Understanding the effect of ESG scores on stock returns using mediation theory*

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Abstract

In this paper, we investigate the impact of ESG scores on stock returns and examine the channels, if any, through which ESG information is transmitted. The literature on the ESG transmission mechanism has essentially identified two channels (the *"investor demand channel"* and the *"fundamentals or profitability channel"*), but these channels are empirically difficult to identify and quantify. We then use a causal mediation model to address this issue, analysing whether ESG scores can predict future returns and identifying which channels are at play. Our results show that current ESG scores have a negative real effect on future stock returns and that the transmission channels are not the same depending on the pillar - either *E*, *S*, *G*, we focus on. The *"investor demand channel"* explains a significant part of the effect we observe empirically. The direct -or fundamental- channel, which we would expect to be positive, is negative, except for G, leading in general to a negative impact of ESG scores on future stock returns. Such results prove that ESG scores do indeed contain information that can be exploited by asset managers in their portfolio choices.

JEL classification: G11, G12, G23, M14

Keywords: ESG performance, Investment decisions, Sustainable investing, Mediation analysis, Transmission channels, Institutional investors.

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1 Introduction

The term ESG (Environment, Social, and Governance) made its first appearance in the landmark ”Who Cares Wins” conference report published in 2005. Yet, practices of considering social concerns in investment decisions can be traced back to the last century in the United States, with Electrical and Mine Workers Unions investing in affordable housing projects and health facilities in the 1950s and 1960s. The development of ESG has come through a “thorny path” in the first two decades of the 21st century. On the one hand, greenwashing scandals and the lack of universal standards have cast doubt on the reliability of ESG measurement. In practice, the ambiguity of the objectives and methods for assessing a firm’s ESG performance renders it difficult for rating agencies to reach a consensus on a firm’s ESG rating. [Edmans (2023)] explains this phenomenon by the special nature of ESG ratings, which distinguish them from other ratings such as credit ratings. According to him, “an ESG rating isn’t fact; it’s opinion.” On the other hand, looming environmental issues and growing social inequalities have contributed to a greater focus on corporate social responsibility, thus urging companies to incorporate ESG attributes into their operations. While more and more people are aware of ESG and do care about it, the efforts of companies on that matter are not perceived in the same way by consumers and investors. These differences in population and perception can have potentially different effects on stock returns.

Today, investors consider non-financial criteria in their decision-making scheme. And they do so, according to the ”increasingly broad interest in ESG investing” documented by [Starks (2023)]. This increasing interest varies across investors. It depends on investors’ types and/or their motivation - the *value* or *values* of [Starks (2023)], countries, industries, and scores (*E*, *S*, *G* or global *ESG*). Still, following [Pedersen et al. (2021)], there is very little guidance on how to efficiently incorporate ESG in portfolio choice. This may be because there is no consensus on the metrics to use. There exists six major commercial ESG ratings and plenty of in-house competitors. In fact, the divergence between these measures is important [see Berg et al. (2022c)]. And if commercial ESG measures (ESG scores) are widely used in the industry, opinions differ dramatically about whether ESG scores are meaningful or not and whether ESG will help or hurt performance. For [Berg et al. (2022a)], MSCI ESG is the only score to have a significant influence on investors holding and a slow/low impact on the returns. For [Pedersen et al. (2021)], ESG measures predict returns positively, negatively, or even close to zero in the case of commercial ratings, for example. These results are puzzling as they suggest that the main solution used in practice to implement ESG approaches does not provide any significant result. Theory, however, may provide an alternative explanation: ESG has two opposite effects on returns that may fight against each other to reduce or even kill the global effect [see Starks et al. (2017) and Pedersen et al. (2021)]. As a result, seemingly contradictory results could be explained by the choice of measurements and of different models measuring a potentially different ESG effect (partial or global). After conducting a comprehensive analysis that involves a global sample and ESG ratings from seven providers, Alves et al. (2023) find little evidence supporting the relationship between ESG ratings and stock returns, thus rejecting the first possibility. In contrast, we focus on the second possibility and seek to disentangle various effects of ESG on stock returns with an improved econometric framework.

This paper examines whether, and if so, how the information contained in corporate environmental, social, governance and global performance is incorporated into stock prices. We propose an appropriate econometric framework to test whether ESG scores are important to predict stock returns. We follow the theoretical framework developed by [Pedersen et al. (2021)] and assume that two effects compete in the causal impact of ESG on returns: a *"profitability"* effect and an *"institutional demand"* effect. On the one hand, a company's commitment to an active ESG policy may affect its future profitability. This *"profitability"* effect can be positive if current investments increase future cash flows. It can also be negative if the amount invested exceeds the gain generated. Finally, there will be no effect if the company's ESG policy has no impact on its future results. In the following, we refer to this *"profitability"* effect as the direct effect of ESG scores on returns. On the other hand, by purchasing highly-rated securities, investors will influence (upwards) the valuation of these securities. This *"institutional demand"* effect may or may not be negative. In what follows, we refer to this effect as the indirect effect of ESG scores on returns - through the investment policies of institutional investors.

The main challenge is identifying the two effects separately and measuring their relative importance (and sign) in the causal relationship between ESG scores and returns. By disentangling the two effects, we can, for example, identify situations where the sum of two significant effects, one positive and one negative, leads to an overall effect of zero, even though the information contained in the ESG scores is relevant.

Our work complements the literature on the relationship between firm performance in the E, S and G dimensions of ESG and stock returns while focusing on one transmission channel—institutional ownership. In line with [Starks et al. (2017)] and [Pedersen et al. (2021)], we use 13 filings to compute institutional ownership of firms and then regress institutional ownership on ESG metrics to capture the sensitivity of institutional investors to ESG performance. According to the literature [See e.g. Pedersen et al. (2021)], Lopez de Silanes et al. (2022), Nofsinger et al. (2019)], institutional investors' ESG preferences are primarily reflected in their portfolio composition. Hence, we use the term "institutional investors' ESG preferences" to generalize their demand for high ESG stocks. In our empirical analysis, institutional investors' portfolio adjustments driven by ESG ratings are taken as evidence that ESG has an indirect effect on stock returns. Although [Starks et al. (2017)] and [Pedersen et al. (2021)] both provide empirical evidence on the existence of two competing forces behind the overall impact of ESG on stock returns, they ignore the comparison of the relative importance of the two competing forces in the overall impact. Our main contribution to the literature on the impact of ESG on stock returns is, therefore, to isolate the respective contributions of the direct and indirect effects to the overall impact of ESG on stock returns. To this end, we use mediation theory to observe how the relationship between ESG and stock returns changes after explicitly allowing for differences in institutional investors' ESG preferences in our analysis.

Mediation analysis allows decomposing an overall effect into a direct effect of the exposure on the outcome and an indirect effect operating through one or more channels - the mediator variable(s). Applied to our concerns, we have a simple mediation approach where the return is the outcome variable Y, the ESG scores are the treatment variable Z, and the institutional ownership is the mediator variable M.

This approach gives us a natural way to isolate the *"institutional demand"* effect in return, and to retrieve the *"profitability"* effect (everything that is not the institutional demand) before calculating the statistical significance and economic importance of each of them. Note that it would have been possible to define a multiple (dual) mediation model in the spirit of [Pedersen et al. (2021)] by defining two mediator variables: M_1 (institutional ownership) and M_2 (future profitability). However, this specification would be sensitive to the chosen measure of future profitability. We decided to stick with the most parsimonious model, knowing that our approach implicitly identifies the second effect once the institutional effect has been taken away. This specification ensures that our results are robust to the measure of future profitability. Finally, we obtain an empirical model that is easy to estimate using accessible data, i.e. stock returns, institutional ownership (using 13F holdings reports), and the ESG scores (Refinitiv).

Our results show that the information contained in corporate *E*, *S*, *G* or global *ESG* scores is effectively incorporated into stock prices through both, the investor demand channel, and the fundamental/profitability channel. While our results are mostly consistent with [Pedersen et al. (2021)], we do not confirm all of their findings. We confirm that *ESG* scores significantly predict/correlate positively with investor demand for all considered scores *E*, *S*, *G* or global *ESG*. We show that investor demand (indirect effect) predicts/correlates significantly negatively with future returns for all considered scores *E*, *S*, *G* or global *ESG*, which is not so clear in [Pedersen et al. (2021)] empirical results, where it seems to be the case only for their *G* measure. Looking at the direct effect, we find that ESG predicts future fundamentals (profitability) for all the scores considered except *G*. [Pedersen et al. (2021)] on their side separate profitability and valuation. They have mixed results on profitability. Investment in *G* has a positive effect on the profitability of firms, regardless of the measure used, but they find that such forecasted profitability is not priced by the market. The impact of any investment on *E*, *S* or global *ESG* can be positive, negative, or null, depending on the measure, and if the prices of stocks with strong E or ESG scores are relatively higher than brown stocks' prices, they find no significant difference for S. Our results show that *E*, *S*, and *ESG* have a negative (profitability) effect on stock returns and *G* has no effect. Finally, we confirm the significant negative overall effect of ESG on future stock returns of [Pedersen et al. (2021)] for *E* and global *ESG* but disagree on the sign of the effect for *S*. We both find a significant effect, but it is negative for us and positive for [Pedersen et al. (2021)]. We also disagree on the overall effect for *G*. While it was positive and significant for [Pedersen et al. (2021)], it is negative and not significant for us.

Our research contributes to the empirical literature by proposing a natural and complete method to test promising theoretical results obtained in particular in [Pedersen et al. (2021)]. [Pedersen et al. (2021)] propose a theoretical model in which the two potentially opposing effects of ESG can "lead to a return premium or discount", and they test it for different measures of ESG. However, they do not propose an empirical model to estimate and test the significativity of the two effects and the resulting overall effect as we do. Instead, they measure the different effects separately using up to seven independent regressions and then combine the results. For example, for *G*, a first regression measures the positive impact of the proxy on future profitability, and then a second regression materialises the impact of *G* on investor demand, which is increasing. But in a third regression, *G* has a negative impact on the company's valuation, i.e. it is not "priced by the market opening the possibility to generate attractive returns". Taken together, these results help them to explain why *G* has a positive impact on (excess) returns in a fourth regression ("because investors did not fully appreciate that *G* predicts profitability").
Mediation theory aims at disentangling the total effect into an indirect effect operating through the mediator, here the investor demand, and a direct effect reflecting any impact not captured by investor demand, which includes the fundamental/profitability effect. Compared to [Pedersen et al. (2021)], our approach is econometrically superior and allows to obtain not only the signs and levels but also the significance of each of the effects and their resulting interaction. Moreover, we do not need to specify any measure of profitability, and as such, our method is more robust.

While [Pedersen et al. (2021)] explicitly consider the two effects of ESG scores (one on firm fundamentals and the other on institutional trading), [Starks et al. (2017)] distinguish the two effects in a more subtle way. By examining the relationship between investors' investment horizons and their ESG preferences, [Starks et al. (2017)] test the hypothesis that investment horizon plays an important role in determining investors' portfolio choices for firms with different ESG profiles. Given previous research on the impact of ESG practices on firm performance, one of their supporting arguments for this hypothesis is that ESG is a driver of long-term value creation. The positive impact of ESG on a firm's future profitability is precisely the heart of the *"profitability"* effect. Moreover, by providing evidence on institutional investors' ESG preferences, [Starks et al. (2017)] empirically verify the rising trend of ESG investing among institutional investors in the financial markets, which is the starting point of the *"institutional demand"* effect of ESG. We find that ESG scores always have a negative indirect effect on stock returns through investor demand, which is consistent with [Starks et al. (2017)], who show that investors with longer horizons exhibit stronger preferences for higher ESG firms. Thus, without explicitly saying so, [Starks et al. (2017)] consider, each of the two effects of ESG. However, in line with their focus on the relationship between firms' ESG profiles and the trading behaviour of investors with different investment horizons, [Starks et al. (2017)] place emphasis on institutional investors' sensitivity to ESG performance and neglect the aggregate impact of ESG. To address this, our research re-estimates the individual effects of ESG scores using a more robust and accurate methodology, and then analyses their relative importance in the overall impact of ESG on stock returns.

Similarly, [Derrien et al. (2021)] also acknowledge the existence of two competing channels through which ESG information affects firm performance but focus primarily on the *"cash flow channel"*, which corresponds to our *"profitability"* effect. In addition, [Derrien et al. (2021)] use negative ESG incidents instead of ESG downgrades to avoid noise in ESG ratings. Regarding the comparison between the *"profitability"* and the *"institutional demand"* effects of ESG on stock returns, [Derrien et al. (2021)] simply use a dividend discount approach to show that the *"profitability"* effect is the only effect at work. Through mediation analysis, we find that ESG scores also contain valuable information, and that the direct and indirect effects together determine the overall impact of ESG on stock returns.

Theoretical models linking investors' ESG preferences manifested in their trading patterns to market responses motivate the use of institutional ownership as the mediator in our research. [Pástor et al. (2021)] distinguish between investors who are only concerned about their financial wealth and investors who are concerned about ESG. Furthermore, their prediction of green stocks' underperformance implies a negative indirect impact of ESG on stock returns due to concentrated investor demand for green stocks. [Baker et al. (2022)] extend the analysis to the US green bonds. Although [Baker et al. (2022)] use a simplified version of the models of Pedersen et al. (2021) and [Pástor et al. (2021)], they arrive at the same prediction that green assets have lower expected returns due to higher ownership concentration. Our finding of a negative indirect effect of ESG on stock returns provides empirical support for these predictions.

