Sustainable Investing Under Delegated Investment Management*

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Abstract

This paper examines how profit-motivated fund managers of sustainable funds with divestment strategies and passive funds choose their level of engagement with portfolio firms to enhance profitability and mitigate any negative externalities, particularly when aiming to attract capital from socially responsible investors. Considering the fund ownership effect resulting from investor capital allocation, we derive several novel implications regarding the effects of growing interest in environmental, social, and governance (ESG) investments, the diminishing impact of shareholder ESG engagement on firms with high-ESG scores, and the increasing proportion of ESG-indexed funds within sustainable funds on the ESG and financial performances generated by portfolio firms.

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1. Introduction

In recent decades, there has been a growing preference for environmental, social, and governance (ESG) investments among investors, who seek nonpecuniary as well as pecuniary benefits from these investments. Consequently, there has been a rapid expansion in sustainable investment.[1] However, a significant portion of sustainable investments is made by institutional investment funds, such as sustainable funds, which are often managed by asset managers who may prioritize their own pecuniary gains. Therefore, it is crucial to motivate fund managers to actively engage in managing their portfolio firms, aiming not only to enhance pecuniary returns but also to improve ESG performance. One dominant investing strategy among these funds is to buy only the stocks of firms with high-ESG performance. We refer to a fund that pursues this strategy as a D-fund, which comprises active sustainable funds and ESG-indexed funds.[2] However, some scholars (e.g., Hartzmark and Shue, 2022) argue that a sustainable investing strategy that directs capital away from firms with low-ESG performance toward firms with high-ESG performance may be counterproductive because this strategy may lead the former firms to lower their ESG performance without incentivizing the high-ESG firms to raise theirs.

In recent years, fund markets have been characterized by the significant presence of passive funds (P-funds).[3] P-fund managers create market portfolios aligned with an index and hence are considered to have little or no governance role in their portfolio firms. Many practitioners and scholars suggest that P-funds present a considerable problem to ESG activists because the efforts of ESG activists to convince investors to avoid stocks with low-ESG characteristics are undermined by the presence of P-funds.[4] However, there is mixed empirical evidence on the governance role of P-funds.[5] Furthermore, recently, P-

[1] According to Alyssa Stankiewicz (Sustainable Fund Flows Reach New Heights in 2021's First Quarter, Morningstar, April 30, 2021, https://www.morningstar.com/articles/1035554/sustainable-fund-flows-reach-new-hights-in-2021s-first-quarter), as of March 21, 2021, assets in US sustainable funds totaled nearly $266 billion, which represents a 12% increase over the previous quarter and a 125% increase year over the year.

[2] Recently, BlackRock and other exchange traded fund providers have offered many ESG-indexed funds.

[3] The fraction of P-funds grew to just under 40% of the US fund market at the end of 2019 (Investment Company Institute 2020 Factbook).

[4] For example, see Billy Nauman (How Passive Investment Dulls the Green Wave, Financial Times, February 7, 2022, https://www.ft.com/content/ abd2a946-48d5-11ea-aee2-9ddbdc86190d). This problem is also related to the passive funds' incentive problem of underinvestment in stewardship (see Bebchuk and Hirst, 2019). In this context, note that ESG-indexed funds are excluded from the definition of P-funds.

[5] See the literature cited in Corum, Malenko, and Malenko (pages 2–3, 2021). Indeed, Fichner,

funds have begun to exert their own ESG engagement efforts (see Chu, 2021). Thus, the governance role of the P-fund managers is becoming increasingly important.

Given the divestment and engagement strategies of D-funds and the engagement strategies of P-funds, investors make capital allocation decisions among assets, thereby influencing the fund ownership stakes of each firm. These ownership stakes impact on the engagement strategies of fund managers within firms. Such engagement strategies encompass two aspects of fund manager engagement: first, managing their portfolio to improve ESG performance (i.e., reducing any negative externalities), and second, improving pecuniary returns. In this study, we refer to efforts to mitigate the negative externalities of portfolio firms and efforts to increase their pecuniary returns as the fund manager's engagement efforts. These efforts may be cost complementary (substitutable), which indicates the degree to which increased engagement efforts to enhance ESG performance reduce (increase) the cost of engagement efforts to improve profit. In particular, in D-funds, the degree of cost complementarity may depend on the proportion of ESG-indexed funds within D-funds, as discussed in Section 5.

In this context, this paper explores the governance role of profit-motivated managers of D- and P-funds when they aim to attract capital from investors with ESG preferences. We address the following questions. First, how does growing interest in ESG affect the negative externalities and pecuniary returns of various types of firms when D- and P-funds are present in the fund market? Does growing interest in ESG truly have a counterproductive effect on negative externalities and pecuniary returns when D- and P-funds are present? Second, how does the decreasing impact of fund managers' engagement efforts regarding ESG in firms with high-ESG performance affect the negative externalities and pecuniary returns of various types of firms when D- and P-funds are present in the market? Finally, we examine how the cost complementarity in fund managers' efforts between improving profit and ESG performances affects the negative externalities and pecuniary returns of various types of firms when D- and P-funds exist.

To the best of our understanding, this paper is the first theoretical study to examine how

Heemskerk, and Garcia-Bernardo (2017) find that the top three passive index fund companies in the US, which are large stakeholders in most of the Standard & Poor's (S&P) 500 firms—BlackRock, Vanguard, and State Street—use coordinated voting strategies and influence the management of their invested companies through private engagements. McCahery, Sautner, and Starks (2016) report that large institutional investors with a long time horizon and low concerns about stock liquidity intervene more intensively with management through private engagements.

fund managers' engagement efforts toward their portfolio firms affect negative externalities and pecuniary returns across different types of firms, while considering the divestment and engagement strategies of D-funds and the engagement strategies of P-funds. This analysis responds to growing interest in ESG, the decreasing impact of shareholder ESG engagement on firms with high-ESG performance, and the cost complementarity of fund managers' efforts.

