-0.006			
	(-3.754)				(-0.632)			
Environmental Risk		-0.001				-0.191***		
		(-0.080)				(-22.126)		
Environmental Risk* Pandemic		-0.146***				0.001		
		(-8.341)				(0.153)		
Social Risk			0.000				0.078***	
			(0.748)				(6.135)	
Social Risk* Pandemic			0.117***				0.040*	
			(4.901)				(1.744)	
Governance Risk				-0.001				0.061***
				(-0.924)				(4.907)
Governance Risk* Pandemic				0.064***				0.010
				(2.783)				(0.463)
Pandemic	0.901***	0.603***	-1.032***	-0.475***	0.118	-0.079	-0.452**	-0.167
	(3.744)	(8.340)	(-4.782)	(-2.641)	(0.477)	(-1.127)	(-2.228)	(-0.894)
Log size	0.007**	0.009***	0.009**	0.008**	-0.001	0.017***	-0.006	-0.005
	(2.226)	(2.625)	(2.387)	(2.227)	(-0.289)	(3.938)	(-1.071)	(-0.802)
Log Family size	0.012	0.022**	0.013	0.014	0.006	0.045***	0.015	0.014
	(1.287)	(2.025)	(1.356)	(1.370)	(0.201)	(2.687)	(1.546)	(0.688)
Return Volatility	-0.007	0.001	-0.010*	-0.010	-0.011*	0.017**	-0.017***	-0.011
	(-1.315)	(0.011)	(-1.698)	(-1.201)	(-1.705)	(2.258)	(-2.947)	(-1.526)
Log Fund age	-0.208***	-0.196***	-0.204***	-0.211***	-0.204***	-0.097***	-0.148***	-0.143***

	(-5.246)	(-5.384)	(-5.846)	(-5.876)	(-5.426)	(-2.925)	(-4.001)	(-3.246)
Manager Turnover	-0.051	-0.042	-0.030	-0.041	0.024	0.003	0.061	0.033
	(-0.692)	(-0.546)	(-0.343)	(-0.579)	(0.394)	(0.052)	(0.912)	(0.452)
Constant	0.487**	0.212	0.409*	0.457*	2.210***	0.353	-0.513	0.148
	(2.063)	(1.293)	(1.791)	(1.804)	(4.952)	(1.112)	(-1.206)	(0.356)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund Family Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,282	2,282	2,282	2,282	1,214	1,214	1,214	1,214
R-sq	0.298	0.316	0.301	0.289	0.387	0.634	0.364	0.328

This table presents the regression results of ESG risk scores on Carhart four-factor alpha, incorporating a pandemic dummy as a moderating variable. Robust t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8. The Pandemic Shock and Pension Fund Flows

Variables	Full Sample				Relatively Low ESG Risk Subsample			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Overall ESG Risk	-0.002 (-0.193)				0.108 (0.582)			
Overall ESG Risk*Pandemic	0.844** (2.007)				0.952** (2.259)			
Overall ESG Risk*R+	-0.004 (-0.577)				0.124 (1.153)			
Overall ESG Risk*R-	-0.048 (-1.153)				0.522 (0.819)			
Environmental Risk		-0.007 (-0.933)				0.415 (1.441)		
Environmental Risk*Pandemic		1.337* (1.901)				0.953 (1.436)		
Environmental Risk*R+		-0.006 (-1.008)				-0.084 (-0.495)		
Environmental Risk*R-		-0.038 (-1.405)				-0.051 (-0.067)		
Social Risk			-0.005 (-0.788)				-0.573** (-2.106)	
Social Risk*Pandemic			-1.006 (-1.421)				-1.275 (-1.511)	
Social Risk*R+			-0.004 (-0.882)				0.287** (2.159)	
Social Risk*R-			-0.033 (-1.411)				-1.837* (-1.907)	
Governance Risk				-0.005 (-0.631)				-0.033 (-0.079)
Governance Risk*Pandemic				-0.419				-0.491