A recent paper by [Avramov et al. (2022)] employs a mean-variance set-up to show that the mixed evidence of ESG scores on stock returns in the extant literature can be reconciled after considering ESG uncertainty, i.e., the uncertainty that investors face when evaluating a firm's ESG performances. Rather than introducing a new variable to enhance explanatory power, we strive to offer explanations for the conflicting outcomes regarding the impact of ESG scores on stock returns using an improved econometric framework. Through mediation analysis, we can explicitly distinguish the potentially competing forces that underlie the relationship between ESG scores and stock returns while still being consistent with the existing theoretical framework.

Overall, existing research on the effects of ESG on asset performance tends to focus on one of these effects, thereby ignoring the potential interactions between them. Building on the findings of [Pedersen et al. (2021)], we deepen our understanding of this issue by capturing the relative importance of the direct and indirect impacts of ESG on stock returns in determining the overall impact.

The remainder of this paper is divided into seven distinct sections. Section 2 presents the current state of research on ESG preferences and institutional investors' behavior. Section 3 describes our methodology. Section 4 presents our data. Section 5 explores and compares the findings on the intermediary role that institutional ownership plays in the relation between corporate environmental/social/governance and financial performance. Section 6 discusses some robustness tests. Finally, Section 7 concludes, presents the possible applications of the findings, and suggests directions for future research.

2 Literature Review

2.1 ESG preferences

Our paper is related to the literature on the relation between investors' ESG preferences and the predictability of ESG ratings on stock returns. [Pedersen et al. (2021)] demonstrate both theoretically and empirically that the overall impact of ESG on stock returns depends on the distribution of investors with different levels of ESG preferences. In addition to the negative indirect impact of ESG on asset returns identified in other papers [See e.g. Baker et al. (2022), Oehmke and Opp (2022), Pástor et al. (2021)], [Pedersen et al. (2021)] find a positive direct impact of ESG: better ESG ratings signal improved firm fundamentals and stock returns are expected to rise following increased profitability. According to their model, the signal of higher profitability carried by a higher ESG rating is not priced into the market when there are many "ESG-unaware investors" who are not sensitive to ESG ratings, so stocks with higher ESG ratings have higher expected returns in this scenario. The arrival of "ESG-aware investors" who use ESG information to update their views on adequate asset prices introduces a negative indirect impact of ESG on stock returns through the bidding process [Pedersen et al. (2021)]. The negative indirect impact of ESG on stock returns offsets the positive direct impact when there are many "ESG-aware investors" and even outweighs the positive direct impact when there are many "ESG-motivated investors" who derive direct utility from holding stocks with higher ESG ratings [Pedersen et al. (2021)].

[Pedersen et al. (2021)] test these model predictions using investor demand as a proxy for investors' ESG preferences. For stocks with better environmental (E), social (S), or overall ESG performance, they find the dominance of the negative indirect impact over the positive direct impact of ESG on stock returns. Indeed, empirical evidence shows that higher E, S, and overall ESG metrics reveal weakly positive or insignificant signals about firm fundamentals but promote demand from institutional investors [Pedersen et al. (2021)]. In contrast, the positive direct impact of a firm's governance (G) performance on stock returns dominates, with higher G metrics forecasting better profitability and attracting modest institutional investment [Pedersen et al. (2021)].

[Starks et al. (2017)] assess investors' ESG preferences through their investment horizons. The reasoning behind their hypothesis on the relationship between investors' investment horizons and ESG preferences is that ESG-enhancing projects incur costs in the short-term but create value in the long-term. As a result, long-term investors who adjust their holdings less frequently are expected to be more patient and invest more in firms with higher ESG ratings [Starks et al. (2017)]. Working on a sample of mutual funds and 13f institutions, [Starks et al. (2017)] find both fund-level and firm-level evidence of the positive correlation between investors' investment horizons and ESG preferences.

[Starks et al. (2017)] and [Pedersen et al. (2021)] both acknowledge the existence of two competing impacts of ESG on stock returns. One is a positive direct impact, where better ESG metrics send promising signals about a firms' prospects and increase expected returns. Another is a negative indirect impact, where better ESG metrics attract more institutional investment and subsequently drive stock prices higher. The overall impact of ESG on stocks returns, the one we observe in the financial markets, is determined by the relative weights of investors having different sensitivities to corporate ESG performance [Pedersen et al. (2021); Starks et al. (2017)]. In Pedersen et al. (2021)'s model, ESG has an overall negative impact on stock returns if there are many "ESG-motivated investors" who prefer and actively invest in firms with better ESG performance. [Starks et al. (2017)] associate investors' sensitivities to ESG with their investment horizons and empirically notice the preference of long-term investors for firms with better ESG performance. Naturally, when there are many long-term investors in the economy, the overall impact of ESG on stock returns should be negative. The shared reasoning of [Starks et al. (2017)] and [Pedersen et al. (2021)] is that the more ESG-sensitive investors there are, the higher the demand for firms with better ESG performance. Higher investor demand will translate into higher stock prices and subsequently lower stock returns. Thus, when the proportion of ESG-sensitive investors in the economy increases, the negative indirect impact of ESG on stock returns is more likely to prevail, and lower returns for high-ESG stocks are more likely to be observed in the financial markets.

The extent to which ESG information matters for firm value is also a debate in the literature, and the channels through which ESG information affects the value of the firms are not totally understood. [Derrien et al. (2021)], for example, investigate a channel directly related to a firm's cash flows. They consider earnings forecasts made by security analysts and study how any change of these forecasts following ESG news may have an impact on firm values. Indeed, ESG could potentially affect firm values if ESG metrics predict the future earnings of the firm. A firm subject to negative ESG news could experience a decrease of future earnings because of negative reactions from customers and shareholders could also downgrade the earnings forecasts of the firm for the same reason. Such real implications of ESG information for firm earnings might be either short-term or potentially long term. Customers or employees may indeed turn their back on firms with poor ESG profiles. This cash flow channel is embedded in the model developed by [Pedersen et al. (2021)] and predicts a positive impact of ESG information on stock returns. [Derrien et al. (2021)] empirically test this channel and provide some evidence that negative ESG news shifts earnings forecasts over both long and short horizon. Moreover, the reaction is stronger in the case of multiple negative ESG news and when news are related to S. Finally, [Derrien et al. (2021)] show that earnings at longer horizon are affected by ESG news more strongly than other negative corporate news, suggesting that negative reactions from customers are the channel in action.

2.2 Institutional ownership

Extant literature provides abundant empirical evidence to explain why institutional investors are sensitive to ESG and to demonstrate how institutional investors' ESG-induced trading behavior is affecting the market.

Institutional ownership's sensitivity to ESG

Institutional investors play a crucial role in firms' ownership structures because of their significant investment volumes and long investment horizons. Although institutional investors still consider traditional financial risks the most critical risks they face in investment decisions, they recognize the financial and non-financial implications that climate risks have on their portfolio firms [Krueger et al. (2020)].

Empirically, institutional investors' sensitivity to firms' ESG profiles can be observed in two main ways: engagements on ESG issues and adjustment of capital allocation to firms [(Krueger et al., 2020; McCahery et al., 2016)]. While the former is often private and hard to observe, the latter can be easily captured from publicly disclosed institutional holdings. Observing how institutional investors allocate capital to firms with different ESG profiles, researchers detect either monotonicity [(Gantchev et al., 2024; Lopez de Silanes et al., 2022; Pedersen et al., 2021; Starks et al., 2017)] or asymmetric patterns [(Fernando et al., 2017; Nofsinger et al., 2019)] in the relationship between corporate ESG performance and institutional holdings.

Some researchers assess institutional investors' sensitivity to ESG from a dynamic perspective. For instance, [Berg et al. (2022a)] observe how mutual fund holdings adjust when a firm's ESG rating changes. Their results show that mutual funds decrease their holdings in firms undergoing rating downgrades and increase their holdings in firms undergoing rating upgrades.

Institutional ownership's role - between ESG and financial performance

Some studies have endeavored to provide deeper insights into how institutional investors intervene in the relationship between ESG and corporate financial performance. By focusing on the environmental (E) dimension of ESG, [Fernando et al. (2017)] note a negative correlation between institutional ownership of a stock and the stock's environmental risk exposure. Moreover, institutional preferences for a stock coincide with the stock valuation in the market—stocks with high environmental risk are less held by institutional investors and have lower valuations [(Fernando et al., 2017)]. Later work of [Pástor et al. (2022)] confirms the results of [Fernando et al. (2017)] from another angle. [Pástor et al. (2022)] remark that institutional investors deem green assets as hedging tools against climate risks. Institutional investors' aversion to climate risks leads them to include more green assets in their portfolios, driving up the stock prices and decreasing expected returns of green assets [(Pástor et al., 2022)]. [Gantchev et al. (2024)] also interpret the negative indirect impact of ESG on stock returns with the upward pressure that institutional investors' trading behavior exerts on the stock prices of ESG leaders.

[Cao et al. (2022)] adopt a more direct approach to measuring institutional investors' ESG preferences and focus on the overall ESG performance. Through investigating the impact of socially responsible ownership on stock return patterns, they find that stocks that are less held by socially responsible institutional investors[1] generate higher abnormal returns.

In a similar vein, [Van der Beck (2021)] identifies the price impact of institutional flows towards ESG funds as the main driver of the recent outperformance of ESG funds over the market. More specifically, institutional demand for ESG funds creates buying pressure on the main constituent stocks of such funds, thus driving up the market value and the realized returns of ESG stocks[Van der Beck (2021)]. Regarding the impact of flow-driven price pressure on expected returns of ESG stocks, [Van der Beck (2021)] adds that the decline in expected returns following a rise in the price of ESG stocks can be mitigated if ESG funds anticipate large inflows or if they substitute elastically between ESG and non-ESG stocks.

ESG, institutional trading, and financial performance

Methodologically, the extant literature mainly analyses institutional investors' sensitivity to firms' ESG performance with panel regressions. [Fernando et al. (2017)] and [Nofsinger et al. (2019)] capture institutional investors' responses to changes in ESG performance from the perspective of firms, thus using institutional ownership as the dependent variable. Institutional investors' reactions to changes in ESG performance can also be captured from the perspective of institutional investors. For instance, the dependent variable in Gantchev et al. (2024)'s regression model is variations in the proportion of a fund's total assets allocated to a firm.

One regrettable feature of the literature on the transmission channels linking ESG performance and corporate financial performance is that few studies attempt to distinguish between the direct impact of ESG performance on corporate financial performance and the indirect impact through the transmission channels. The studies that draw the distinction between the two impacts share the following hypotheses: if firms' ESG performance indirectly affects financial performance, we would expect the impact of ESG performance to vanish once we control for the transmission channel [(Bardos et al., 2020; Cao et al., 2022; Servaes and Tamayo, 2013)]. Furthermore, if firms' ESG performance directly affects financial performance, we would expect the impact of ESG performance to persist and remains significant before and after controlling for the transmission channel [(Bardos et al., 2020; Cao et al., 2022; Servaes and Tamayo, 2013)].

In the asset pricing domain, the study by [Cao et al. (2022)] compares value-weighted average monthly abnormal returns of triple-sorted portfolios based on socially responsible ownership, ESG scores, and mispricing signals to find out whether ESG scores indirectly affect return patterns through institutional preferences or directly affect return patterns. In the corporate finance domain, the study by [Servaes and Tamayo (2013)] seeks to answer whether CSR affects firm value (Tobin's Q) directly or indirectly through consumer awareness proxied by advertising intensity. To address this research question, [Servaes and Tamayo (2013)] regress firms' Tobin's Q on CSR and the interaction term of CSR and advertising while including firm-level control variables in the regression equation. Another research in the corporate finance domain conducted by [Bardos et al. (2020)] tries to answer a similar question, while this time, the transmission channel is product market perception. [Bardos et al. (2020)] implement a mediation analysis while considering product market perception as the mediator.

[1] Socially responsible institutional investors are those who favor ESG outperformers in the construction of portfolios.

3 Methodology

In this section, we apply mediation theory to the analysis of ESG performances and stock returns, seeking to distinguish the direct impact of ESG ratings on stock returns from the indirect impact exercised through institutional ownership. Originally designed for psychological studies, the mediation analysis is now used in numerous fields, including economics and finance [(Bardos et al., 2020; Fedaseyeu et al., 2018; Ferris et al., 2017)].

3.1 Mediation theory

The goal of mediation analyses is to disentangle the direct effect of a treatment variable on an outcome from the mediated effect on the pathway from the same covariate to the outcome. The intermediate variable is referred to as a mediator. The most commonly used approach for mediation analysis is the four-step linear structural equation modeling (LSEM) (see e.g., Baron and Kenny (1986a); Judd and Kenny (1981)). In LSEM, the total effect of the treatment variable on the outcome is decomposed into two kinds of effects: the direct effect and the indirect effect, where the indirect effect refers to the effect of the covariate on the outcome that goes through the mediator. In some situations, the effect of the treatment variable on the outcome occurs through multiple pathways/mediators, but we only consider here a single mediator case.