To address these questions, we build an asset management market model in which ESG-conscious fund investors allocate their wealth between a D-fund, a P-fund, and outside investment opportunities, such as public bonds. These fund investors can invest their wealth in firms only via funds.[6] However, these funds are managed by for-profit fund managers who may not favor ESG investments. If fund investors decide to invest in a D-fund, P-fund, or both funds, they must search for these funds, which incurs a search cost. After matching, fund investors and the fund manager bargain over the asset management fee. Then, the fund manager invests in firms that differ in the sustainability of their activities; the D-fund buys only the stocks of firms with high-ESG performance and the P-fund invests all of its money in a value-weighted market portfolio.[7] After investing, each fund manager chooses his costly level of ownership engagement effort to mitigate the negative externalities and to increase the profits of his portfolio firms.

Our first main results are as follows. When investors' ESG preferences are strengthening, the following results are obtained. (i) If the D-fund managers have a comparative cost advantage over the P-fund managers in improving firms' *profit* performance over improving their *ESG* performance, the expected negative externality decreases for the high-ESG firms (hereafter referred to as G-firms) and all the firms in the market portfolio; otherwise, under particular conditions, the expected negative externality may increase for these firms. (ii) Growing interest in ESG always reduces the expected negative externality but raises the expected profit for the low-ESG firms (hereafter, B-firms).

The intuition behind these results is decomposed into two parts, namely the direct effect and the fund ownership effect. As the effort cost parameters are fixed, the fund managers' incentives to exert ESG effort are determined by their expected marginal return

[6] We also consider liquidity investors, who directly invest in firms for various reasons but do not engage in the governance of the firms.

[7] In Appendix B.2, we introduce a non-sustainable fund that buys only the stocks of firms with low-ESG performance. Under certain conditions, our main results are unaffected.

from such ESG effort. Thus, when investors' ESG preferences are strong, this directly raises the fund managers' expected marginal return from ESG effort. However, the fund ownership effect, which occurs through a change in the fund ownership stake, is more complicated because it involves investors' capital allocation among assets.

Indeed, if investors' preferences for ESG strengthen, they may allocate less of their wealth to the D-fund, even though they allocate more wealth to the P-fund. This possibility arises because the expected negative externality released by G-firms is smaller than that released by B-firms. Then, the fund ownership effect arising from the reduction of the D-fund's ownership weakens the D-fund manager's level of engagement effort. However, if the D-fund managers have a comparative cost advantage in improving firms' *profit* performance over their *ESG* performance compared with the P-fund managers, the fund ownership effect from the reduction of ownership by the D-fund is dominated by that from the rise of ownership by the P-fund. Then, the expected negative externality decreases for both G-firms and market portfolio firms.

By contrast, if, compared with the P-fund managers, the D-fund managers have a comparative cost advantage in improving firms' *ESG* performance over their *profit* performance, the fund ownership effect from the reduction of ownership by the D-fund may dominate the remaining effects, including the direct effect, in a particular situation. Then, the expected negative externality may increase for G-firms and/or market portfolio firms. However, for B-firms, the fund ownership effect works only through a rise of ownership by the P-fund and a decline of ownership by liquidity investors. Consequently, growing interest in ESG always reduces the expected negative externality but raises the expected profit because the liquidity investors do not make engagement efforts.

Our second main result examines the result of a decrease in shareholder ESG engagement in G-firms relative to that in B-firms. The decreasing impact of shareholder ESG engagement on G-firms increases both the expected negative externality and the expected profit for G-firms and market portfolio firms, but does not affect the expected negative externality or the expected profit for B-firms.

Intuitively, such a decreasing impact directly weakens the incentives for ESG effort for both D- and P-fund managers in G-firms, but does not affect this incentive for the P-fund managers in B-firms. Again, we need to consider how the fund managers' effort incentive is impacted by a fund ownership effect occurring through a change in fund

ownership stakes. However, although the fund ownership effect operates in G-firms, the fund investors' expected rate of return can be adjusted in equilibrium so that it does not change in either fund in this case. Furthermore, the decreasing impact of shareholder ESG engagement on G-firms has no effect on the expected negative externality or the expected profit for B-firms because it does not directly affect the P-fund manager's ESG effort in B-firms, and the fund ownership effect does not operate in B-firms either.

Our third main result examines the effect of greater cost complementarity in fund managers' efforts, which refers to the degree to which increased engagement efforts to enhance ESG performance reduce the cost of engagement efforts to improve profit. For both G-firms and market portfolio firms, regardless of whether D- or P-fund managers are considered, the greater cost complementarity in these efforts reduces both the expected negative externality and the expected profit. In addition, for B-firms, the greater cost complementarity in the P-fund managers' efforts reduces both the expected negative externality and the expected profit.

Intuitively, when cost complementarity increases for one fund manager, this directly strengthens his incentives for ESG efforts, but it does not directly affect these incentives for other fund managers. Hence, the opposite arguments regarding the decreasing impact of shareholder ESG engagement on G-firms apply to the greater cost complementarity case for G-firms and market portfolio firms. Furthermore, because the P-fund buys B-firms and the D-fund does not, the B-firms are affected only by the greater cost complementarity of the P-fund manager.

The theoretical implications of our results are as follows. Our first results show that the effect of growing interest in ESG on the expected negative externality in the presence of D- and P-funds depends on the comparative cost advantage between each fund in improving ESG or generating profit. This is attributed to the influence of growing interest in ESG on the fund ownership stakes. Thus, under certain conditions, growing interest in ESG can reduce the expected negative externality across all types of firms in the presence of D- and P-funds. However, if these conditions are not met, growing interest in ESG in the presence of D- and P-funds may not necessarily reduce the expected negative externality for all firms, but will do so only for B-firms. This discrepancy arises because of the fund ownership effect, which differs from the argument of Hartzmark and Shue (2023), which is primarily based on the limited ESG impact on G-firms.