				(-0.486)				(-0.537)
Governance Risk*R+				-0.004				0.194
				(-0.826)				(1.366)
Governance Risk*R-				-0.027				0.254
				(-1.114)				(0.216)
Pandemic	-19.557**	-5.677*	9.875	3.599	-21.138**	-4.332	8.751	3.953
	(-2.093)	(-1.722)	(1.359)	(0.501)	(-2.023)	(-1.273)	(1.115)	(0.462)
R+	0.615*	0.499**	0.504**	0.496**	-1.776	1.005	-1.993*	-0.725
	(1.668)	(2.332)	(2.315)	(2.225)	(-0.805)	(1.381)	(-1.848)	(-0.707)
R-	4.157***	3.573***	3.811***	3.467***	-8.846	3.875	7.155	1.157
	(2.740)	(4.053)	(3.902)	(3.778)	(-0.557)	(0.505)	(1.552)	(0.260)
Log size	-0.117*	-0.126**	-0.118*	-0.119*	-0.075	-0.115	-0.108	-0.118
	(-1.815)	(-1.987)	(-1.820)	(-1.816)	(-0.885)	(-1.412)	(-1.105)	(-1.377)
Log Family size	0.075	0.042	0.084	0.121	0.388	0.313	0.408	0.515
	(0.327)	(0.128)	(0.413)	(0.439)	(0.877)	(0.597)	(0.712)	(1.183)
Return Volatility	1.612***	1.753***	1.881***	1.923***	1.656***	1.542***	1.638***	1.619***
	(10.571)	(9.983)	(11.009)	(11.126)	(8.677)	(8.324)	(9.542)	(8.345)
Log Fund age	0.755	0.689	0.638	0.587	0.957	0.621	0.802	0.753
	(1.538)	(1.011)	(1.233)	(1.117)	(1.571)	(0.732)	(1.103)	(1.009)
Manager Turnover	0.488	0.442	0.356	0.397	1.336	1.287	1.013	1.185
	(0.515)	(0.428)	(0.336)	(0.399)	(1.012)	(0.997)	(0.848)	(0.976)
Constant	-3.705	-3.001	-3.544	-3.388	-9.323	-7.529	-6.433	-9.576
	(-0.878)	(-0.769)	(-0.829)	(-0.783)	(-1.377)	(-0.905)	(-0.508)	(-1.382)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund Family Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,282	2,282	2,282	2,282	1,214	1,214	1,214	1,214
R-sq	0.271	0.273	0.269	0.260	0.291	0.288	0.285	0.273

This table presents the regression results of ESG risk scores on fund flows, incorporating a pandemic dummy as a moderating variable. Robust t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

4.4. Robustness Analysis

I conduct robustness analyses to assess whether the ESG associations primarily reflect differences between SRI and conventional pension funds. Prior literature frequently compares the performance of SRI and non-SRI funds, arguing that sustainability-oriented funds may differ systematically in investment philosophy, screening criteria, and portfolio construction (Bauer, Koedijk, and Otten, 2005; Renneboog, Ter Horst, and Zhang, 2011; Alda, 2020). If this is the case, the observed relationship between ESG risk exposure and pension fund performance may simply capture the presence of SRI strategies rather than the pricing of ESG risk itself.

To address this concern, I augment the baseline performance and fund flow models by incorporating an SRI indicator variable and its interaction with ESG risk exposure:

$$\text{Alpha}_{i,t} = \alpha + \beta_1 \text{ESG Risk}_{i,t} + \beta_2 \text{SRI}_{i,t} + \beta_3 \text{SRI}_{i,t} * \text{ESG Risk}_{i,t} + \gamma_1 \text{Controls}_{i,t-1} + \varepsilon_{i,t} \quad (8)$$

$$\begin{aligned} \text{Fund Flow}_{i,t} = & \alpha + \beta_1 \text{ESG Risk}_{i,t} + \beta_2 \text{SRI}_{i,t} * \text{ESG Risk}_{i,t} + \beta_3 \text{SRI}_{i,t} \\ & + (\beta_4 R^+ + \beta_5 R^-) \text{Return}_{i,[t-1,t-12]} + (\beta_6 R^+ + \beta_7 R^-) \text{Return}_{i,[t-1,t-12]} * \text{ESG Risk}_{i,t} \\ & + \gamma_1 \text{Controls}_{i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (9)$$