Let us denote the treatment variable by Z, the outcome variable[2] by Y, the mediator variable by M, and the control variables $X = (X_1, ..., X_k)'$. The mediation effect can be calculated through the following set of regression models:

$$Y = \gamma_0 + \gamma Z + \gamma'_X X + \varepsilon_1, \quad (1)$$

$$Y = \beta_0 + \beta M + \gamma' Z + \beta'_X X + \varepsilon_2, \quad (2)$$

$$M = \alpha_0 + \alpha Z + \alpha'_X X + \varepsilon_3, \quad (3)$$

where $\varepsilon_i \sim (0, \sigma_i^2)$, $i = 1, 2, 3$. In these models, the direct effect is defined as γ' (i.e., the effect of the treatment on the outcome when M is fixed) while the indirect effect is $\alpha \cdot \beta$ (i.e., the effect of the treatment on the outcome that goes through the mediator). As a result, examining whether a mediation effect exists is equivalent to testing $H_0 : \alpha \cdot \beta = 0$[3][4]

We estimate all of the parameters in a standard way by least squares and obtain least square estimators of the direct effect ($\hat{\gamma}'$), the indirect effect ($\hat{\alpha} \cdot \hat{\beta}$) and the total effect ($\hat{\alpha} \cdot \hat{\beta} + \hat{\gamma}' = \hat{\gamma}$). However, statistical tests of models that include mediating variables are not standard. Mackinnon et al. (2002) reviewed fourteen different methods that have been proposed for testing models that include mediating variables. They grouped them into three general approaches: causal steps, difference in coefficients, and product of coefficients. The bootstrap analysis we use here was initially proposed by [Shrout and Bolger (2002)] and belongs to the last group. [Shrout and Bolger (2002)] show how to use bootstrap methods to obtain better power, especially when sample sizes are small.

[2]A control variable is a variable that (1) jointly affects Z and Y; or (2) jointly affects Z and M; or (3) jointly affects M and Y ; and (4) is not affected by Z [see e.g., VanderWeele (2016), Valente et al. (2017)].

[3]Although Model (1) is not used to estimate α and β, if we substitute Model (3) into Model (2) and compare it with Model (1), we get $\gamma - \gamma' = \alpha \cdot \beta$. If all of the parameters are estimated by least squares, we have $\hat{\gamma} - \hat{\gamma}' = \hat{\alpha} \cdot \hat{\beta}$ [MacKinnon et al. (1995)].

[4]If Z is randomized, the total effect of Z on $Y(\gamma)$ and the effect of Z on $M(\alpha)$ may be interpreted causally. On the other hand, γ' and β do not readily admit a causal interpretation as M is a post-treatment variable, which can be affected by the treatment.

3.2 Triangular relation between ESG, IO and R

In our analysis, the mediator is defined by [Baron and Kenny (1986b)] as "the generative mechanism through which the focal independent variable is able to influence the outcome (dependent) variable of interest." In our case, the focal independent (treatment) variable is ESG ratings (ESG), the outcome variable of interest is stock returns (R), and the mediator is institutional ownership (IO). The triangular relation can be represented in Figure 1.

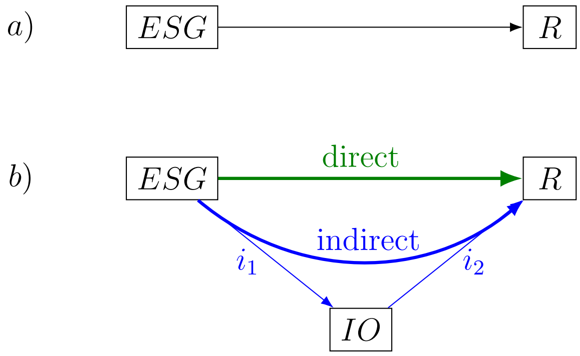

Figure 1: ESG - return relation through mediation

The top graph a) of Figure 1, represents the global effect of ESG performance on asset returns. The bottom graph b) shows how the global effect separates into an indirect effect (indirect effect $= i_1 \times i_2$) and a direct effect (direct).

In summary, one should employ a system of three regressions to test for mediation: one regression of the outcome variable on the treatment variable, one regression of the mediator on the treatment variable, and a last regression of the outcome variable on both the mediator and the treatment variable [see Baron and Kenny (1986b),Preacher and Hayes (2004)]. The direct effect is measured by γ', the indirect effect by $\alpha \cdot \beta$ and the global effect is the sum of the two ($\gamma = \gamma' + \alpha \cdot \beta$). We expect α to be positive as institutional investors are sensitive to ESG performance, β to be negative (discount rate/capital cost explanation), and γ' to be positive if all the investors' demand is accurately captured by IO.

3.3 Example of mediation in the literature

The study by [Bardos et al. (2020)] is a direct application of the mediation analysis to the relation between ESG and corporate financial performance. Bardos et al. (2020) adopt a corporate finance-oriented research perspective, considering product market perception as the mediator through which CSR exercises an indirect impact on firm performance proxied by Tobin's Q and profit margin. Following [Baron and Kenny (1986b)] and [Preacher and Hayes (2004)], they estimate three regressions: the first regressing the product market perception on CSR, the second regressing firm performance on CSR, and the last regressing firm performance on both CSR and product market perception. The last regression aims to observe whether the direct impact of CSR on firm performance persists after controlling for product market perception. [Bardos et al. (2020)] question the validity of the first regression results because of potential endogeneity issues, including reverse causality between CSR and product market perception and omitted variables that affect both CSR and product market perception. To check the robustness of the observed positive correlation between CSR and product market perception, [Bardos et al. (2020)] carry out an IV (Instrumental

Variable) analysis and a quasi-natural experiment analysis. For the second and the third regressions, [Bardos et al. (2020)] are also concerned that the results might be biased by the reverse causality between firm performance and CSR and the reverse causality between firm performance and product market perception. Again, to address these potential endogeneity issues, they replace CSR and product market perceptions with valid instruments and perform instrumental variable regressions. [Baron and Kenny (1986b)] also describe the recommended procedure for mediation analysis that is later on formalized by [Preacher and Hayes (2004)].

3.4 Preliminary research questions

In this context, our approach consists in analyzing the influence of ESG scores on stock returns following scheme *b*), where it can materialized directly (just like in scheme *a*)), but also indirectly through the influence of investors' demand. As a consequence, to know whether ESG scores predict future returns (our final question), we must know first if ESG scores predict investors' demand which in turn predicts future stock returns (our investor demand channel) as well as if ESG scores predict future firm fundamentals (our fundamental channel). In summary, using this stock-level approach, we aim to test the three following preliminary questions on the effect of ESG scores on stock returns before answering our main research question: which channel is at work when we empirically observe that ESG scores and future returns correlate (or not)?

The first preliminary question concerns the effect of ESG scores on investor demand: does ESG predict/influence investor demand? Answering this question is the first step in the analysis of the investor channel. Indeed, a necessary (but not sufficient) condition to observe an impact of ESG scores on returns is to establish that investors effectively react to the information contained in these scores.

The second preliminary question is about the real impact of investor demand on stock valuation: does investor demand predict/influence future returns? A positive answer is the second step in the analysis of the investor channel. If both answers are positive, then institutional ownership is a mediator in the relation between ESG scores and returns, and the mediation model is able to clean up the ESG total effect of this demand pressure effect.

The third preliminary question is related to the profitability/fundamental channel: does ESG predict/influence future fundamentals? Following [[Pedersen et al. (2021)], the two channels are the demand and the fundamental ones, then the residual effect of ESG scores once the demand effect is cleaned up corresponds to this fundamental channel. All these three questions are associated with a subsection in the empirical part of our study.

3.5 Deriving the main economic hypotheses

If the mediation model can disentangle the two channels through which ESG scores affect stock returns, we have all we need to discuss the three following economic hypotheses.

H1: The negative effect of global ESG score on stock returns is only explained by investor demand through the mediation effect.

In order to test H_1, we need to test whether we have pure[5], partial[6] or no mediation[7] of investor demand for overall impact of ESG score on stock returns. If firms' ESG scores only indirectly affect stock returns (pure mediation), the coefficient γ' of ESG scores is insignificant after controlling for institutional ownership in Equation (2). If firms' ESG scores only directly affect stock returns (no mediation), the coefficient γ of ESG scores in Equation (1) and γ' in Equation (2) should remain the same, non-zero and significant before and after controlling for institutional ownership. We should then have, $\gamma \# \gamma'$, and the indirect effect $\alpha \cdot \beta$ should be not significant. If firms' ESG performance indirectly affects stock returns to some extent(partial mediation), the magnitude of the coefficient γ' of ESG scores should be lower after controlling for institutional ownership, i.e. $|\gamma| \geq |\gamma'|$, and the indirect effect $\alpha \cdot \beta$ should always be negative and significant.

H2: The mediation effect related to investor demand is not the same throughout the different pillars E, S, G, and the overall score ESG.

Testing H_2 consists of comparing the direct and indirect effects across the different ESG pillars. The literature reports unique behavior for G pillar compared to E and S ones. Applying our mediation model for all three pillars behind the overall ESG scores is a natural way to discuss this assumption and confirm (or not) this reported fact.

H3: A more important mediation through investor demand comes from an increase in investor demand for E, S or G attractive stocks and/or a more important sensitivity of returns to the investor demand.

Exploring H_3 involves identifying where the increase/decrease of the indirect effect $\alpha \cdot \beta$ originates. If it comes from the α of Equation (3), we can conclude that the mediation is originated by the increased interest of institutional investors for ESG. If it comes from the increase/decrease of β in Equation (2), the mediation is due to an increase in the impact of investor demand on future returns.

4 Data

4.1 ESG Scores

We collect data on firms' environmental, social, governance, and global ESG performances from the Refinitiv ESG (formerly known as Thomson Reuters ASSET4 ESG) database. Refinitiv ESG database is one of the most comprehensive databases in the industry, covering more than 9,500 companies worldwide, with about 1,000 of them dating back to 2002. Refinitiv ESG scores are constructed in three steps. First, content research analysts collect ESG data from publicly available information sources (annual reports, company websites, non-governmental organization websites, stock exchange filings, CSR reports, and global media sources) and filter a subset of 186 most comparable ESG measures. This subset of ESG measures is then grouped into ten categories which will be used to assess firms' ESG

[5]Pure mediation case corresponds to the situation where γ' in Equation (2) is non-significant while $\alpha \cdot \beta$ is significant and "close" to γ in Equation (1).

[6]Partial mediation case corresponds to the situation where γ' in Equation (2) is still significant but lower than γ in Equation (1), while $\alpha \cdot \beta$ is also significant.

[7]No mediation case corresponds to the situation where γ' in Equation (2) is very close to γ in Equation (1), while $\alpha \cdot \beta$ is not significant.

performance, commitment, and effectiveness and compute ESG scores. The second step consists of aggregating the category scores to obtain the pillar scores (the environmental, social, and governance pillars) and overall ESG scores. Each pillar encompasses three or four relevant categories. Finally, an ESG Combined score that accounts for ESG controversies captured from global media sources is computed to provide a more comprehensive view of a firm's ESG performance.

Refinitiv adopts a percentile ranking scoring methodology to calculate the ten category scores and the ESG controversies scores. Refinitiv's analysts attribute a percentile rank score less sensitive to outliers by comparing each firm to benchmark firms. The benchmark used to calculate the environmental and social category scores, as well as the controversies scores, is firms belonging to the same TRBC industry group, as firms in the same industry tend to face similar environmental and social issues. As for the calculation of the governance category scores, Refinitiv analysts use the firm having the same country of incorporation as the benchmark, as governance practices tend to be consistent within countries. As the aggregation of category scores, ESG pillar scores and overall scores are also rank-based scores that measure a firm's ESG performance relative to all other firms in a given year. They are available in both percentages (from 0 to 100) and letter grades (from D- to A+).

The main advantage of Refinitiv ESG scores is the granularity of its scoring methodology. The large number of ESG metrics underlying the computation of ESG scores allows for the distinction between two groups of firms: ESG laggards, which lack evidence of actual implementation of ESG-related policies, and ESG leaders, which show genuine efforts in complying with ESG principles. The granularity of the scoring methodology can also be seen in the use of a materiality matrix to define the weights for each category in the computation of ESG pillar scores and overall scores. Considering discrepancies in the importance of each ESG topic to different industry groups, the Refinitiv ESG Materiality Matrix provides industry-specific magnitude weights of each category. These magnitude weights will be used to determine the category weights and, ultimately, the ESG scores for the different industry groups.

While the Refinitiv ESG database is continuously updated and ESG scores are recalculated weekly, Refinitiv ESG scores are reported only once a year rather than at shorter intervals, such as quarterly. Annual reporting reduces the transparency of a firm's ESG performance, which can vary at different times of the year. In addition, the only definitive scores are those before the most recent five years. The Refinitiv ESG scores of the most recent five years may be revised to accommodate updates in the underlying data. Therefore, the data collection timing will impact empirical studies that rely on the latest Refinitiv ESG scores. The potential problems arising from revisions to ESG scores are negligible if the modifications are minor, which is an essential assumption for using Refinitiv ESG scores in this study.

Refinitiv ESG scores are far from a perfect measure of corporate ESG performance, and their shortcomings largely stem from the difficulty of accurately assessing corporate ESG performance. Still, [Berg et al. (2022b)] consider Refinitiv ESG scores to be one of the most "exogenous" ESG measures, making them stand out among existing ESG measures. Following the literature (Dyck et al., 2019; Gibson Brandon et al., 2021), we use firms' ESG scores in percentages for the empirical analysis. To maximize the sample size, we use data from 2003 through year-end 2020.

4.2 Institutional ownership

Quarterly institutional holdings (13F) are from Refinitiv. 13F collects data on institutional holdings while covering entire investment companies (banks, insurance companies, parents of mutual funds, pension funds, university endowments, and numerous other types of professional investment advisors). The statutory reporting requirement is quarterly for 13F. Following the previous literature, we compute each firm's institutional ownership at a given date as the sum of a firm's shares held by institutional investors at that date divided by a firm's number of outstanding shares:

$$IO_{i,t} = \frac{\sum_{n=1}^{N} \text{Institutional Holding}_{n,i,t}}{\text{Shares Outstanding}_{i,t}},$$

where $i, i = 1, ..., I$, indicates the firm, $t, t = 1, ..., T$, indicates the date, and $n, n = 1, ..., N$, indicates the institutional investor, with N institutional investors in total. For each report date of the 13F database, institutional investors disclose not only the number of shares held in a firm but also stock information, including share price and the total number of shares outstanding. However, the number of outstanding shares of a company reported by different institutional investors on the same date is sometimes inconsistent, jeopardizing the validity of institutional ownership calculated using 13F data. To address this issue, we use holdings data from the 13F database to compute only the number of a firm's shares held by institutional investors on a given date (the numerator in the formula of institutional ownership). As for the denominator in the formula of institutional ownership, we extract the total number of a firm's outstanding shares from the Compustat database.