The decreasing impact of shareholder ESG engagement on G-firms has a direct effect on the ESG efforts of both the D- and P-fund managers in G-firms. Because of the possible effect of changes in fund ownership stakes, determining the effects of this decreasing impact is not straightforward. However, we can show that the fund ownership effect works only in G-firms. Hence, as we only need to analyze the interaction between the direct effect and the fund ownership effect in G-firms, we can derive our second result.

Our theoretical results have several empirical implications as a result of imposing restrictions on the model parameters that cause D- and P-funds to have different types of costs and to specialize in different types of engagement. To this end, we define expected financial returns as [the expected profit of the firm] − [the price of the firm]. Next, suppose that improving ESG performance can be achieved to a certain degree by setting broad, market-wide standards for ESG rather than focusing on firm-specific operational improvements, or that most of the D-funds are made up of ESG-indexed funds. Then, as will be discussed in Section 5, the D-fund has a comparative cost advantage compared with the P-fund in improving *profit* performance over *ESG* performance.

Now, under this setup, we suggest the following. First, growing interest in ESG is likely to improve expected ESG performance but decrease expected financial returns in any type of firm if the cost complementarity in the D-fund manager's efforts is not sufficiently large, particularly if most of the D-funds comprise ESG-indexed funds. However, in firms with low-ESG scores, growing interest in ESG always improves expected ESG performance but decreases expected financial returns. In addition, it creates a positive association between ESG scores and the earnings before interest, taxes, depreciation, and amortization (EBITDA) attained by firms with low-ESG scores.

Second, the decreasing impact of shareholder ESG engagement on firms with high-ESG scores reduces expected ESG performance but improves expected financial returns in firms with high-ESG scores and all the firms in the market portfolio. Furthermore, it causes a negative association between ESG scores and the EBITDA attained by firms with high-ESG scores and all the firms in the market portfolio.

Third, as sustainable active funds are more inclined to focus on firm-specific operational engagements compared with ESG-indexed funds, there is greater cost complementarity between the efforts of fund managers in sustainable active funds than is the case for ESG-indexed funds. Thus, the higher proportion of ESG-indexed funds in D-funds worsens

expected ESG performance but improves expected financial returns in firms with high-ESG scores and all the firms in the market portfolio. It also causes a negative association between ESG scores and the EBITDA attained by firms with high-ESG scores and by all the firms in the market portfolio. Furthermore, the higher cost complementarity between the engagement efforts of firm-specific operational involvements and the establishment of broad, market-wide standards for ESG improves expected ESG performance but reduces expected financial returns in any type of firm. It also causes a negative association between ESG scores and the EBITDA attained by any type of firm.

The remainder of the paper is organized as follows. Section 2 reviews the related literature, and Section 3 presents the basic model. Sections 4.1 and 4.2 examine fund managers' efforts and trading decisions, taking asset management fees and investment decisions by fund investors as given. Section 4.3 derives the asset management fees and the investment allocation decisions by fund investors. Section 4.4 characterizes the equilibrium and Section 4.5 discusses the comparative static results. Section 5 considers the empirical implications of our main results. The final section concludes the paper. Appendix A provides the proofs of all propositions. Appendix B discusses the robustness of our main results in the case of multiple D- and P-funds and in the presence of non-sustainable funds, and provides additional comparative static results regarding P-fund growth.

2. Related Literature

The analysis in this paper is related to the delegated asset management literature on the interaction between active and passive funds in general equilibrium (Gârleanu and Pedersen, 2018, and Corum, Malenko, and Malenko, 2021). In particular, by extending the model of Gârleanu and Pedersen (2018) with shareholder engagement, Corum, Malenko, and Malenko (2021) mainly examine how the fund managers' governance incentives to improve the expected profit of their portfolio firms are affected by passive fund growth evidenced by a decrease in fund investors' search costs for the P-fund.[8] By contrast, based on the model of Corum, Malenko, and Malenko (2021), we consider multiple task-setting by D- and P-fund managers who make engagement decisions to improve not only the

[8]Kakhbod, Loginova, Malenko, and Malenko (2023) discuss the effect of shareholder engagement; that is, shareholders communicating their views to management, under growing ownership by passively managed funds. However, they do not consider the agency relationship between fund investors and fund managers.

expected profit but also the social performance (i.e., impact) of their portfolio firms when investors have an ESG preference.

Our model is related to theoretical studies of sustainable investing and provides implications for the existence of socially responsible investors. Pástor, Stambaugh, and Taylor (2021b) derive an ESG factor in an equilibrium asset-pricing model when investors have an ESG preference. They show that sustainable investing brings about a positive social impact by making firms greener and by shifting real investment toward green firms. Goldstein, Kopytov, Shen, and Xiang (2022) develop a model with socially responsible and traditional for-profit investors, and suggest that an increase in the fraction of socially responsible investors and an improvement in the ESG information quality can reduce price informativeness about the financial payoff and raise the financial returns for investors.

Under the interaction between socially responsible investors and traditional for-profit investors when firms are subject to financing constraints, several papers consider the effect of socially responsible investors providing more capital to sustainable investment. Chowdhry, Davies, and Waters (2019) indicate that socially responsible investors must hold financial claims to counterbalance project owners' tendencies to overemphasize profits, if project owners cannot commit to social objectives when they finance capital from profit-motivated investors alone. Green and Roth (2021) examine the situation in which socially responsible and commercial investors compete to finance for-profit entrepreneurs, and characterize alternative strategies for socially responsible investors that result in higher social welfare and higher financial returns. Oehmke and Opp (2023) identify optimal investment choices for socially responsible investors who bargain with the entrepreneur with ESG preferences, and show that socially responsible and for-profit financial investors are complementary. Using the model in which entrepreneurs search for capital, Landier and Lovo (2022) indicate that a firm's incentive to reduce negative externalities increases with the size of socially responsible capital.