The variable $\text{SRI}_{i,t}$ equals one if a pension fund is classified as socially responsible according to Morningstar Direct's sustainability classifications, including both positive screening ("Sustainable Investment") and exclusion-based screening ("Employs Exclusions") criteria.

The estimation results, reported in Tables 9 and 10, indicate that the inclusion of the SRI indicator does not materially alter the previously documented relationships between ESG risk exposure, pension fund performance, and investor flows. The persistence of these results suggests that ESG risk exposure captures economically meaningful information beyond conventional SRI classifications and sustainability labels. In other words, investors appear to respond not only to whether a fund is formally categorized as socially responsible, but also to the underlying unmanaged ESG risks embedded within portfolio holdings.

I also observe several noteworthy differences between SRI and non-SRI funds within the low-ESG-risk subsample. Specifically, the negative relationship between environmental risk exposure and abnormal returns becomes less pronounced for SRI funds relative to non-SRI funds. Similarly, the adverse effect of social risk exposure on fund flows is weaker among SRI funds. These findings imply that investors may exhibit greater tolerance toward moderate environmental and social risks when they are embedded within portfolios that already possess recognized sustainability mandates or stronger ESG reputations. Such portfolios may be perceived as better positioned to manage sustainability-related challenges through active stewardship, engagement practices, and long-term transition strategies.

To further assess the robustness of the empirical analysis, I also examine whether the results are sensitive to alternative estimation procedures. First, standard errors are clustered at the fund-family level to account for potential correlation across funds managed within the same investment family. Second, I augment the baseline models by including style fixed effects to control for differences in investment styles and portfolio mandates across pension funds. Across all alternative

specifications, the main findings remain qualitatively unchanged, providing additional support for the robustness of the conclusions⁸.

V. Conclusion and Discussion

This study examines the conditional associations between ESG risk exposure, performance, and investor flows among British pooled pension funds using monthly fund-level data. The findings provide strong evidence that investors in the British pension market increasingly perceive ESG exposure as a financially material risk factor rather than merely an ethical or reputational consideration. In particular, the results suggest that sustainability considerations have become embedded in pension fund investment decisions, influencing both portfolio performance and capital allocation behavior.

Among pension funds with relatively low overall ESG risk exposure, social and governance risks are positively associated with risk-adjusted abnormal returns estimated from conventional asset pricing models. Importantly, these relationships remain significant even after controlling for traditional systematic risk factors captured by the CAPM, Carhart four-factor, and Fama-French five-factor models. This suggests that unmanaged ESG risks contain incremental information beyond conventional financial risk measures.

The findings further indicate that sustainability-oriented investors can influence asset prices and firms' cost of capital. Firms with stronger ESG risk management appear to benefit from lower expected returns and higher valuations because investors are willing to pay a premium for assets perceived as more sustainable and resilient. At the same time, the results provide evidence consistent with the "neglected firm effect" documented by Arbel, Carvell, and Strebel (1983) and Merton (1987). Stocks associated with elevated ESG risks may receive less investor attention and weaker risk-sharing, resulting in depressed prices and temporarily higher expected returns.