4.3 Preliminary treatments

We obtain quarterly stock prices, the number of shares outstanding, and accounting data from Compustat. Fama-French risk factors and the risk-free rate are accessible from Kenneth French's website. After collecting data from various sources, we use CUSIP numbers and dates to match Compustat data with 13F data. CUSIP is a 9-digit firm identifier, with the 9th digit being a check number. Firms are identified with CUSIP 9 (full CUSIP) in the Refinitiv ESG database and Compustat but with CUSIP 8 in the 13F dataset and CRSP. To uniformize CUSIP numbers, we remove the last digit of CUSIP 9 in the Refinitiv ESG and Compustat datasets. To increase the internal validity of results, we focus on common shares of American firms traded on NYSE, AMEX, and NASDAQ National following [Cao et al. (2022)]. We first eliminate firms without identifiers (CUSIP numbers). Then, we exclude firms with missing environmental, social, governance, and ESG scores over the entire sample period, as [Cao et al. (2022)] did. We also remove small firms whose last available market capitalization is below \$200 million because they are prone to outliers (Cao et al., 2022; Fernando et al., 2017; Lins et al., 2017). Finally, we observe that the institutional ownership of some firms is higher than 100%, meaning that institutional investors hold more shares than what exists.

Institutional holdings above 100% appear to be technically impossible but can be rationalized in two circumstances. One possible and most obvious explanation for such high institutional holdings stems from the delay in updating publicly available data. A firm's institutional ownership is computed using the holdings data released by all institutional investors in 13F. Although 13F prescribes institutions to report the latest holdings data every quarter, some institutions may fail to abide by this obligation, thus causing errors in the computation of a firm's institutional ownership level. Short selling among investors provides an alternative explanation for institutional holdings above 100%. In a short sale, an institution (short seller) borrows a firm's shares from some institutions (stock lenders). It then sells the borrowed shares to another institution (buyer), expecting to make a profit by repurchasing the shares at a lower price. If both the stock lender and the buyer of the short sale claim ownership of the shares shorted by the short seller, the shorted shares will be double counted in the aggregation of institutional holdings, resulting in a temporarily inflated level of the firm's institutional holdings.

Although the cases where institutional ownership exceeds 100% are caused by reporting errors, they still allow us to infer a high actual institutional ownership and can be retained in the data as long as the two explanations above apply. Once reported institutional ownership breaches the 200% threshold, the economic significance of such high institutional ownership becomes too imprecise to be used for analysis. Indeed, institutional ownership above 200% means that there is a significant delay in institutional holdings updates or that the company has more than 100% of its shares sold short. In the first case, the information carried by institutional ownership is too outdated to be useful for analysis, while the second case is simply unrealistic or extremely rare. Thus, we judge observations with institutional ownership higher than two as outliers and discard them.

4.4 Details on the sample size

Depending on the model specification considered, differences between the number of observations in the regression tables can be explained by the presence of missing variables and/or missing observations due to the use of forward returns rather than contemporaneous returns as the dependent variable. In order to maximize the number of observations in the empirical tests, we keep missing observations in the dataset for environmental, social, and governance scores and institutional ownership and selectively ignore them in each empirical test. For example, when we test for the overall effect of environmental scores on stock returns (as in column 1 of Table 3), we remove missing observations for forward returns and the natural logarithm of environmental scores. Observations included in that test can include missing values for the natural logarithm of other scores (S, G, and overall ESG scores) and institutional ownership, since these variables are not involved in the test. The number of missing observations for E, S, G, and overall ESG scores are respectively 12, 16, 12, and 12. Regarding the other key variables involved in the empirical tests, forward returns and institutional ownership record 11103 and 28 missing values, respectively.

We treat ESG scores equal to 0 as missing values, and this treatment also leads to differences in the number of observations in the regression tables. This scenario is only relevant to the environmental score, as it records 660 values of 0, and not to the other scores. The 660 observations with 0 E-scores are distributed among 162 firms. In decreasing order of weight, these observations are spread across the "Finance, Insurance and Real Estate", "Manufacturing", "Mining", "Retail Trade", "Services", "Transportation, Communications, Electricity, Gas and Sanitation Services", and "Wholesale Trade" industries. The majority (80%) of the observations with an E score of 0 belong to the "Finance, Insurance and Real Estate" sector. After manual checking, these 0 scores are due to non-reporting of data metrics under the relevant pillar (pillar E) or inactivity and de-listing of the firm concerned in a given year. Hence, it is reasonable to treat these 0 environmental scores as missing values and exclude them from the analysis.

We show the regression results with and without fixed effects to illustrate the impact of including fixed effects on the results. When the only difference between the two empirical tests is fixed effects (as in columns 1 and 2 of Table 3), the difference in the number of observations is mainly due to the fact that some firms are missing SIC division codes. The number of missing observations for SIC division codes, which are the basis for industry fixed effects, is 8427.

We illustrate the above interpretation with the first two columns of Table 3. Starting with 358531 firm-quarter observations, we eliminate 672 (660+12) missing observations for the natural logarithm of the E-score and 10739 missing observations for forward returns. As a result, the final number of observations for empirical testing is 24,440 (35,851-672-10,739), as shown in column 1 of Table 3. From column 1 to column 2, we lose another 5696 missing observations for SIC division codes and 3 singleton observations. As shown in column 2 of Table 3, the final number of observations is 18741 (24440-5696-3). Note that 5696 is different from 8427 because the former is the number of missing observations for SIC division codes after excluding the missing observations for the natural logarithm of the E score and forward returns. To check the robustness of the results, we replicate Table 3 on a dataset with no missing observations for the key variables (the natural logarithm of E, S, G, and ESG scores, forward returns, institutional ownership, and SIC division codes). The number of observations remains stable between the different empirical tests, and the results in Table 3 still hold. The results of this robustness test are available upon request.

4.5 Moderate ESG scores and high institutional ownership firms

The sample covers 1447 unique firms (35851 firm-quarter observations) for which Refinitiv ESG scores and other information (accounting data, institutional holdings data, and trading data) are available from 2003 to 2020.

[Include here - Table 1: Data Sources]

Table 1 summarizes the sources and the periodicities of firms' institutional ownership, ESG scores, and other characteristics (market capitalization, the number of common shares outstanding, common/ordinary equity, total assets, Tobin's Q, quarterly return, 3-quarter return, and 4-quarter return volatility).

[Include here - Table 2: Descriptive statistics]

Table 2 presents the summary statistics of firms' institutional ownership, ESG scores, and other characteristics mentioned above. The statistics are the time-series average of cross-sectional distributions from January 2003 to December 2020. More specifically, for each firm attribute, we compute the cross-sectional average at each period (the year for ESG scores and the quarter for other firm characteristics) before taking the mean of all available cross-sectional averages.

On average, sample firms have moderate ESG score performance, large size, relatively high institutional ownership, and positive returns. The mean (median) ESG score of sample firms is 46.76 (47.58), whereas a perfect score would be 100. Institutional ownership has a mean (median) of 0.76 (0.78). Regarding the size of sample firms, the average market capitalization, the average number of common shares outstanding, the average common equity, and the average total assets are, respectively, \$25.64 billion, 538.83 million, \$9.68 billion, and \$55.09 billion.In terms of the financial performance of sample firms, the average Tobin's Q, quarterly return, and 3-quarter return are respectively 1.88, 0.04, and 0.08.Sample stocks have thus positive returns in both the short-term and longer-term. Moreover, 4-quarter return volatility has a mean of 0.16, indicating that quarterly returns of sample stocks are relatively stable.

4.6 Institutional ownership and ESG scores link

However, descriptive statistics only provide a static view of sample firms' characteristics. Graphs on the most critical firm characteristics that this research focuses on (institutional ownership and ESG scores) are indispensable for a complete overview of sample firms.

[Include here - Figures 2 to 3]

Figure 2 shows the evolution of average environmental, social, governance and global ESG scores over time. Figure 3 presents the evolution of average institutional ownership over time. As time trends are influenced by sample composition, these graphs concentrate on a constant panel of firms for which all scores are available in all years between 2003 and 2020, and institutional ownership is available in all quarters between January 2003 and December 2020. This constant sample is constituted of 81 firms, a small part of the entire sample. Figure 2 shows an increasing trend in average environmental, social, governance, and ESG scores from 2003 to 2020 that we will have to take into account by including time fixed effects in the regressions.

We also see that governance has always been an important issue, even at times when ESG was not so popular. Environmental, social and ESG started to catch up at the beginning of our sample. The financial crisis pushed up all the scores even further, reaching a plateau in 2010 and starting to rise again since 2015, except for governance.

For instance, the average ESG score of firms in the constant panel was 40.51 in 2003 and reached 69.76 in 2020. As for the average institutional ownership of firms in the constant panel, its evolution differs before and after 2008. Average institutional ownership increased from 0.64 in March 2003 to an all-time high (0.84) in September 2007. It then declined to below 0.8 and remained mainly within the 0.65-0.8 range between 2008 and 2020. We thus observe parallel trends between ESG performance and institutional ownership of firms in the constant panel in the early part (before 2008) of the sample.

5 Empirical results

In this section, we empirically test how the information contained in firms' E, S, G and overall ESG scores is incorporated or not into stock prices, directly and/or indirectly through the actions of institutional investors, using the mediation model introduced in Section 3. Let us denote by $R^e_{i,t}$ the excess returns of stock $i, i = 1, ..., I$ at time $t, t = 1, ..., T$ and $IO_{i,t}$ the institutional ownership of stock $i, i = 1, ..., I$ at time $t, t = 1, ..., T$. The full mediation model corresponds to the set of the three following equations:

$$R^e_{i,t+1} = \gamma_0 + \gamma \cdot ln(score_{i,t}) + \varepsilon_{i,t} \quad (4)$$

$$IO_{i,t} = \alpha_0 + \alpha \cdot ln(score_{i,t}) + \epsilon_{i,t} \quad (5)$$

$$R^e_{i,t+1} = \beta_0 + \beta \cdot IO_{i,t} + \gamma' \cdot ln(score_{i,t}) + \varepsilon_{i,t} \quad (6)$$

where the variable $score_{i,t}$ can either be the E, S, G or the overall ESG score of stock $i, i = 1, ..., I$ at time $t, t = 1, ..., T$. We now aim to answer the 3 preliminary questions listed in Section 3 using the mediation approach for the 3 pillars E, S, G and the overall ESG scores. As explained previously, our identification strategy consists of, first, validating that ESG scores correlate (or not) to future returns (Section 5.1), then isolating the mediated demand effect on returns (Section 5.2 and Section 5.3), and finally implicitly quantifying the fundamental channel (Section 5.4). After that, we can delve into the three primary economic hypotheses that all pertain to the same question: which channel is at play in the observed correlation between ESG and future returns? We will first focus on the ESG score and then examine all the pillars that make it up (Section 5.5).

5.1 Baseline model

We start our analysis by estimating Equation (4) introduced just above using a simple pooled OLS regression approach. This baseline model corresponds to the Figure 1, graph *a*) on page 11. Previous findings in the literature suggest two competing effects in this relation. On the one hand, ESG scores correlate to future fundamentals and push the coefficient γ in Equation (4) to positive values. On the other hand, investors tilt their portfolios toward stocks with more attractive scores. Stocks become more expensive and exhibit lower future returns than stocks with bad ESG scores. The competition between these two effects could lead to a premium, a discount, or no effect at all. The results of the regressions of excess returns on scores for the different pillars are reported in Table 3. They basically show that only pillar E (-0.714***) and ESG (-1.013**) exhibit significant coefficients, always associated with negative values. Adding industry and year-quarter fixed effects confirms this result with three significant and negative results for the E (-0.738***), S (-1.989***) and ESG (-1.821***) scores. The coefficient γ in Equation (4) are then all negative and significant, except for G. Moreover, the effect is highly negative for the global ESG as well as for the S score.

[Include here - Table 3: Global effect of ESG on returns]

The theoretical framework developed in [Pedersen et al. (2021)] helps us to comment on these results. Any potential positive impact of E, S and ESG scores on future profitability (implying a positive relationship between returns and scores) would be completely offset by high investor demand for attractive E, S and ESG stocks. The sign of the relationship reverses for all these scores, and only the G score regression spares this flip with no statistically significant relation between the G score and future returns. Our results are consitent with the empirical findings of the literature showing that the G-score has a very specific impact on future returns. [Pedersen et al. (2021)], for example, found qualitatively the same kind of results for the global effect of ESG on returns, but quantitatively their results are more optimistic, as if there were a shift; it is positive for G and insignificant for E, S and ESG, while we find the G effect to be null and the other three negative.

The main difficulty here is that we cannot really disentangle the two effects mentioned above with a single regression approach and confirm the intuition given by the model. One possible solution is to run separate additional regressions on profitability and investor demand to confirm the intuitions behind the results reported in Table 3, as in [Pedersen et al. (2021)]. Let us consider, for example, the E score regression. Is the negative γ simply due to investor pressure flipping a positive relationship between E score and fundamentals? Or does investor pressure align with a negative relationship between E score and fundamentals? The pressure may disappear once investors load up on attractive E stocks, and fundamental relations will drive long-term returns, making this information relevant to all investors.[Pedersen et al. (2021)] answer this question with two separate regressions. The first one predicts future fundamentals with scores and the second one predicts institutional holdings with scores. The results are qualitatively convincing, showing that the fundamental relation between future profits and E, S and ESG scores is not strong enough to cancel the negative impact of investor pressure. On the contrary, the G score has a stronger positive correlation with future profits. The correlation remains positive even when accounting for the negative impact of investor pressure.