Heinkel, Kraus, and Zechner (2001) and Edmans, Levit, and Schneemeier (2022) derive conditions concerning whether holding stocks of a "brown" firm taking a corrective action dominates divestment of stocks of "brown" firms. Broccardo, Hart, and Zingales (2022) find that engagement (i.e., through voting rights) is more effective than divesting stocks to make firms internalize negative externalities. Inderst and Opp (2022) investigate a situation in which the social planner sets a minimum susceptibility standard that all

investment and production must satisfy, and ask whether such labeling is socially optimal. Hartzmark and Shue (2022) discuss that the current sustainable investment strategy mainly rewards green firms for trivial reductions in their already low levels of emissions.

Our paper is the first in the literature to explore how the expected negative externality and expected profits of firms vary in the presence of sustainable funds with divestment strategies and passive funds, considering (i) investors' ESG preferences, (ii) the relative impact of shareholder ESG engagement in high-ESG firms compared with low-ESG firms, and (iii) the cost complementarity between fund managers' efforts. In particular, we examine these issues in the case where profit-motivated fund managers encounter a multitask agency scenario, wherein they apply engagement efforts to improve ESG and profit levels for socially responsible investors. Although the direct effects of the key parameters in these problems are crucial, a significant aspect of our study is that, in contrast with the literature, we examine the interaction between fund investors reallocating investments across assets and fund managers reallocating engagement efforts across tasks in the presence of D- and P-funds. This interaction may result in the failure of growing interest in ESG to effectively contribute to improving expected ESG performance.

3. The Basic Model

3.1. Firms, fund managers, and investors.—

The model considers a single period, from time 0 to time 1, in which there are three types of agents: fund managers, who invest in firms on behalf of fund investors but are purely interested in their monetary payoffs; fund investors, who indirectly invest in firms through the fund managers and consider both firm profit and ESG performances; and liquidity investors, who directly invest in firms for various reasons, and consider both firm profit and ESG performances. Fund investors can be interpreted as aggregations of both socially responsible and non-socially responsible investors. In Appendix B.2, we extend the basic model by incorporating non-socially responsible investors, who do not care about ESG performance. All agents are risk neutral.

There is a mass one of firms with observable high-ESG performance (which we refer to as G-firms), and a mass one of firms with observable low-ESG performance (B-firms). G-firms generate lower negative externalities (e.g., they are cleaner and pollute the en-

vironment less) than B-firms. We index G-firms (B-firms) by $G_j \in [0, 1]$ ($B_j \in [0, 1]$). Each firm's stock is in unit supply because the initial owners of the firm have sufficiently low valuations such that they are willing to sell their shares regardless of the price.

The observable profit of firm G_j is represented by

$$\widetilde{R}_{G_j} \equiv R_{G_j} + \epsilon_{RG_j} = R_0 + \sum_{i \in \Upsilon_{G_j}} e_{iG_j} + \epsilon_{RG_j}, \tag{1}$$

where R_0 is the base profit without shareholder engagement, e_{iG_j} is the amount of unobservable effort exerted by shareholder i to improve the profit of firm G_j, Υ_{G_j} is the set of shareholders of firm G_j, and ϵ_{RG_j} is unobservable noise that has a mean of zero.[9] Similarly, the observable profit of firm B_j is

$$\widetilde{R}_{B_j} \equiv R_{B_j} + \epsilon_{BG_j} = R_0 + \sum_{i \in \Upsilon_{B_j}} e_{iB_j} + \epsilon_{RB_j}, \tag{2}$$

where e_{iB_j} is the amount of unobservable effort exerted by shareholder i to improve the profit of firm B_j, Υ_{B_j} is the set of shareholders of firm B_j, and ϵ_{RB_j} is the unobservable noise that has mean zero. For simplicity, note that the base profit is the same for both G- and B-firms.

The observable negative externality released by firm G_j is given by

$$\widetilde{Z}_{G_j} \equiv Z_{G_j} + \epsilon_{ZG_j} = Z_{G0} - \lambda \sum_{i \in \Upsilon_{G_j}} a_{iG_j} + \epsilon_{ZG_j}, \tag{3}$$

where Z_{G0} is the negative externality of G-firms without shareholder engagement, $\lambda \geq 0$ is a constant parameter, a_{iG_j} is the amount of unobservable effort exerted by shareholder i to improve the ESG performance of firm G_j, and ϵ_{ZG_j} is the unobservable noise that has mean zero. Similarly, the observable negative externality released by firm B_j is

$$\widetilde{Z}_{B_j} \equiv Z_{B_j} + \epsilon_{ZB_j} = Z_{B0} - \sum_{i \in \Upsilon_{G_j}} a_{iB_j} + \epsilon_{ZB_j}, \tag{4}$$

where Z_{B0} is the negative externality of B-firms without shareholder engagement, a_{iB_j} is

[9] The noise terms ϵ_{RG_j} and ϵ_{RB_j} (ϵ_{ZG_j} and ϵ_{ZB_j}) prevent fund investors from stipulating the efforts for their fund managers directly by observing R_{G_j} and R_{B_j} (Z_{G_j} and Z_{B_j}).

the amount of unobservable effort exerted by shareholder i to improve the ESG performance of firm B_j, and ϵ_{ZB_j} is the unobservable noise that has mean zero. Comparing (3) and (4), note that the effect of each shareholder on improving the ESG performance is more (or less) effective in B-firms than in G-firms if $0 \leq \lambda < 1$ (or $1 < \lambda$).

It follows from (3) and (4) that in response to an increase in the effort of each shareholder, there is a marginal improvement in the ESG performance of G-firms that is smaller than that of B-firms if $0 \leq \lambda < 1$. The scenario where $0 \leq \lambda < 1$ reflects the observation that the shareholder effort would be more valuable for firms that lag behind in terms of ESG; that is, for B-firms (for empirical evidence, see Hartzmark and Shue, 2023).