The results also reveal important differences across ESG pillars. Environmental risk exposure exhibits a consistently negative relationship with pension fund performance, particularly among low-ESG-risk funds, while most ESG risk measures negatively affect performance within the high-risk subsample. These findings are broadly consistent with the "doing well while doing good" hypothesis proposed by Hamilton, Jo, and Statman (1993), which suggests that investors increasingly reward firms perceived as sustainable while penalizing portfolios exposed to elevated sustainability vulnerabilities. One possible explanation is that portfolios heavily exposed to environmental or broader ESG risks underestimate the likelihood and impact of adverse sustainability-related events. When negative ESG information emerges, investors react by revising valuations downward, resulting in lower abnormal returns.

The findings also align closely with the sustainable investing equilibrium framework developed by Pástor, Stambaugh, and Taylor (2021). Their model suggests that investors with strong ESG preferences are willing to pay a premium for sustainable assets, thereby lowering the cost of capital for firms with stronger ESG characteristics. However, when ESG concerns intensify unexpectedly—particularly regarding climate-related risks—green assets may outperform conventional assets. The present estimates do not isolate such preference shocks and should not be treated as a direct test of that mechanism.

I find that pension funds invested in firms with stronger social risk management attract greater investor inflows, particularly within the low-ESG-risk subsample. This result suggests that pension investors increasingly value stakeholder relations, labor practices, and broader social sustainability

⁸ To conserve space, the detailed estimation results are not reported in the paper but are available from the authors upon request.

when allocating capital. Interestingly, moderate increases in environmental risk exposure appear to attract additional inflows when a fund's overall ESG profile remains relatively strong. This pattern indicates that investors do not respond mechanically to ESG risks; rather, they appear willing to tolerate selective sustainability risks when they anticipate superior long-term risk-adjusted returns. Overall, the findings suggest that ESG integration is evolving from a niche investment preference into a fundamental mechanism through which financial markets assess long-term resilience, allocate capital, and price risk. Future research may further explore how ESG risks interact with macroeconomic shocks, regulatory changes, and technological transformation across different financial markets and institutional settings.

The findings carry several important implications for practitioners, regulators, and policymakers. Firstly, the results highlight the growing importance of treating ESG risks as core components of financial risk management rather than supplementary ethical considerations. Pension fund managers and institutional investors may therefore need to integrate ESG analysis more directly into portfolio construction, risk monitoring, and asset allocation decisions. Secondly, the evidence underscores the importance of transparent and disaggregated ESG disclosure. Because environmental, social, and governance risks affect performance differently, aggregate ESG ratings may obscure economically important sources of portfolio risk. Regulators and standard-setting bodies should therefore encourage more granular ESG reporting frameworks that separately identify environmental, social, and governance exposures. Thirdly, the study suggests that sustainability-oriented investment strategies can alter market outcomes by shaping firms' financing costs and investor demand. As institutional investors increasingly allocate capital toward firms with stronger ESG characteristics, sustainability considerations may become an increasingly powerful mechanism driving corporate behavior, long-term value creation, and capital market discipline. Finally, the results emphasize the need for greater investor education and ESG literacy within the pension industry. A deeper understanding of how ESG risks affect long-term portfolio resilience may help pension trustees, asset managers, and beneficiaries make more informed investment decisions while supporting the broader transition toward sustainable financial markets.

Table 9. ESG Risk Exposures and Risk-Adjusted Performance after Controlling for SRI Classification