If this separate approach is qualitatively convincing, it does not give an integrated statistical framework to test the two competing effects conjointly and conclude which one is effectively stronger. All the statistical indicators are obtained through separate regressions and cannot be easily combined to quantitatively test the channels in action. To solve this issue, we build on [Pedersen et al. (2021)] and include a demand pressure proxy in Equation (4) to get Equation (6). Jointly with Equation (5), we obtain a mediation model allowing to quantitatively test the various channels between future returns and scores. This mediation model corresponds to the Figure 1, Panel b).

5.2 Does ESG predict/influence investor demand?

The first step in building the mediation model is to estimate Equation (5), i.e., the relation between investor demand and corporate ESG performance. Following the literature, we consider institutional ownership as a proxy to capture investors' interest in owning given stocks. Table 4 uses the same format as Table 3 to explain institutional holdings based on current ESG scores.[8]

[Include here - Table 4: Effect of ESG on institutional ownership (IO)]

Table 4 shows that institutional investors are sensitive to ESG when forming their portfolios. All four scores correlate positively and significantly with institutional holdings with positive α estimates. In line with [McCahery et al. (2016)], investors are more sensitive to governance score (0,080***) than to environmental (0,013***) or social (0,052***) ones. However, the most significant effect is obtained with ESG scores (0.074***). Adding industry and year-quarter fixed effect confirms this result with significant and positive results for the E, S, G and ESG scores. This first result is interesting by itself, as it confirms the demand pressure channel. However, it does not fully quantify the impact of ESG scores on future returns through institutional ownership. Indeed, we cannot gauge the real impact of institutional holdings on prices, i.e., their market impact, using this equation.

At this stage, there are two possible scenarios that can lead to completely different conclusions. If institutional ownership effectively correlates with future returns, then ESG is priced by the market, and scores will have a negative impact on future returns through the investor demand channel. However, if this market impact does not exist or remains rather small, then the previous result on investor pressure does not hold anymore as ESG is, in this case, not priced by the market. Equation (5) alone cannot help us understand the relation between ESG and future returns. In other words, the α coefficient in Equation (5) only gives a part of the full story. It must be multiplied by the β coefficient in Equation (6) to measure the real effect we are looking for. If previous empirical studies such as [Pedersen et al. (2021)] do not cover this aspect of the story, our mediation model provides a suitable framework to address it.

[8]We can find in the literature different specifications using 3-month lagged ESG scores. To keep a natural structure to our mediation model, we decide to use current score instead to better capture the instantaneous pressure of ESG metrics on investors' behavior.

5.3 Does investor demand predict/influence future returns?

Let us now consider Equation (6) when we basically add the institutional ownership variable to the initial Equation (4). The β coefficient associated with this new explanatory variable is the key coefficient to quantify the importance of the demand pressure channel. If β is significant in the regression, then the (positive) effect of scores on institutional holdings will be (negatively) priced by the market, and attractive ESG stocks will exhibit unattractive returns even if scores are associated with higher future profitability.

[**Include here - Table 5: ESG and institutional ownership effects on returns**]

Table 5 shows that future returns correlate, in all cases, negatively and significantly with the institutional ownership variable. This result confirms that the demand pressure is effectively priced by the market for E, S, G and ESG pillars. Adding fixed effects does not change the main results. This result goes against some of the previous results documented in the literature. For instance, [Pedersen et al. (2021)] explain the positive impact of G score on future returns by the low valuation ratios observed for stocks with high G scores. Attractive forecasted profitability is not priced by the market, and these stocks may generate attractive returns. We do not obtain such results with our model as β estimates show that all increases in institutional ownership will push prices up and returns down.

The challenge now is to combine the two previous results on α and β estimates to measure the whole effect of ESG scores on future returns through the demand pressure channel. If the numerical computation is quite easy to get by simply multiplying α and β coefficients, the statistical significance of this product is not straightforward to obtain. We give in Table 6, the estimation of the size of the indirect or demand pressure effect obtained with the bootstrap approach developed by [Preacher and Hayes (2004)] and [Hayes (2009)]. The demand pressure effect is always negative and significant. It is more pronounced for governance (-0.676***), then social (-0.468***), then environmental (-0.124**) performances, with a highly significant sensitivity to ESG overall performance of -0,640. Adding fixed effects does not change the main results, as we can see in Tables 7 and 8 in the Appendix. The indirect effect is always negative and significant. It is more pronounced and less significant for governance (-0.877*** and -0.795***), then social (-0.603*** and -0.493***), then environmental (-0.136**) performances, with again a highly significant sensitivity to ESG overall performance of -0.817 and -0.700. Based on the results, it is evident that the desire for appealing stocks is being converted into actual demand pressure on prices. As a result, there is a negative correlation observed between E, S, G, ESG and stock returns across all pillars.

[**Include here - Table 6: Direct and indirect effect of ESG on returns, bootstrap confidence intervals, no fixed effects.**]

We can now compare these values with the ones obtained in Table 3 corresponding to the baseline model in which we do not isolate the demand pressure effect. We hence answer the following question: is the demand pressure impact able to flip the sign of the relation between score and future returns? It appears that even when we subtract the $\alpha \cdot \beta$ estimates from the γ estimates, we still obtain a negative value in the relation. The negative impact of scores on returns may not be explained by the high demand pressure from institutional investors during the period of interest. Of course, this demand has a negative impact on returns, but the magnitude of this negative impact is too low to fully explain what we get. The sign in the relation was negative before considering the demand pressure, and this latter one only increased the negative impact of scores on future returns. However, without additional assumptions, we are not able to investigate this negative relation observed before taking into account the demand pressure.

5.4 Does ESG predict/influence future fundamentals ?

Let us now assume, as in the theoretical framework of [Pedersen et al. (2021)], that the total effect of ESG score can be decomposed into a fundamental effect and a demand pressure effect. We may then exploit Equation (6) to study the effect of ESG on future fundamentals. As we measure the demand effect through the $\alpha\beta$ product, we may filter the fundamental effect by simply considering the γ' coefficient in Equation (6). This implicit approach has many advantages, the first one being to avoid the choice of a proxy for stock fundamentals. The relation between scores and future fundamentals is implicitly obtained by controlling the demand effect of returns through the mediation model.

Table 6 reports the direct effect for E, S, G and ESG scores, i.e., the γ' estimates in Equation (6). Without fixed effects, this coefficient is, as expected, economically positive but statistically non-significant for G scores. High G scores are associated with attractive future fundamentals, but this relation is not strong enough to be statistically significant, and the magnitude of the estimates is too small to compensate for the demand pressure effect (0.087 vs -0.676). The two opposing effects explain why the total effect of G scores on returns is not significant: the positive impact of G scores on future fundamentals is too weak. On the contrary, E and S scores have a negative impact on future profitability, significant for E but not for S. If we add this negative fundamental impact to the negative demand impact, the total impact of E and S scores on future returns is negative, significant for E but not for S. Finally, overall ESG scores seem to have no fundamental effects, resulting in a total negative and significant effect coming from the sole important demand channel. If we introduce fixed effects in the regression, the results show a similar trend. Adding only industry fixed effects (see Table 7) increases the magnitude of the effect, but the significativity remains the same. The fundamental channels for E, S and ESG are economically more pronounced and statistically significant when adding both time and industry fixed effects (see Table 8). The only non-significant effects are observed for G, positive but still non-significant. If we look at the total effect, we obtain numbers close to the ones reported for the baseline model in Subsection 5.4. Economically speaking, we observe through the mediation model that the fundamental effect is, after retreatment, negative and, therefore, the opposite of what is usually expected in the literature [see e.g., Pedersen et al. (2021)].

5.5 Answering the main hypothesis

Another way of summarising the results presented in Tables 6-8 is to calculate the percentage of the total effect explained by the demand pressure, i.e. the mediated effect. The indirect effect is an important part of the total effect of ESG on stock returns and is around 63% for the overall ESG. The same percentage ranges from 115% for G, 81% for S and only 17% for E, implying that the mediation of institutional investors is more pronounced for G than for S and E. Adding fixed effects gives similar results for E and G, but slightly different results for S and ESG. The indirect effect is still an important part of the total effect of ESG on stock returns (38% for the overall ESG), and it varies from 129% for the G, 25% for the S and 19% for the E. This suggests that the mediation of institutional investors is more pronounced for G than for S and E. Adding only industry fixed effects increases the dominance of the indirect effect to 166% for G, while the share of the indirect effect in the total effect is 51% and 56% for S and ESG, respectively, and only 15% for E.

Using this global view, we can now discuss the three main assumptions developed in Subsection 3.5. The first one is related to the sign in the relation between ESG scores and future returns. If we follow the literature, this negative sign is explained by the dominant channel associated with the demand pressure. Assumption H_1 assumes that this channel is operating exclusively, and therefore we expect a negative relation between scores and returns. However, the empirical results we obtain contradict this assumption. We conclude with a partial mediation for E, S and overall ESG scores and full mediation for G scores. The indirect coefficients are always significant, showing that institutional investors play an important role in explaining the relation between scores and returns (representing around 69% on average). It also means that investor demand is not the only explaination for the negative effect on stock returns. This result is economically important. Assuming that the demand pressure may vanish in the long term, we can still expect a negative but relatively less significant correlation between scores and returns, except for G. This is due to the negative effect observed on the residual direct channel.

Assumption H_2 assumes a different behavior for E, S, and G. The empirical applications confirm this as we have different mediation results for E, S and G: pure mediation for G, and partial mediation for S and E. This result confirms a well-known result in the literature. The demand pressure is active in the relation between scores and returns, as in the case of E and S. But the main difference is in the non-significant direct impact of score on return in this case. If we assume that the demand channel is temporary, then we may expect to have a non-significant relation between score and returns for pillar G. The second important economic consequence of the heterogeneity observed within the E, S and G pillars is the inconsistency of the overall ESG scores, computed as a weighted average of E, S and G scores. We clearly observe some differences in the relation between pillars and returns, and a simple aggregation of these relations may bring to non-significant global results, although some desegregated effects are significant.

Assumption H_3 explores how mediation occurs. As mediation is fundamentally a product of the two parameters α and β involved in Equation (5) and Equation (6), we may ask which parameter is leading this effect. Our previous empirical results show that the mediation level is numerically due to the demand pressure, i.e. the β parameter, as the α parameter measuring the interest of institutional investors for ESG takes lower values. However, these levels are highly sensitive to the unity of measurement selected for the different variables involved in the regression equations. It is then difficult to draw conclusions about these single results.

More interestingly, we may also study the differences observed in mediation for the different pillars E, S, G and the overall ESG score. Taking the E result as a benchmark, where mediation is working the least, we compute the relative change in the mediation effect $\alpha \cdot \beta$ while distinguishing (by linearization) the part that comes from the change in α from the part that comes from the change in β, i.e.:

$$\frac{\Delta \text{mediation}}{\text{mediation}} \approx \frac{\Delta\alpha}{\alpha} + \frac{\Delta\beta}{\beta}.$$

This time, we get that the full change in the mediation effect for ESG [resp. S, G] compared to E is coming from $\Delta\alpha$, i.e. the change in the interest of institutional investors for attractive

ESG [resp. S, G] stocks. Indeed, the β coefficient capturing the impact of institutional demand on returns is quite the same across pillars, and thus not significant to understand how the mediation effect differs across scores. Market prices react similarly to an increase in institutional holdings in all regressions. Hence, differences in mediation stem from how institutional investors perceive information related to different scores.

6 Robustness check

6.1 Controlling for past returns

We now look at the same 3-equation model where we add the past returns as a control variable in the return equations.

$$R^e_{i,t+1} = \gamma_0 + \gamma \cdot ln(score_{i,t}) + \theta \cdot R^e_{i,t} + \varepsilon_{i,t} \quad (7)$$
$$IO_{i,t} = \alpha_0 + \alpha \cdot ln(score_{i,t}) + \epsilon_{i,t} \quad (8)$$
$$R^e_{i,t+1} = \beta_0 + \beta IO_{it} + \gamma' \cdot ln(score_{i,t}) + \theta' \cdot R^e_{i,t} + \varepsilon_{i,t} \quad (9)$$

In this formula, the index i indicates firms, the index t indicates dates, and the index n indicates institutional investors, with N institutional investors in total. *Score* can either be the "E-score", the "S-score", the "G-score", or the overall "ESG-score".

As we see in Tables from 9 to 14, we still have negative γs and significant estimated coefficients in the "global" ESG effect regression.

		E 9%	S 61%	G 172%	ESG 46%
no FE	Direct:	-0.973***	-0.250	0.240	-0.627
	Indirect:	-0.102**	-0.400***	-0.575***	-0.535***
	Total:	-1.075***	-0.651	-0.335	-1.162**
FE	Direct	-0.852***	-1.830***	0.274	-1.508**
	Indirect	-0.130**	-0.465***	-0.763***	-0.660***
	Total	-0.982***	-2.294***	-0.490	-2.168***
		E 13%	S 20%	G 156%	ESG 30%

6.2 Risk-adjusted returns of high-ESG minus low-ESG portfolios

Following [Pedersen et al. (2021)], we look at the return predictability of ESG proxies based on high-ESG minus low-ESG portfolios. For each quarter, we sort stocks into portfolios based on quintiles of their ESG scores within the sample (as in Table 15) or within their respective industry (as in Table 16). We calculate the difference in returns during the following quarter between the portfolio of firms with the highest quintile ESG scores and that of firms with the lowest quintile scores. Table 15 [resp. Table 16] reports the performances of the equal-weighted and value-weighted portfolios for all firms [resp. for firms by industry].