We assume that ϵ_{RG_j}, ϵ_{RB_j}, ϵ_{ZG_j}, and ϵ_{ZB_j} are distributed independently. It follows from (1)–(4) that R_{G_j}, R_{B_j}, Z_{G_j}, and Z_{B_j} are the expected values of $\widetilde{R}_{G_j}$, $\widetilde{R}_{B_j}$, $\widetilde{Z}_{G_j}$, and $\widetilde{Z}_{B_j}$, respectively. As G-firms have better ESG performance than B-firms, we focus on the case of $Z_{G_j} < Z_{B_j}$, which implicitly assumes that Z_{B0} is sufficiently larger than Z_{G0}. In the subsequent analysis, we focus on the case of $(Z_{G_j}, Z_{B_j}) > 0$.

We assume that the stocks of firms can be accessed by fund investors only through two fund types: namely, D-funds and P-funds. For simplicity, there is one fund manager of each type of fund, although we can easily extend to any number of D-funds and P-funds, N_D and N_P.[10] The D-fund is restricted to holding stocks of firms with high-ESG performance, whereas the P-fund is restricted to holding a value-weighted portfolio of all stocks according to a mechanical rule. In our framework, the D-fund can be taken as either sustainable active funds or ESG-indexed funds. On the other hand, the P-fund can be interpreted as index funds excluding ESG-indexed funds. In Appendix B.2, we consider a non-sustainable fund (N-fund) that only invests in stocks of firms with low-ESG performance. The fund manager of each fund offers to invest the wealth of fund investors in stocks of firms in exchange for an asset management fee.

The fund manager of type $i \in (D, P)$ chooses the amount of unobservable efforts (e_{ih_j}, a_{ih_j}) to improve the profit and ESG performance of his portfolio firms h_j at time 0, where $h \in (G, B)$. If he exerts an effort regarding the firm profit e_{ih_j} and an effort regarding ESG performance a_{ih_j}, he incurs a private cost $c_{Ri}(e_{ih_j}) + c_{Ci}(a_{ih_j})$ for $i \in$

[10] Although we extend our model to the case of multiple D- and P-funds, the only things that matter for fund managers' engagements with portfolio firms are the combined holdings of all D-funds and those of all P-funds. The individual fund's ownership stakes do not matter; therefore, our results continue to hold. See Appendix B.1 for further details.

(D, P) and $h \in (G, B)$ to improve profit performance, whereas he incurs a private cost $c_{Zi}(a_{ih_j})$ for $i \in (D, P)$ and $h \in (G, B)$ to improve ESG performance. We assume that $c_{ki}(0) = 0$, $c'_{ki}(\cdot) > 0$, $c''_{ki}(\cdot) > 0$, $c'_{ki}(0) = 0$, and $c'_{ki}(\infty) = \infty$ for $k \in (R, Z)$ and $i \in (D, P)$; and $c_{Ci}(0) = 0$, $c''_{Ci}(\cdot) > 0$, $c'_{Ci}(0) = 0$, and $c'_{Ci}(\infty) = \infty$ for $i \in (D, P)$. These standard assumptions ensure an interior solution to (e_{ih_j}, a_{ih_j}) for $i \in (D, P)$ and $h \in (G, B)$. In addition, $c'_{Ci}(\cdot) < 0$ ($c'_{Ci}(\cdot) > 0$) implies that for each type of fund manager, improving the profit performance of his portfolio firms h_j is cost complementary (substitutable) to improving the ESG performance of his portfolio firm h_j.

The effort e_{ih_j} (a_{ih_j}) exerted by the fund manager i for $i \in (D, P)$ and $h \in (G, B)$ includes any actions, such as communicating with management, submitting shareholder proposals, nominating directors, and voting on proxy contests. These engagement strategies are more extensively discussed in Section 5. Although large passive and index funds charge substantially smaller management fees than actively managed funds, the large amount of assets under their management and ownership stakes can compensate for their low management fees and strongly incentivize their fund managers to exert managerial effort (see Brav, Malenko, and Malenko, 2022, for a numerical discussion; and Kahn and Rock, 2020, Lewellen and Lewellen, 2022, and Brav, Jiang, and Pinnington, 2024, for empirical evidence regarding financial incentives of P-funds). In particular, recently, fund managers of large passive and index funds have been involved in engagement through voting and communications with management (see the literature review of Section 4.2 in Brav, Malenko, and Malenko, 2022, for the empirical evidence). Hence, greater ownership of passive and index funds has various effects on governance. In the subsequent analysis, we focus on the case of $(e_{DG_j}, a_{DG_j}) > 0$ and $(e_{Ph_j}, a_{Ph_j}) > 0$ for $h \in (G, B)$ and any j. Note that the D-fund does not hold stakes in B-firms.

There is a large mass of homogeneous fund investors, who have a certain amount of wealth to invest, ε.[11] We denote their aggregate wealth by W, which is given exogenously. Although fund investors want to receive more pecuniary investment returns, they also derive disutility from holding stocks of firms generating negative externalities. For simplicity, we assume that the amount of disutility incurred by fund investors per unit of their stock holdings is equal to $\eta \times$ (the negative externality generated by their holding

[11] Fund investors typically include pension funds, sovereign wealth funds, and wealthy retail investors who have invested in family offices in which hedge funds manage their covert operations.

firms per unit of their stock holdings), where η (> 0) is a scalar measuring the degree of investors' "ESG" preference.[12]