Variables	Full Sample				High ESG Risk Exposures				Relatively Low ESG Risk Exposures			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Overall ESG Risk	-0.002*				-0.013***				-0.066***			
	(-1.867)				(-3.316)				(-11.622)			
Overall ESG Risk*SRI	0.000				0.014*				0.028**			
	(0.069)				(1.762)				(2.248)			
Environmental Risk		0.000				0.002				-0.185***		
		(0.457)				(0.519)				(-21.863)		
Environmental Risk*SRI		-0.001*				0.020*				0.099***		
		(-1.727)				(1.782)				(3.267)		
Social Risk			0.000				-0.013***				0.084***	
			(1.042)				(-3.601)				(6.756)	
Social Risk*SRI			-0.001*				0.017***				-0.030	
			(-1.846)				(2.703)				(-1.267)	
Governance Risk				-0.001				-0.019***				0.055***
				(-1.103)				(-7.995)				(4.957)
Governance Risk*SRI				-0.001				0.025***				-0.015
				(-1.187)				(4.234)				(-0.540)
SRI	-0.038	-0.048**	-0.045*	-0.051**	-0.715*	-1.157*	-0.997***	-1.378***	-0.831***	-0.546***	0.121	0.006
	(-1.012)	(-2.153)	(-1.887)	(-2.259)	(-1.819)	(-1.893)	(-2.872)	(-4.151)	(-3.111)	(-3.573)	(0.542)	(0.017)
Log size	0.008**	0.008**	0.008**	0.008**	0.021***	0.021***	0.020***	0.014**	-0.005	0.011***	-0.010*	-0.006
	(2.125)	(2.104)	(2.108)	(2.069)	(3.381)	(3.433)	(3.047)	(2.241)	(-1.377)	(3.461)	(-1.825)	(-1.291)
Log Family size	0.019*	0.019*	0.017	0.020*	-0.105***	-0.100***	-0.103***	-0.077**	0.012	0.036***	0.028	0.011
	(1.737)	(1.712)	(1.528)	(1.780)	(-3.251)	(-3.013)	(-3.104)	(-2.282)	(0.803)	(2.583)	(1.165)	(0.512)
Return Volatility	-0.019***	-0.020***	-0.020***	-0.018***	0.014	0.026	0.014	-0.002	-0.015***	0.003	-0.021***	-0.024***
	(-3.157)	(-3.208)	(-3.221)	(-3.007)	(0.513)	(0.987)	(0.543)	(-0.047)	(-2.653)	(0.499)	(-4.047)	(-3.904)
Log Fund age	-0.175***	-0.171***	-0.172***	-0.169***	-0.298***	-0.301***	-0.265***	-0.249***	-0.155***	-0.071*	-0.121***	-0.124***
	(-4.877)	(-4.443)	(-4.127)	(-4.002)	(-5.001)	(-5.127)	(-4.449)	(-4.126)	(-4.776)	(-1.907)	(-3.521)	(-3.114)
Manager Turnover	-0.038	-0.032	-0.029	-0.035	-0.148	-0.139	-0.145	-0.157	0.016	-0.008	0.042	0.036
	(-0.624)	(-0.485)	(-0.423)	(-0.546)	(-1.452)	(-1.344)	(-1.431)	(-1.524)	(0.324)	(-0.137)	(0.792)	(0.341)
Constant	0.124	0.116	0.108	0.131	1.578*	1.534*	1.521*	1.392	1.875**	0.452	0.057	0.157
	(0.982)	(0.957)	(0.946)	(0.968)	(1.721)	(1.715)	(1.707)	(1.579)	(2.013)	(1.237)	(0.624)	(0.354)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund Family Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,282	2,282	2,282	2,282	1,068	1,068	1,068	1,068	1,214	1,214	1,214	1,214

R-sq	0.292	0.291	0.290	0.289	0.336	0.324	0.343	0.395	0.398	0.625	0.401	0.337
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

This table presents the robustness test of the relationship between ESG risk exposure and pension fund performance after controlling for socially responsible investment (SRI) fund classification. The dependent variable is Carhart four-factor alpha. Robust t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 10 ESG Risk Exposures and Fund Flows after Controlling for SRI Classification