Contrary to [Pedersen et al. (2021)], but in line with our previous results, we find in all cases a negative ESG premium represented by a negative alpha. Moreover, as we see in Table 15 no portfolio show highly significant results. The only slightly significant result is found for the overall ESG score with an economic value around -6% for the value-weighted portfolio, no matter the model considered, and nothing for the equal-weighted portfolio. Focusing on best-worst stocks by industry in Table 16 allows us to recover more significativity for equal-weighted as well as value-weighted portfolios but only for E (until the Three-factor model) and overall ESG (even after controlling for the five factors augmented with momentum), where the economic magnitude of the effect is around -7%.

7 Conclusion

In this paper, we examine how the information contained in the corporate environmental, social, governance and overall ESG performances is incorporated into stock prices by studying two transmission channels: ”the investor demand” channel and the ”profitability” channel. We propose a natural and complete method to test promising theoretical results obtained in the literature. In [Pedersen et al. (2021)], there are two effects of ESG, potentially opposite, which can ”lead to a return premium or discount”. We use causal mediation analysis to identify and quantify the two effects empirically using U.S.-listed firms and Refinitiv E, S, G, and overall ESG scores.

We show that the information contained in corporate *E*, *S*, *G* or overall *ESG* scores is effectively incorporated into stock prices through both the investor demand channel and the fundamental/profitability channel. We confirm that institutional investors, like many others before us, are sensitive to ESG [(Fernando et al., 2017; Gantchev et al., 2024; Lopez de Silanes et al., 2022; Nofsinger et al., 2019; Pedersen et al., 2021; Starks et al., 2017)]. Indeed, institutional ownership is positively correlated with a firm's environmental, social, governance and overall ESG scores. This finding is consistent with the increasing trend of institutional investors to allocate capital on the basis of ESG criteria. We also find that they are more sensitive to *G*-performance and overall *ESG* performance than *S* and then *E* performance.

Our results also show that ESG is priced by the market and that all scores have a significant negative impact on future returns. Indeed, if the (indirect) demand pressure effects differ according to the E, S, G, and overall ESG scores, the ranking is the same as the sensitivity of institutional investors to ESG. These results could imply that institutional ownership is indeed correlated with future returns, and that the more sensitive they are to one of the pillars, the stronger the negative impact of that pillar on future returns. Looking at the direct effect, we find that ESG predicts future fundamentals (profitability) for all the scores considered except *G*. Our results show that *E*, *S*, and *ESG* have a negative (profitability) effect on stock returns while *G* has no effect. This result is unexpected as it suggests that not only the profitability effect is not strong enough to offset the negative demand effect, but that it may even contribute to the negative effect. As for the global effect, we show that it is negative, but again, and contrary to our first hypothesis, this negative effect is not only due to the dominance of the mediating demand effect. And if the importance of this effect varies across different scores, as we assume in our second hypothesis, it is always significant and important, accounting for 69% on average. Finally, when analysing the indirect demand pressure effect, we show that the mediating effect increases with the interest of institutional investors in ESG scores and with the sensitivity of returns to demand pressure over our sample period.

The practical implications for portfolio selection are numerous. First, we show the dominance of the mediation effect related to the demand pressure in the impact of ESG scores on returns. This pressure effect is explained by the observed trend of high demand by institutional investors for attractive stocks. If we assume that this pressure naturally diminishes when the portfolio is sufficiently green, we might think that only the fundamental channel will remain active. Our findings indicate that there is a persistent negative relation between scores and future returns, even after controlling for the mediation effect.

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A Appendix

A.1 Data description, descriptive statics and regression tables

Table 1: Data Sources

This table reports general information on the main variables in the empirical analysis: sources and periodicities of the main variables.

Variable	Source	Periodicity
Environmental Score	Refinitiv ESG	Yearly
Social Score	Refinitiv ESG	Yearly
Governance Score	Refinitiv ESG	Yearly
ESG Score	Refinitiv ESG	Yearly
Institutional Ownership	13F, Compustat	Quarterly
Market Capitalisation ($ billion)	Compustat	Quarterly
Common Shares Outstanding (million)	Compustat	Quarterly
Common/Ordinary Equity ($ billion)	Compustat	Quarterly
Total Assets ($ billion)	Compustat	Quarterly
Tobin's Q	Compustat	Quarterly
Return	Compustat	Quarterly
3-Quarter Return	Compustat	Every 3 quarters
4-Quarter Return Volatility	Compustat	Every 4 quarters

Table 2: Descriptive statistics

This table presents the descriptive statistics of social scores, institutional ownership, and other stock characteristics. The statistics are the time-series average of cross-sectional distributions from January 2003 to December 2020 for all variables.
The units of variables are in parentheses.

Variable	Period	Mean	Std	10-Pctl	Q1	Median	Q3	90-Pctl
Environmental Score	2003-2020	38.48	3.87	33.09	34.95	39.52	41.43	42.87
Social Score	2003-2020	47.20	3.99	39.89	46.97	48.36	49.59	50.55
Governance Score	2003-2020	54.16	1.56	52.32	52.74	53.82	55.59	55.59
ESG Score	2003-2020	46.76	3.12	40.93	46.64	47.58	48.73	49.86
Institutional Ownership	2003-2020	0.76	0.05	0.69	0.73	0.78	0.79	0.81
Market Capitalisation ($ billion)	2003-2020	25.53	6.53	19.15	20.31	23.14	30.84	35.24
Common Shares Outstanding (million)	2003-2020	522.73	209.45	247.89	308.32	501.94	748.32	816.23
Common/Ordinary Equity ($ billion)	2003-2020	9.46	2.42	5.71	6.96	10.20	11.21	12.52
Total Assets ($ billion)	2003-2020	53.74	15.95	30.18	35.79	56.58	68.63	73.37
Tobin's Q	2003-2020	1.92	0.23	1.66	1.80	1.87	2.06	2.18
Return	2003-2020	0.04	0.11	-0.09	-0.01	0.04	0.08	0.14
3-Quarter Return	2003-2020	0.11	0.23	-0.12	0.02	0.08	0.19	0.19
4-Quarter Return Volatility	2003-2020	0.16	0.07	0.10	0.11	0.13	0.20	0.26

A.2 Regression results

	Excess Return$_{t+1}$											
Variable	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score
$Ln(E\ score)_t$	-0.714***				-0.940***				-0.738***			
	(-3.59)				(-3.93)				(-3.51)			
$Ln(S\ score)_t$		-0.576				-1.199**				-1.989***		
		(-1.32)				(-2.12)				(-3.53)		
$Ln(G\ score)_t$			-0.589				-0.490				-0.575	
			(-1.31)				(-0.93)				(-1.15)	
$Ln(ESG\ score)_t$				-1.013**				-1.481**				-1.821***
				(-2.15)				(-2.53)				(-3.33)
Constant	6.803***	6.627***	6.737***	8.289***	7.577***	9.015***	6.374***	10.090***	6.901***	12.014***	6.706***	11.386***
	(9.41)	(3.86)	(3.73)	(4.48)	(8.80)	(4.02)	(3.02)	(4.39)	(8.98)	(5.39)	(3.35)	(5.30)
Industry Fixed Effect	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Industry x Year Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Clustering Level	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Number of Observations	24,440	24,740	24,742	24,742	18,744	19,002	19,004	19,004	18,741	19,000	19,002	19,002
R^2	0.001	0.000	0.000	0.000	0.003	0.003	0.002	0.003	0.251	0.252	0.251	0.252

Table 3: Global effect of ESG on returns

Notes: Estimation of the equation $R^e_{i,t+1} = \gamma_0 + \gamma\,\text{Ln}\,(\text{Score}_{i,t}) + \varepsilon_{i,t}$ without fixed effects, with only industry fixed effects, and with both industry and time fixed effects, where $\text{Score}_{i,t}$ can either be the for Environmental score (E $\text{Score}_{i,t}$), the Social score (S $\text{Score}_{i,t}$), the Governance score (G $\text{Score}_{i,t}$), or the overall ESG score (ESG $\text{Score}_{i,t}$).

	Institutional Ownership$_t$											
Variable	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score
Ln(E score)$_t$	0.013***				0.012**				0.013**			
	(2.70)				(2.38)				(2.53)			
Ln(S score)$_t$		0.052***				0.053***				0.049***		
		(5.16)				(4.93)				(4.30)		
Ln(G score)$_t$			0.080***				0.075***				0.074***	
			(8.10)				(6.70)				(6.60)	
Ln(ESG score)$_t$				0.074***				0.073***				0.069***
				(5.95)				(5.36)				(4.92)
Constant	0.742***	0.587***	0.471***	0.504***	0.743***	0.578***	0.488***	0.505***	0.739***	0.596***	0.490***	0.520***
	(43.83)	(15.05)	(11.79)	(10.50)	(42.21)	(13.70)	(10.79)	(9.63)	(40.58)	(13.52)	(10.78)	(9.62)
Industry Fixed Effect	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Industry x Year Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Clustering Level	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Number of Observations	35,154	35,810	35,814	35,814	26,817	27,385	27,389	27,389	26,817	27,385	27,389	27,389
R^2	0.004	0.017	0.045	0.026	0.050	0.065	0.088	0.072	0.093	0.101	0.126	0.109

Table 4: Effect of ESG on institutional ownership (IO)

Notes: Estimation of the equation $IO_{i,t} = \alpha_0 + \alpha \, \mathrm{Ln} \left(\mathrm{Score}_{i,t} \right) + \epsilon_{i,t}$ without fixed effects, with only industry fixed effects, and with both industry and time fixed effects, where $\mathrm{Score}_{i,t}$ can either be the for Environmental score (E $\mathrm{Score}_{i,t}$), the Social score (S $\mathrm{Score}_{i,t}$), the Governance score (G $\mathrm{Score}_{i,t}$), or the overall ESG score (ESG $\mathrm{Score}_{i,t}$).

	Excess Return$_{t+1}$											
Variable	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score
$Ln(E\ score)_t$	-0.590***				-0.788***				-0.587***			
	(-2.90)				(-3.23)				(-2.81)			
$Ln(S\ score)_t$		-0.107				-0.571				-1.488***		
		(-0.25)				(-1.07)				(-2.86)		
$Ln(G\ score)_t$			0.087				0.348				0.179	
			(0.18)				(0.59)				(0.32)	
$Ln(ESG\ score)_t$				-0.372				-0.652				-1.124**
				(-0.74)				(-1.05)				(-2.01)
$Institutional\ Ownership_t$	-8.616***	-8.606***	-8.691***	-8.508***	-11.467***	-11.306***	-11.697***	-11.271***	-10.677***	-10.138***	-10.701***	-10.219***
	(-4.09)	(-4.18)	(-4.06)	(-4.05)	(-4.02)	(-4.08)	(-4.04)	(-3.98)	(-3.99)	(-3.93)	(-3.93)	(-3.87)
Constant	13.153***	11.595***	10.917***	12.525***	16.036***	15.460***	12.240***	15.743***	14.749***	18.031***	12.125***	16.719***
	(7.22)	(4.91)	(5.10)	(5.47)	(6.79)	(4.96)	(4.71)	(5.43)	(6.42)	(5.80)	(4.98)	(6.00)
Industry Fixed Effect	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Industry x Year Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Clustering Level	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Number of Observations	24,436	24,736	24,738	24,738	18,740	18,998	19,000	19,000	18,737	18,996	18,998	18,998
R^2	0.004	0.003	0.003	0.003	0.008	0.008	0.008	0.008	0.255	0.256	0.255	0.255

Table 5: ESG and institutional ownership effects on returns

Estimation of the equation $R^e_{i,t+1} = \beta_0 + \beta IO_{i,t} + \gamma' \operatorname{Ln}(\text{Score}_{i,t}) + \varepsilon_{i,t}$ without fixed effects, with only industry fixed effects, and with both industry and time fixed effects, where $\text{Score}_{i,t}$ can either be the for Environmental score (E $\text{Score}_{i,t}$), the Social score (S $\text{Score}_{i,t}$), the Governance score (G $\text{Score}_{i,t}$), or the overall ESG score (ESG $\text{Score}_{i,t}$).

1. Environmental score → stock returns

	Coefficient	std. err.	z	$P>\|z\|$	[95% confidence interval]	
Direct effect	-0.5903641	0.2039032	-2.9	0.004	-0.990007	-0.1907212
Indirect effect (through institutional ownership)	-0.1241473	0.0522543	-2.38	0.018	-0.2265638	-0.0217308
Total effect	-0.7145114	0.1990063	-3.59	0	-1.104557	-0.3244662

2. Social score → stock returns

	Coefficient	std. err.	z	$P>\|z\|$	[95% confidence interval]	
Direct effect	-0.1065353	0.4249608	-0.25	0.802	-0.9394431	0.7263726
Indirect effect (through institutional ownership)	-0.46764	0.1425405	-3.28	0.001	-0.7470143	-0.1882657
Total effect	-0.5741752	0.4357503	-1.32	0.188	-1.42823	0.2798796

3. Governance score → stock returns

	Coefficient	std. err.	z	$P>\|z\|$	[95% confidence interval]	
Direct effect	0.0869841	0.4921782	0.18	0.86	-0.8776674	1.051636
Indirect effect (through institutional ownership)	-0.6760272	0.1826281	-3.7	0	-1.033972	-0.3180827
Total effect	-0.5890431	0.4489428	-1.31	0.189	-1.468955	0.2908686

4. ESG score → stock returns

	Coefficient	std. err.	z	$P>\|z\|$	[95% confidence interval]	
Direct effect	-0.3717761	0.5053851	-0.74	0.462	-1.362313	0.6187604
Indirect effect (through institutional ownership)	-0.6406978	0.1885818	-3.4	0.001	-1.010311	-0.2710843
Total effect	-1.012474	0.4717254	-2.15	0.032	-1.937039	-0.087909

Table 6: Direct and indirect effect of ESG on returns, bootstrap confidence intervals, no fixed effects.
Estimation of the equation $R^e_{i,t+1} = \beta_0 + \beta IO_{i,t} + \gamma' \text{Ln}\,(\text{Score}_{i,t}) + \varepsilon_{i,t}$ without fixed effects, where $\text{Score}_{i,t}$ can either be the for Environmental score (E $\text{Score}_{i,t}$), the Social score (S $\text{Score}_{i,t}$), the Governance score (G $\text{Score}_{i,t}$), or the overall ESG score (ESG $\text{Score}_{i,t}$).