At time 0, each fund investor chooses whether to invest in the D-fund and/or the P-fund by delegating her wealth to the fund manager, and whether to invest in an alternative investment opportunity such as public bonds that generates a fixed net return of 0. When each fund investor with wealth ε seeks an D-fund (a P-fund) manager, she must search for and vet fund managers by incurring a search cost $\psi_D\varepsilon$ ($\psi_P\varepsilon$). Fund investors are assumed to be homogeneous; therefore, they incur the same search cost $\psi_D\varepsilon$ ($\psi_P\varepsilon$) when they try to find an D-fund (a P-fund) manager. Thus, the proportional parameter ε can be interpreted as a normalization by adjusting the scale of ψ_D and ψ_P. These costs indicate that most fund investors must spend significant resources to find a fund manager whom they trust with their money, and to examine the funds' investment strategies and fee structures.[13]

After a fund investor finds a fund manager $i \in (D, P)$, they negotiate the fee f_i through generalized Nash bargaining at time 0.[14] The fund manager of the D-fund (P-fund) has bargaining power ω_D (ω_P) $\in$ (0, 1), whereas the fund investor has bargaining power $1 - \omega_D$ ($1- \omega_P$). We assume that the fee charged by the fund manager to the fund investor is a fraction of the sum of the realized values of the profit and the disutility of the negative externality of their portfolio firms, which is assumed to be observable. The pecuniary amount deducted from the fund manager's compensation as a result of the negative externality arises directly from bargaining between the fund manager and the fund investor.[15]

[12]The utility of fund investors depends on the pecuniary returns that they receive and the social value created by firms they have financed through funds. Green and Roth (2021) refer to these investors as value-aligned social investors. The assumption that investors prefer socially responsible performance is supported by empirical studies in the mutual fund literature. For example, see Riedl and Smeets (2017) and Hartzmark and Sussman (2019).

[13]For more information, see Corum, Malenko, and Malenko (2021) and the references listed in footnote 9 in their text. Furthermore, in our model, the positive search costs, $(\psi_D, \psi_P) > 0$, ensure that the fund investors' indifference conditions, (18), can be compatible with the Nash bargaining outcomes, (19) and (20), under the equity pricing rule, (14) and (16).

[14]This assumption is also made in Gârleanu and Pedersen (2018) and Corum, Malenko, and Malenko (2021).

[15]Note that the deduction amount, $f_i \times$ (the disutility of the negative externality), in turn, increases the pecuniary payoff of fund investors, while decreasing the pecuniary payoff of the fund manager. In addition, the fund manager's payoff is positive even though this amount is deducted because we impose the assumption, as discussed below, that the stock price is always positive. Adachi-Sato (2022) clarifies that a profit-oriented agent pursues improvement in ESG performance under the bargaining between a socially and environmentally aware principal and the agent.

However, it may be viewed as the fund manager's reward reduction being tied to ESG criteria and/or the fund manager's reputation loss from the nonaccomplishment of direct contract commitments on ESG goals or from public sentiment that the fund manager may impair improvement in firms' ESG performance. Regardless of which interpretation is chosen, the bargaining provides an incentive for the profit fund manager to improve ESG performance.

Finally, there is a large mass of liquidity investors, who directly invest in firms at time 0 for various reasons, such as liquidity need, hedging demand, firms' issuance, repurchase of shares, or investor sentiment, although they also incur a disutility of amount as $\eta \times$ (the negative externality generated by their holding firms per unit of their holding stocks).[16] Liquidity investors apply rational expectations in predicting the value of each stock. However, their valuation is perturbed by an additional factor that captures the amount of liquidity need, hedging demand, firms' issuance, repurchase of shares, or investor sentiment. As a result, liquidity investors' expectation of the value of the stock of each firm is equal to the sum of the expected values of the profit and the disutility of the negative externality generated by the firm h_j, $R_{h_j} - \eta Z_{h_j}$, minus the additional component, $L_{h_j} > 0$; that is, $R_{h_j} - \eta Z_{h_j} - L_{h_j}$ for $h \in (G, B)$.[17]

3.2. Equilibrium.—

The equilibrium includes the search and investment allocation strategies of fund investors, management fees, each agent's trading strategy, each fund manager's engagement effort strategy, and the market clearing price, as follows.

At the beginning of time 0, fund investors make their search and investment allocation decisions with the aim of maximizing the sum of their expected profit and their expected disutility from negative externalities minus the search cost. After a fund investor finds a fund manager, they negotiate the management fee through generalized Nash bargaining. Then, each fund manager invests the delegated amount of fund investors' wealth in stocks according to the trading strategy of each fund, as described below. First, the D-fund is restricted to holding stocks of firms with high-ESG performance. Specifically, we assume that the D-fund manager invests only in G-firms. Second, the P-fund is restricted to

[16] These traders include insurance companies and retail investors.

[17] All of our results continue to hold even when $L_{G_j} = L_{B_j}$.

holding a value-weighted portfolio of all stocks according to a mechanical rule.

However, liquidity investors trade according to their predictions about the stock price of each firm. Their predictions are made by anticipating the equilibrium effort of fund managers under rational expectations.

After trading, each fund manager selects his effort at time 0 to maximize his expected compensation minus his effort cost by improving the profit and ESG performance of his portfolio firms, given his management fee.

Finally, at time 1, the profit and negative externality generated by each firm is realized. Then, the payoffs of the fund manager and fund investors in each fund are determined according to the management fee.

The stock price of each firm is set to clear the market at time 0. Short sales are ruled out. We restrict our analysis to the case in which liquidity investors hold at least some shares of each type of stock.[18] The assessment of both the D-fund and the P-fund of each stock $h \in (G, B)$ reflects the fund investors' valuation of the stock h, which is higher than that of the liquidity investors; therefore, the market clearing price of stock $h \in (G, B)$ may be determined by the liquidity investors' assessment of stock h.[19]

Figure 1 illustrates the model timing.

4. The Analysis

We solve this model by backward induction. First, we determine the effort decisions of fund managers and examine the trading decisions of liquidity investors and fund managers. Then, we clarify the investment allocation decisions of fund investors and the determination of asset management fees. Finally, the equilibrium is defined as a set of these decisions and market clearing conditions.