Variables	Full Sample				High ESG Risk Exposures				Relatively Low ESG Risk Exposures			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Overall ESG Risk	0.002				0.025				0.335*			
	(0.248)				(0.286)				(1.726)			
Overall ESG Risk*SRI	-0.018				-0.387				0.673			
	(-0.427)				(-1.513)				(1.298)			
Overall ESG Risk*R+	-0.004				0.022				0.049			
	(-0.496)				(0.489)				(0.461)			
Overall ESG Risk*R-	-0.059				-0.435**				-0.033			
	(-1.435)				(-1.986)				(-0.048)			
Environmental Risk		-0.002				-0.058				0.571*		
		(-0.487)				(-0.607)				(1.823)		
Environmental Risk*SRI		-0.015				-0.255				-0.543		
		(-0.555)				(-0.761)				(-0.231)		
Environmental Risk*R+		-0.008				0.079				-0.159		
		(-0.959)				(1.287)				(-0.823)		
Environmental Risk*R-		-0.031				-0.657**				-1.105		
		(-1.482)				(-2.361)				(-0.921)		
Social Risk			-0.005				-0.008				-0.822***	
			(-0.705)				(-0.129)				(-2.626)	
Social Risk*SRI			-0.014				-0.036				1.674*	
			(-0.575)				(-0.165)				(1.723)	
Social Risk*R+			-0.004				0.051				0.356**	
			(-0.821)				(1.113)				(2.156)	
Social Risk*R-			-0.040				-0.331				-1.121	
			(-1.392)				(-1.557)				(-1.339)	
Governance Risk				-0.002				0.035				0.004
				(-0.402)				(0.676)				(0.009)
Governance Risk*SRI				-0.012				0.178				1.857

				(-0.519)				(0.802)				(1.347)
Governance Risk*R+				-0.006				0.005				0.138
				(-0.863)				(0.104)				(0.953)
Governance Risk*R-				-0.024				-0.105				0.548
				(-1.228)				(-0.649)				(0.573)
SRI	1.952*	1.901*	1.925*	1.912*	13.127	14.648	4.546	-7.651	-9.765	8.426	-10.159	-8.653
	(1.831)	(1.717)	(1.742)	(1.758)	(1.287)	(0.701)	(0.423)	(-0.229)	(-0.436)	(0.253)	(-1.346)	(-0.357)
R+	0.412*	0.329**	0.386**	0.341**	-0.649	-2.346	-2.331	-1.107	-0.433	-0.358	-0.459	-0.327
	(1.719)	(2.226)	(2.309)	(2.347)	(-0.156)	(-0.783)	(-0.914)	(-0.623)	(-0.158)	(-0.104)	(-0.078)	(-0.211)
R-	2.345**	2.115**	2.686**	2.559**	15.754**	16.249**	9.854*	9.283*	2.547	7.569	6.547	0.876
	(2.258)	(2.228)	(2.347)	(2.186)	(2.015)	(2.255)	(1.816)	(1.664)	(1.324)	(0.997)	(0.956)	(0.014)
Log size	-0.087	-0.087	-0.086	-0.091	-0.104	-0.106	-0.106	-0.101	-0.027	-0.045	-0.038	-0.052
	(-1.327)	(-1.364)	(-1.359)	(-1.395)	(-1.579)	(-1.564)	(-1.518)	(-1.523)	(-0.108)	(-0.429)	(-0.317)	(-0.511)
Log Family size	0.026	0.021	0.026	0.025	1.215*	1.007*	1.186*	1.208*	0.857	0.546	0.811	0.649
	(0.176)	(0.170)	(0.185)	(0.188)	(1.756)	(1.682)	(1.712)	(1.697)	(1.512)	(0.843)	(1.476)	(0.859)
Return Volatility	2.105***	2.008***	2.112***	2.016***	3.526***	3.128***	3.756***	3.421***	1.543***	1.492***	1.564***	1.423***
	(13.549)	(13.130)	(13.251)	(13.117)	(8.513)	(7.834)	(8.992)	(8.634)	(8.457)	(7.958)	(8.224)	(8.109)
Log Fund age	0.225	0.209	0.257	0.233	0.449	0.463	0.412	0.501	0.627	0.268	0.431	0.348
	(0.317)	(0.325)	(0.296)	(0.236)	(0.573)	(0.551)	(0.413)	(0.508)	(0.924)	(0.336)	(0.676)	(0.494)
Manager Turnover	0.305	0.296	0.251	0.327	-0.128	-0.157	-0.111	-0.096	1.672	1.759	1.473	1.681
	(0.375)	(0.318)	(0.297)	(0.407)	(-0.474)	(-0.551)	(-0.392)	(-0.186)	(1.237)	(1.382)	(1.118)	(1.281)
Constant	-1.284	-0.993	-1.185	-1.237	-8.469**	-7.561*	-8.512*	-10.387**	-8.316	-7.124	-10.112	-13.479
	(-0.145)	(-0.117)	(-0.128)	(-0.150)	(-2.115)	(-1.711)	(-1.839)	(-2.008)	(-1.029)	(-0.771)	(-1.255)	(-1.598)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund Family Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,282	2,282	2,282	2,282	1,068	1,068	1,068	1,068	1,214	1,214	1,214	1,214
R-sq	0.268	0.268	0.267	0.267	0.339	0.335	0.315	0.311	0.314	0.305	0.307	0.297