1. Environmental score → stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence	interval]
Direct effect	-0.787876	0.2440576	-3.23	0.001	-1.26622	-0.309532
Indirect effect (through institutional ownership)	-0.1355	0.0680606	-1.99	0.046	-0.268897	-0.002104
Total effect	-0.923376	0.2402379	-3.84	0	-1.394234	-0.452519

2. Social score → stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence	interval]
Direct effect	-0.570521	0.5347205	-1.07	0.286	-1.618553	0.4775125
Indirect effect (through institutional ownership)	-0.603309	0.19614	-3.08	0.002	-0.987737	-0.218882
Total effect	-1.17383	0.5729125	-2.05	0.04	-2.296717	-0.050942

3. Governance score →stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence	interval]
Direct effect	0.3484415	0.5884174	0.59	0.554	-0.804835	1.501718
Indirect effect (through institutional ownership)	-0.877327	0.248161	-3.54	0	-1.363714	-0.39094
Total effect	-0.528886	0.5246359	-1.01	0.313	-1.557153	0.499382

4. ESG score →stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence	interval]
Direct effect	-0.65172	0.6226173	-1.05	0.295	-1.872028	0.5685872
Indirect effect (through institutional ownership)	-0.817342	0.2561569	-3.19	0.001	-1.3194	-0.315284
Total effect	-1.469062	0.5865479	-2.5	0.012	-2.618675	-0.31945

Table 7: Direct and indirect effect of ESG on returns, bootstrap confidence intervals, industry fixed effects.
Estimation of the equation $R^e_{i,t+1} = \beta_0 + \beta IO_{i,t} + \gamma' \,\mathrm{Ln}\,(\mathrm{Score}_{i,t}) + \varepsilon_{i,t}$ with industry fixed effects, where $\mathrm{Score}_{i,t}$ can either be the for Environmental score (E $\mathrm{Score}_{i,t}$), the Social score (S $\mathrm{Score}_{i,t}$), the Governance score (G $\mathrm{Score}_{i,t}$), or the overall ESG score (ESG $\mathrm{Score}_{i,t}$).

1. Environmental score → stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence interval]	
Direct effect	-0.5871209	0.207783	-2.83	0.005	-0.994368	-0.1798737
Indirect effect (through institutional ownership)	-0.1364112	0.0643884	-2.12	0.034	-0.2626102	-0.0102123
Total effect	-0.7235321	0.2099335	-3.45	0.001	-1.134994	-0.3120701

2. Social score → stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence interval]	
Direct effect	-1.488091	0.5179647	-2.87	0.004	-2.503284	-0.4728993
Indirect effect (through institutional ownership)	-0.4931474	0.1718598	-2.87	0.004	-0.8299863	-0.1563084
Total effect	-1.981239	0.5677735	-3.49	0	-3.094054	-0.8684231

3. Governance score → stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence interval]	
Direct effect	0.1790952	0.5538369	0.32	0.746	-0.9064051	1.264596
Indirect effect (through institutional ownership)	-0.7952204	0.228027	-3.49	0	-1.242145	-0.3482956
Total effect	-0.6161252	0.4949161	-1.24	0.213	-1.586143	0.3538925

4. ESG score → stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence interval]	
Direct effect	-1.124405	0.5577356	-2.02	0.044	-2.217547	-0.0312637
Indirect effect (through institutional ownership)	-0.70079	0.2267011	-3.09	0.002	-1.145116	-0.2564639
Total effect	-1.825195	0.545705	-3.34	0.001	-2.894758	-0.7556334

Table 8: Direct and indirect effect of ESG on returns, bootstrap confidence intervals, fixed effects.

Estimation of the equation $R^e_{i,t+1} = \beta_0 + \beta IO_{i,t} + \gamma' \text{Ln}\,(\text{Score}_{i,t}) + \varepsilon_{i,t}$ with industry and time fixed effects, where $\text{Score}_{i,t}$ can either be the for Environmental score (E $\text{Score}_{i,t}$), the Social score (S $\text{Score}_{i,t}$), the Governance score (G $\text{Score}_{i,t}$), or the overall ESG score (ESG $\text{Score}_{i,t}$).

A.3 Robustness tests regressions

	Excess Return$_{t+1}$											
Variable	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score
$Ln(E\ score)_t$	-1.074***				-1.361***				-0.985***			
	(-4.51)				(-4.62)				(-3.85)			
$Ln(S\ score)_t$		-0.653				-1.375**				-2.288***		
		(-1.24)				(-2.00)				(-3.48)		
$Ln(G\ score)_t$			-0.333				-0.229				-0.405	
			(-0.79)				(-0.48)				(-0.98)	
$Ln(ESG\ score)_t$				-1.161**				-1.717**				-2.127***
				(-2.10)				(-2.49)				(-3.46)
Excess Return$_t$	-0.016**	-0.016**	-0.015**	-0.016**	-0.023**	-0.023**	-0.023**	-0.023**	-0.016***	-0.016***	-0.016***	-0.016***
	(-2.21)	(-2.22)	(-2.22)	(-2.23)	(-2.35)	(-2.37)	(-2.38)	(-2.38)	(-3.23)	(-3.21)	(-3.24)	(-3.23)
Constant	9.238***	8.131***	6.951***	10.067***	10.161***	10.837***	6.508***	12.144***	8.870***	14.273***	7.167***	13.673***
	(10.63)	(3.95)	(4.15)	(4.66)	(9.54)	(4.02)	(3.48)	(4.52)	(9.51)	(5.53)	(4.46)	(5.71)
Industry Fixed Effect	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Industry x Year Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Clustering Level	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Number of Observations	20,320	20,600	20,601	20,601	15,639	15,886	15,887	15,887	15,635	15,883	15,884	15,884
R^2	0.002	0.001	0.001	0.001	0.007	0.005	0.005	0.006	0.275	0.275	0.274	0.275

Table 9: Global effect of ESG and past returns on returns

Notes: Estimation of the equation $R^e_{i,t+1} = \gamma_0 + \gamma\,\mathrm{Ln}\,(\mathrm{Score}_{i,t}) + \theta R^e_{i,t} + \varepsilon_{i,t}$ without fixed effects, with only industry fixed effects, and with both industry and time fixed effects, where $\mathrm{Score}_{i,t}$ can either be the for Environmental score (E $\mathrm{Score}_{i,t}$), the Social score (S $\mathrm{Score}_{i,t}$), the Governance score (G $\mathrm{Score}_{i,t}$), or the overall ESG score (ESG $\mathrm{Score}_{i,t}$).

	Institutional Ownership$_t$											
Variable	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score
Ln(E score)$_t$	0.013***				0.012**				0.013**			
	(2.70)				(2.38)				(2.53)			
Ln(S score)$_t$		0.052***				0.053***				0.049***		
		(5.16)				(4.93)				(4.30)		
Ln(G score)$_t$			0.080***				0.075***				0.074***	
			(8.10)				(6.70)				(6.60)	
Ln(ESG score)$_t$				0.074***				0.073***				0.069***
				(5.95)				(5.36)				(4.92)
Constant	0.742***	0.587***	0.471***	0.504***	0.743***	0.578***	0.488***	0.505***	0.739***	0.596***	0.490***	0.520***
	(43.83)	(15.05)	(11.79)	(10.50)	(42.21)	(13.70)	(10.79)	(9.63)	(40.58)	(13.52)	(10.78)	(9.62)
Industry Fixed Effect	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Industry x Year Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Clustering Level	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Number of Observations	35,154	35,810	35,814	35,814	26,817	27,385	27,389	27,389	26,817	27,385	27,389	27,389
R^2	0.004	0.017	0.045	0.026	0.050	0.065	0.088	0.072	0.093	0.101	0.126	0.109

Table 10: Effect of ESG on institutional ownership (IO)

Notes: Estimation of the equation $IO_{i,t} = \alpha_0 + \alpha \, \mathrm{Ln}\,(\mathrm{Score}_{i,t}) + \epsilon_{i,t}$ without fixed effects, with only industry fixed effects, and with both industry and time fixed effects, where $\mathrm{Score}_{i,t}$ can either be the for Environmental score (E $\mathrm{Score}_{i,t}$), the Social score (S $\mathrm{Score}_{i,t}$), the Governance score (G $\mathrm{Score}_{i,t}$), or the overall ESG score (ESG $\mathrm{Score}_{i,t}$).

	Excess Return$_{t+1}$											
Variable	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score	E Score	S Score	G Score	ESG Score
$Ln(E\ score)_t$	-0.973***				-1.231***				-0.852***			
	(-4.05)				(-4.17)				(-3.41)			
$Ln(S\ score)_t)$		-0.250				-0.808				-1.829***		
		(-0.49)				(-1.24)				(-3.00)		
$Ln(G\ score)_t$			0.240				0.515				0.274	
			(0.49)				(0.90)				(0.53)	
$Ln(ESG\ score)_t$				-0.627				-0.992				-1.508**
				(-1.08)				(-1.38)				(-2.42)
$Institutional\ Ownership_t$	-7.463***	-7.528***	-7.743***	-7.387***	-10.621***	-10.467***	-11.019***	-10.396***	-10.179***	-9.562***	-10.269***	-9.624***
	(-3.22)	(-3.33)	(-3.25)	(-3.20)	(-3.41)	(-3.47)	(-3.45)	(-3.37)	(-3.41)	(-3.33)	(-3.34)	(-3.27)
$Excess\ Return_t$	-0.016**	-0.016**	-0.016**	-0.017**	-0.025**	-0.025**	-0.024***	-0.025**	-0.018***	-0.018***	-0.017***	-0.018***
	(-2.42)	(-2.42)	(-2.42)	(-2.42)	(-2.55)	(-2.57)	(-2.59)	(-2.57)	(-3.56)	(-3.51)	(-3.59)	(-3.54)
Constant	14.753***	12.501***	10.781***	13.825***	18.020***	16.850***	12.204***	17.495***	16.375***	19.992***	12.532***	18.826***
	(7.17)	(4.56)	(5.35)	(5.28)	(6.75)	(4.64)	(5.14)	(5.26)	(6.19)	(5.58)	(6.02)	(6.03)
Industry Fixed Effect	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Quarter Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Industry x Year Fixed Effect	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes
Clustering Level	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Number of Observations	20,316	20,596	20,597	20,597	15,635	15,882	15,883	15,883	15,631	15,879	15,880	15,880
R^2	0.004	0.003	0.003	0.003	0.011	0.010	0.010	0.010	0.279	0.279	0.278	0.278

Table 11: ESG and institutional ownership effects and past return on returns

Estimation of the equation $R^e_{i,t+1} = \beta_0 + \beta IO_{lt} + \gamma' \operatorname{Ln}(\text{Score}_{i,t}) + \theta' R^e_{i,t} + \varepsilon_{i,t}$ without fixed effects, with only industry fixed effects, and with both industry and time fixed effects, where $\text{Score}_{i,t}$ can either be the for Environmental score (E $\text{Score}_{i,t}$), the Social score (S $\text{Score}_{i,t}$), the Governance score (G $\text{Score}_{i,t}$), or the overall ESG score (ESG $\text{Score}_{i,t}$).

1. Environmental score → stock returns

	Coefficient	std. err.	z	$P > \lvert z \rvert$	[95% confidence interval]	
Direct effect	-0.97311	0.240063	-4.05	0	-1.44362	-0.50259
Indirect effect (through institutional ownership)	-0.10153	0.049206	-2.06	0.039	-0.19797	-0.00509
Total effect	-1.07463	0.238074	-4.51	0	-1.54125	-0.60802

2. Social score → stock returns

	Coefficient	std. err.	z	$P > \lvert z \rvert$	[95% confidence interval]	
Direct effect	-0.25047	0.510804	-0.49	0.624	-1.25163	0.750687
Indirect effect (through institutional ownership)	-0.40044	0.144199	-2.78	0.005	-0.68307	-0.11782
Total effect	-0.65091	0.525572	-1.24	0.216	-1.68102	0.379187

3. Governance score → stock returns

	Coefficient	std. err.	z	$P > \lvert z \rvert$	[95% confidence interval]	
Direct effect	0.240294	0.489696	0.49	0.624	-0.71949	1.200081
Indirect effect (through institutional ownership)	-0.57484	0.189481	-3.03	0.002	-0.94621	-0.20346
Total effect	-0.33454	0.423684	-0.79	0.43	-1.16495	0.495861

4. ESG score → stock returns

	Coefficient	std. err.	z	$P > \lvert z \rvert$	[95% confidence interval]	
Direct effect	-0.6274	0.582887	-1.08	0.282	-1.76984	0.515037
Indirect effect (through institutional ownership)	-0.53464	0.190309	-2.81	0.005	-0.90764	-0.16164
Total effect	-1.16204	0.554085	-2.1	0.036	-2.24803	-0.07606

Table 12: Direct and indirect effect of ESG on returns (with past returns), bootstrap confidence intervals, no fixed effects. Estimation of the equation $R^e_{i,t+1} = \beta_0 + \beta IO_{i,t} + \gamma' \operatorname{Ln}(\text{Score}_{i,t}) + \theta' R^e_{i,t} + \varepsilon_{i,t}$ without fixed effects, where $\text{Score}_{i,t}$ can either be the for Environmental score (E $\text{Score}_{i,t}$), the Social score (S $\text{Score}_{i,t}$), the Governance score (G $\text{Score}_{i,t}$), or the overall ESG score (ESG $\text{Score}_{i,t}$).