We drop the subscript j from each variable in the subsequent discussions because G-firms (B-firms) are all homogeneous and because the D-fund finds it optimal to diversify equally across all G-firms.[20]

4.1. Fund managers' effort decisions.—

[18] Proposition 1 provides a sufficient condition for this to hold.

[19] For an alternative justification, we can assume that the D- and P-funds submit a market order, whereas liquidity investors submit a limit order reflecting their valuation of each stock.

[20] We provide a sufficient condition for this in Proposition 1.

Suppose that the D-fund manager charges the management fee f_D, holds x_{DG} shares, and exerts the efforts (e_{DG}, a_{DG}). Then, the D-fund manager's expected payoff is given by

$$f_D x_{DG}(R_G - \eta Z_G) - c_{RD}(e_{DG}) - c_{CD}(a_{DG}) - c_{ZD}(a_{DG}). \tag{5}$$

Note that the D-fund holds only the stock of the G-firm, and that the sum of the expected profit and the expected disutility from the negative externality of the G-firm is $R_G - \eta Z_G$. As discussed in Section 3.1, note that the fund manager's compensation includes the pecuniary amount deducted as a result of the negative externality.

Next, suppose that the P-fund manager charges the management fee f_P, holds x_{Ph} shares, and exerts the efforts (e_{Ph}, a_{Ph}) for $h \in (G, B)$. Then, the P-fund manager's expected payoff is given by

$$\sum_{h\in(G,B)} \left[f_P x_{Ph}(R_h - \eta Z_h) - c_{RP}(e_{Ph}) - c_{CP}(a_{Ph}) - c_{ZP}(a_{Ph})\right]. \tag{6}$$

Note that the P-fund holds stocks of both the G-firm and the B-firm, and that the sum of the expected profit and the expected disutility from the negative externality of firm h is $R_h - \eta Z_h$ for $h \in (G, B)$.

For simplicity, we assume that $c_{Ri}(e_{ih})$, $c_{C\,i}(a_{ih})$, and $c_{Zi}(a_{ih})$ are quadratic; that is,

$$c_{Ri}(e) = \frac{c_{Ri}}{2}e^2,\ c_{C\,i}(a_{ih}) = \frac{c_{C\,i}}{2}a^2,\ \text{and}\ c_{Zi}(a) = \frac{c_{Zi}}{2}a^2, \qquad \text{for } i \in (D, P), \tag{7}$$

where $c_{Ri} > 0$ and $c_{Zi} > 0$ for $i \in (D, P)$. However, for $i \in (D, P)$, either $c_{C\,i} > 0$ or $c_{C\,i} < 0$ is possible, although we assume that $c_{Zi} + c_{C\,i} > 0$. Then, it follows from (1)–(4) that maximizing (5) and (6) yields the following first-order conditions; that is, the optimal effort decisions of the D-fund manager, (e_{DG}, a_{DG}), and the P-fund manager, (e_{Ph}, a_{Ph}) for $h \in (G, B)$, satisfy

$$e_{DG} = \frac{f_D x_{DG}}{c_{RD}} \text{ and } a_{DG} = \frac{\eta\lambda f_D x_{DG}}{c_{ZD} + c_{CD}}, \tag{8}$$

$$e_{Ph} = \frac{f_P x_{Ph}}{c_{RP}} \text{ and } a_{Ph} = \frac{\eta\lambda_h f_P x_{Ph}}{c_{ZP} + c_{CP}}, \qquad \text{for } h \in (G, B), \tag{9}$$

where $\lambda_G = \lambda$ and $\lambda_B = 1$. Next, (8) and (9) imply the following: for $i \in (D, P)$ and

$h \in (G, B)$, (i) each fund manager exerts more effort regarding both firm profit and ESG performance in all firms if he holds more shares of his portfolio firms (i.e., if x_{ih} is higher) and/or if his management fee is higher (i.e., if f_i is higher); (ii) each fund manager exerts more effort regarding ESG performance in all firms if the degree of investors' ESG preference is larger (i.e., if η is larger); (iii) each fund manager exerts more effort regarding ESG performance in G-firms if his effort is more valuable in G-firms (i.e., if λ higher); and (iv) each fund manager exerts more effort regarding ESG performance in all firms if the cost complementarity between efforts regarding firm profit and ESG performance is larger (i.e., if $c_{C\,i}$ is smaller).

4.2. Trading decisions.—

In making their trading decisions, liquidity investors and fund managers rationally anticipate the fund managers' effort decisions given by (8) and (9).

Under rational expectations, if liquidity investors expect the D- and P-funds to hold x_{DG} and x_{PG} shares in G-firms, it follows from (1), (3), (8), and (9) that the liquidity investors' assessment of the stock of G-firms is

$$R_G - \eta Z_G - L_G = R_0 + \frac{f_D x_{DG}}{c_{RD}} + \frac{f_P x_{PG}}{c_{RP}} - \eta \left(Z_{G0} - \lambda \frac{\eta \lambda f_D x_{DG}}{c_{ZD} + c_{CD}} - \lambda \frac{\eta \lambda f_P x_{PG}}{c_{ZP} + c_{CP}} \right) - L_G. \tag{10}$$

Similarly, using (2), (4), and (9), liquidity investors' assessment of the stock of B-firms is

$$R_B - \eta Z_B - L_B = R_0 + \frac{f_P x_{PB}}{c_{RP}} - \eta \left(Z_{B0} - \frac{\eta f_P x_{PB}}{c_{ZP} + c_{CP}} \right) - L_B. \tag{11}$$

Note that the D-fund holds only the stock of G-firms.