This table presents the robustness test of the relationship between ESG risk exposure and fund flows after controlling for socially responsible investment (SRI) fund classification. The dependent variable is Fund Flow (%). Robust t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

References

- Alda, M. (2020). ESG fund scores in UK SRI and conventional pension funds: Are the ESG concerns of the SRI niche affecting the conventional mainstream? *Finance Research Letters*, 36, Article 101313. <https://doi.org/10.1016/j.frl.2019.101313>
- Alda, M. (2021). The environmental, social, and governance (ESG) dimension of firms in which socially responsible investment (SRI) and conventional pension funds invest: The mainstream SRI and the ESG inclusion. *Journal of Cleaner Production*, 298, Article 126812. <https://doi.org/10.1016/j.jclepro.2021.126812>
- Arbel, A., Carvell, S., & Strebel, P. (1983). Giraffes, institutions and neglected firms. *Financial Analysts Journal*, 39(3), 57–63. <https://doi.org/10.2469/faj.v39.n3.57>
- Bauer, R., Koedijk, K., & Otten, R. (2005). International evidence on ethical mutual fund performance and investment style. *Journal of Banking & Finance*, 29(7), 1751–1767. <https://doi.org/10.1016/j.jbankfin.2004.06.035>
- Bolton, P., & Kacperczyk, M. (2021). Do investors care about carbon risk? *Journal of Financial Economics*, 142(2), 517–549. <https://doi.org/10.1016/j.jfineco.2021.05.008>
- Bollen, N. P. B. (2007). Mutual fund attributes and investor behavior. *Journal of Financial and Quantitative Analysis*, 42(3), 683–708. <https://doi.org/10.1017/S0022109000004142>
- Bouslah, K., Kryzanowski, L., & M'Zali, B. (2013). The impact of the dimensions of social performance on firm risk. *Journal of Banking & Finance*, 37(4), 1258–1273. <https://doi.org/10.1016/j.jbankfin.2012.12.004>
- Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of Finance*, 52(1), 57–82. <https://doi.org/10.1111/j.1540-6261.1997.tb03808.x>
- Dai, Y., Guo, L., Liu, S., & Zhang, H. (2022). Are socially responsible exchange-traded funds paying off in performance? *International Review of Finance*, 23(1), 4–26. <https://doi.org/10.1111/irfi.12366>
- Dumitrescu, A., & Zakriya, M. (2021). Stakeholders and the stock price crash risk: What matters in corporate social performance? *Journal of Corporate Finance*, 67, Article 101871. <https://doi.org/10.1016/j.jcorpfin.2020.101871>
- Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, 116(1), 1–22. <https://doi.org/10.1016/j.jfineco.2014.10.010>
- Fernando, C. S., Sharfman, M. P., & Uysal, V. B. (2017). Corporate environmental policy and shareholder value: Following the smart money. *Journal of Financial and Quantitative Analysis*, 52(5), 2023–2051. <https://doi.org/10.1017/S0022109017000688>
- Hamilton, S., Jo, H., & Statman, M. (1993). Doing well while doing good? The investment performance of socially responsible mutual funds. *Financial Analysts Journal*, 49(6), 62–66. <https://doi.org/10.2469/faj.v49.n6.62>