1. Environmental score → stock returns

	Coefficient	std. err.	z	$P > \lvert z \rvert$	[95% confidence interval]	
Direct effect	-1.23053	0.294822	-4.17	0	-1.80837	-0.65269
Indirect effect (through institutional ownership)	-0.1255	0.066873	-1.88	0.061	-0.25657	0.005566
Total effect	-1.35604	0.29564	-4.59	0	-1.93548	-0.77659

2. Social score → stock returns

	Coefficient	std. err.	z	$P > \lvert z \rvert$	[95% confidence interval]	
Direct effect	-0.80829	0.652088	-1.24	0.215	-2.08636	0.469775
Indirect effect (through institutional ownership)	-0.55854	0.20312	-2.75	0.006	-0.95665	-0.16043
Total effect	-1.36683	0.696592	-1.96	0.05	-2.73213	-0.00154

3. Governance score →stock returns

	Coefficient	std. err.	z	$P > \lvert z \rvert$	[95% confidence interval]	
Direct effect	0.514994	0.570611	0.9	0.367	-0.60338	1.63337
Indirect effect (through institutional ownership)	-0.82647	0.26414	-3.13	0.002	-1.34418	-0.30877
Total effect	-0.31148	0.472348	-0.66	0.51	-1.23726	0.614309

4. ESG score →stock returns

	Coefficient	std. err.	z	$P > \lvert z \rvert$	[95% confidence interval]	
Direct effect	-0.99167	0.719872	-1.38	0.168	-2.4026	0.419252
Indirect effect (through institutional ownership)	-0.75389	0.266473	-2.83	0.005	-1.27617	-0.23162
Total effect	-1.74557	0.69396	-2.52	0.012	-3.1057	-0.38543

Table 13: Direct and indirect effect of ESG on returns (with past returns), bootstrap confidence intervals, industry fixed effects. Estimation of the equation $R^e_{i,t+1} = \beta_0 + \beta IO_{i,t} + \gamma' \operatorname{Ln}(\text{Score}_{i,t}) + \theta' R^e_{i,t} + \varepsilon_{i,t}$ without fixed effects, where $\text{Score}_{i,t}$ can either be the for Environmental score (E $\text{Score}_{i,t}$), the Social score (S $\text{Score}_{i,t}$), the Governance score (G $\text{Score}_{i,t}$), or the overall ESG score (ESG $\text{Score}_{i,t}$).

1. Environmental score → stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence interval]	
Direct effect	-0.85155	0.248302	-3.43	0.001	-1.33821	-0.36489
Indirect effect (through institutional ownership)	-0.13004	0.064684	-2.01	0.044	-0.25682	-0.00326
Total effect	-0.98159	0.255988	-3.83	0	-1.48332	-0.47986

2. Social score → stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence interval]	
Direct effect	-1.82917	0.607743	-3.01	0.003	-3.02032	-0.63802
Indirect effect (through institutional ownership)	-0.46513	0.178785	-2.6	0.009	-0.81554	-0.11472
Total effect	-2.2943	0.665463	-3.45	0.001	-3.59858	-0.99001

3. Governance score → stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence interval]	
Direct effect	0.273532	0.512362	0.53	0.593	-0.73068	1.277744
Indirect effect (through institutional ownership)	-0.76313	0.24779	-3.08	0.002	-1.24879	-0.27748
Total effect	-0.4896	0.40511	-1.21	0.227	-1.2836	0.3044

4. ESG score → stock returns

	Coefficient	std. err.	z	$P > \|z\|$	[95% confidence interval]	
Direct effect	-1.50785	0.620711	-2.43	0.015	-2.72442	-0.29128
Indirect effect (through institutional ownership)	-0.65999	0.238086	-2.77	0.006	-1.12663	-0.19336
Total effect	-2.16785	0.616555	-3.52	0	-3.37627	-0.95942

Table 14: Direct and indirect effect of ESG on returns (with past returns), bootstrap confidence intervals, fixed effects. Estimation of the equation $R^e_{i,t+1} = \beta_0 + \beta IO_{i,t} + \gamma' \operatorname{Ln}(\text{Score}_{i,t}) + \theta' R^e_{i,t} + \varepsilon_{i,t}$ without fixed effects, where $\text{Score}_{i,t}$ can either be the for Environmental score (E $\text{Score}_{i,t}$), the Social score (S $\text{Score}_{i,t}$), the Governance score (G $\text{Score}_{i,t}$), or the overall ESG score (ESG $\text{Score}_{i,t}$).

A.4 Robustness check: portfolio results

A.4.1 Best-worst for all firms

	E	S	G	ESG
Panel A: Equal-weighted returns				
Average excess return	-4.179	-2.965	-2.979	-4.026
	(-1.56)	(-1.11)	(-1.16)	(-1.35)
CAPM alpha	-3.822	-2.776	-3.274	-3.706
	(-1.40)	(-1.02)	(-1.26)	(-1.23)
Three-factor (FF) alpha	-4.234	-3.230	-4.130	-4.549
	(-1.53)	(-1.17)	(-1.64)	(-1.53)
Five-factor (FF) alpha	-3.366	-2.925	-4.348*	-3.911
	(-1.23)	(-1.03)	(-1.71)	(-1.32)
Six-factor (FF+Mom) alpha	-2.870	-2.440	-4.304	-3.511
	(-1.12)	(-0.91)	(-1.68)	(-1.21)
Panel B: Value-weighted returns				
Average excess return	-6.410	-1.423	-3.495	-5.355
	(-1.60)	(-0.37)	(-1.03)	(-1.64)
CAPM alpha	-6.551	-2.191	-3.980	-6.037*
	(-1.60)	(-0.56)	(-1.15)	(-1.84)
Three-factor (FF) alpha	-6.789	-2.361	-4.808	-6.450*
	(-1.61)	(-0.59)	(-1.41)	(-1.93)
Five-factor (FF) alpha	-5.773	-2.061	-5.006	-6.052*
	(-1.37)	(-0.50)	(-1.46)	(-1.80)
Six-factor (FF+Mom) alpha	-5.006	-1.629	-4.838	-5.501*
	(-1.26)	(-0.40)	(-1.40)	(-1.71)

Table 15: Do ESG-scores predict returns?(Best-worst for all firms)

This table reports the performance of high-ESG minus low-ESG portfolios. For each quarter, we sort stocks into portfolios based on quintiles of their Refinitiv ESG scores. We then compute the return over the following quarter of the quintile with the best ESG scores minus that with the lowest scores. Stocks are equal weighted in Panel A and value weighted in Panel B. We report the portfolios' excess return, one-factor capital asset pricing model (CAPM) alpha, three-factor alpha that also controls for the Fama-French (FF) factors related to size and value, five-factor alpha that further controls for the FF factors related to profitability and investment, and six-factor alpha that also controls for momentum (Mom), annualized and in percentages. t-statistics are reported in parentheses.

A.4.2 Best-worst by industry

	E	S	G	ESG
Panel A: Equal-weighted returns				
Average excess return	-4.276*	-4.368	-2.431	-5.545*
	(-1.77)	(-1.64)	(-1.11)	(-1.90)
CAPM alpha	-4.150*	-4.432	-2.951	-5.824*
	(-1.68)	(-1.63)	(-1.36)	(-1.96)
Three-factor (FF) alpha	-4.451*	-4.824*	-3.483	-6.557**
	(-1.76)	(-1.75)	(-1.64)	(-2.22)
Five-factor (FF) alpha	-3.732	-4.529	-3.725*	-6.189**
	(-1.49)	(-1.60)	(-1.73)	(-2.05)
Six-factor (FF+Mom) alpha	-3.455	-4.128	-3.589	-5.744*
	(-1.40)	(-1.50)	(-1.66)	(-1.97)
Panel B: Value-weighted returns				
Average excess return	-7.109*	-3.951	-2.978	-6.885*
	(-1.73)	(-1.03)	(-0.92)	(-1.70)
CAPM alpha	-7.580*	-4.906	-3.975	-7.970*
	(-1.81)	(-1.29)	(-1.25)	(-1.98)
Three-factor (FF) alpha	-7.584*	-5.059	-4.857	-8.145*
	(-1.76)	(-1.29)	(-1.56)	(-1.97)
Five-factor (FF) alpha	-6.408	-4.587	-4.982	-7.612*
	(-1.50)	(-1.14)	(-1.59)	(-1.80)
Six-factor (FF+Mom) alpha	-5.814	-4.36	-4.869	-7.106*
	(-1.40)	(-1.08)	(-1.54)	(-1.71)

Table 16: Do ESG-scores per industry predict returns?(Best-worst by industry)

This table reports the performance of high-ESG minus low-ESG portfolios. For each quarter and each industry, we sort stocks into portfolios based on quintiles of their Refinitiv ESG scores. We then compute the return over the following quarter of the quintile with the best ESG scores minus that with the lowest scores. Stocks are equal weighted in Panel A and value weighted in Panel B. We report the portfolios' excess return, one-factor capital asset pricing model (CAPM) alpha, three-factor alpha that also controls for the Fama-French (FF) factors related to size and value, five-factor alpha that further controls for the FF factors related to profitability and investment, and six-factor alpha that also controls for momentum (Mom), annualized and in percentages. t-statistics are reported in parentheses.

A.5 Graphs

Figure 2: Evolution of the average E, S, G, and overall ESG scores over time.

This figure shows average E, S, G, and overall ESG scores by year. Data are from the Refinitiv database and obtained for years between 2003 and 2020 (x-axis). Average overall ESG scores are between 40 and 70 (y-axis). As time trends are influenced by sample composition, we plot the evolution of average social scores on a constant panel of firms for which all scores are available in all years between 2003 and 2020, and institutional ownership is available in all quarters between January 2003 and December 2020. The constant panel is composed of 81 firms.

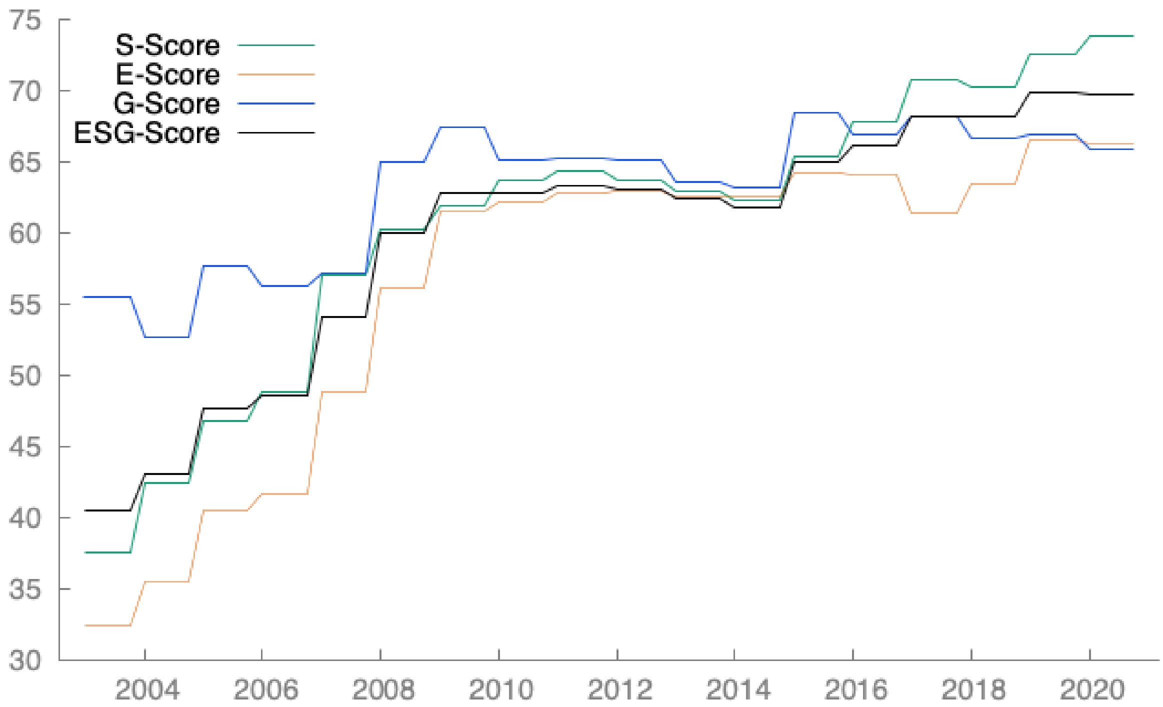

Figure 3: Average Institutional Ownership Over Time

This figure shows average institutional ownership by quarter. Data are from the 13F database and are obtained for the quarters between January 2003 and December 2020 (x-axis). Average institutional ownership is between 0.55 and 0.85 (y-axis). As time trends are influenced by sample composition, we plot the evolution of average social scores on a constant panel of firms for which all scores are available in all years between 2003 and 2020, and institutional ownership is available in all quarters between January 2003 and December 2020. The constant panel is composed of 81 firms.