- Hartzmark, S. M., & Sussman, A. B. (2019). Do investors value sustainability? A natural experiment examining ranking and fund flows. *The Journal of Finance*, 74(6), 2789–2837. <https://doi.org/10.1111/jofi.12841>
- Hoepner, A. G. F., Rezac, M., & Siegl, S. (2011). *Does pension funds' fiduciary duty prohibit the integration of environmental responsibility criteria in investment processes? A realistic prudent investment test* (SSRN Working Paper). <https://doi.org/10.2139/ssrn.1930064>
- Hoepner, A. G. F., & Schopohl, L. (2020). State pension funds and corporate social responsibility: Do beneficiaries' political values influence funds' investment decisions? *Journal of Business Ethics*, 165(3), 489–516. <https://doi.org/10.1007/s10551-018-4091-z>
- Hong, H., & Kacperczyk, M. (2009). The price of sin: The effects of social norms on markets. *Journal of Financial Economics*, 93(1), 15–36. <https://doi.org/10.1016/j.jfineco.2008.09.001>
- Krueger, P., Sautner, Z., & Starks, L. T. (2020). The importance of climate risks for institutional investors. *Review of Financial Studies*, 33(3), 1067–1111. <https://doi.org/10.1093/rfs/hhz137>
- Merton, R. C. (1987). A simple model of capital market equilibrium with incomplete information. *The Journal of Finance*, 42(3), 483–510. <https://doi.org/10.1111/j.1540-6261.1987.tb04565.x>
- OECD. (2017). *Investment governance and the integration of environmental, social and governance factors*. OECD Publishing.
- Pástor, L., Stambaugh, R. F., & Taylor, L. A. (2021). Sustainable investing in equilibrium. *Journal of Financial Economics*, 142(2), 550–571. <https://doi.org/10.1016/j.jfineco.2020.12.011>
- Pástor, L., & Vorsatz, M. B. (2020). Mutual fund performance and flows during the COVID-19 crisis. *The Review of Asset Pricing Studies*, 10(4), 791–833. <https://doi.org/10.1093/rapstu/raaa015>
- Pedersen, L. H., Fitzgibbons, S., & Pomorski, L. (2021). Responsible investing: The ESG-efficient frontier. *Journal of Financial Economics*, 142(2), 572–597. <https://doi.org/10.1016/j.jfineco.2020.11.001>
- Renneboog, L., Ter Horst, J., & Zhang, C. (2011). Is ethical money financially smart? Nonfinancial attributes and money flows of socially responsible investment funds. *Journal of Financial Intermediation*, 20(4), 562–588. <https://doi.org/10.1016/j.jfi.2010.12.002>
- Sirri, E. R., & Tufano, P. (1998). Costly search and mutual fund flows. *The Journal of Finance*, 53(5), 1589–1622. <https://doi.org/10.1111/0022-1082.00066>

- Solomon, J., Solomon, A., & Norton, S. (2002). Socially responsible investment in the UK: Drivers and current issues. *Journal of General Management*, 27(3), 1–13. <https://doi.org/10.1177/030630700202700301>
- Sparkes, R., & Cowton, C. J. (2004). The maturing of socially responsible investment: A review of the developing link with corporate social responsibility. *Journal of Business Ethics*, 52, 45–57. <https://doi.org/10.1023/B:BUSI.0000033106.43260.99>
- Zhang, D., Hu, M., & Ji, Q. (2020). Financial markets under the global pandemic of COVID-19. *Finance Research Letters*, 36, Article 101528. <https://doi.org/10.1016/j.frl.2020.101528>