Each liquidity investor purchases stock $h \in (G, B)$ if his valuation exceeds the price; that is, $R_h - \eta Z_h - L_h \geq P_h$ for $h \in (G, B)$. We focus on the case in which liquidity investors hold at least some shares of stocks in each type of firm; that is, G- and B-firms. As mentioned at the end of Section 3.2, this implies that the market clearing price of stock $h \in (G, B)$ is determined by the liquidity investors' assessment of stock h:

$$P_h = R_h - \eta Z_h - L_h, \qquad \text{for } h \in (G, B), \tag{12}$$

where $R_h - \eta Z_h - L_h$ for $h \in (G, B)$ is given by (10) and (11). Here, we assume that $R_0 > \max(\eta Z_{G0} + L_G, \eta Z_{B0} + L_B)$, which is also provided in Proposition 1. Given (10) and (11), this assumption ensures that the price of each stock is always positive.

To characterize the trading decisions of the D- and P-funds, let W_D and W_P denote the sizes of the D- and P-funds, respectively, which are endogenously determined in equilibrium. The D- and P-fund managers use all of W_D and W_P delegated to them as long as liquidity investors hold at least positive shares of stocks of each firm.[21]

The D-fund invests only in G-firms. As mentioned, the D-fund finds it optimal to diversify equally across all G-firms. Given that the D-fund can use all W_D to purchase x_{DG} units of the stock of G-firms, we have

$$x_{DG} = \frac{W_D}{P_G}. \tag{13}$$

Because of (12), note that

$$P_G = R_G - \eta Z_G - L_G. \tag{14}$$

The P-fund is restricted to holding a value-weighted portfolio of all stocks, with this market portfolio denoted by index M. As there is a mass one of G-firms and a mass one of B-firms, the price of the market portfolio is $P_M = \int_0^1 P_G dj + \int_0^1 P_B dj = P_G + P_B$. The P-fund purchases x_{Ph} units of stock h according to the market portfolio rule, under which the proportion of the amount invested in stock h in the fund, $\frac{x_{Ph}P_h}{W_P}$, equals the weight of this stock in the market portfolio, $\frac{P_h}{P_M}$. This implies that x_{Ph} is the same for any $h \in (G, B)$ and is equal to

$$x_P = \frac{W_P}{P_M}. \tag{15}$$

Furthermore, let $R_M = R_G + R_B$, $Z_M = Z_G + Z_B$, and $L_M = L_G + L_B$. Then, it follows from (10)–(12) with $x_{Ph} = x_P$ for any $h \in (G, B)$ that

$$P_M = R_M - \eta Z_M - L_M, \tag{16}$$

[21] Note that these fund managers evaluate each stock more highly than do liquidity investors or submit a market order.

where

$$R_M - \eta Z_M - L_M = R_0 + \frac{f_D x_{DG}}{c_{RD}} + \frac{f_P x_P}{c_{RP}} - \eta \left(Z_{G0} - \lambda \frac{\eta \lambda f_D x_{DG}}{c_{ZD} + c_{CD}} - \lambda \frac{\eta \lambda f_P x_P}{c_{ZP} + c_{CP}} \right)$$
$$+ R_0 + \frac{f_P x_P}{c_{RP}} - \eta \left(Z_{B0} - \frac{\eta f_P x_P}{c_{ZP} + c_{CP}} \right) - L_M. \tag{17}$$

Note that from (9) and (15), e_{Ph} is the same for any $h \in (G, B)$. Thus, (9) is rewritten so that

$$e_P = \frac{f_P x_P}{c_{RP}} \text{ and } a_{Ph} = \frac{\eta \lambda_h f_P x_P}{c_{ZP} + c_{CP}}, \qquad \text{for } h \in (G, B), \tag{9'}$$

where $\lambda_G = \lambda$ and $\lambda_B = 1$.

4.3. Investment allocation decisions and asset management fees.—

Now, we discuss the investment allocation decision by infinitesimal fund investors, who choose between investing in the D-fund and/or the P-fund and investing in an alternative investment opportunity, such as public bonds, that generates the fixed return 0.

Consider a fund investor with wealth ε. If the fund investor invests ε_D in the D-fund, the fund manager buys $\frac{\varepsilon_D}{P_G}$ stocks. Then, the fund investor's expected payoff is $(R_G - \eta Z_G) \frac{\varepsilon_D}{P_G}$ $- f_D (R_G - \eta Z_G) \frac{\varepsilon_D}{P_G} - \psi_D \varepsilon_D = (1 - f_D)(R_G - \eta Z_G) \frac{\varepsilon_D}{P_G} - \psi_D \varepsilon_D$ because she incurs a search cost $\psi_D \varepsilon$ and pays the fee f_D. Similarly, if the fund investor invests ε_P in the P-fund, her expected payoff with the P-fund is $(1 - f_P)(R_M - \eta Z_M) \frac{\varepsilon_P}{P_M} - \psi_P \varepsilon_P$. Hence, time 0, the objective function of the fund investor is represented by

$$(1 - f_D)(R_G - \eta Z_G) \frac{\varepsilon_D}{P_G} - \psi_D \varepsilon_D + (1 - f_P)(R_M - \eta Z_M) \frac{\varepsilon_P}{P_M} - \psi_P \varepsilon_P + \varepsilon - \varepsilon_D - \varepsilon_P.$$

Note that the net return of the alternative investment opportunities apart from the D- and P-funds is equal to zero.

To characterize the investment allocation decisions of fund investors, we begin by examining their indifference conditions regarding the investment allocation. Under the condition of Proposition 1 derived below, we can ensure that $W_D + W_P < W$ if the aggregate wealth of fund investors such as pension funds is sufficiently large that they purchase public bonds.[22] Then, fund investors make a positive investment in public bonds with the

[22] For each investor level, this implies that $\varepsilon_D + \varepsilon_P < \varepsilon$.

fixed net return of 0. This implies that fund investors earn the same rate of expected net return regardless of whether they invest with D- or P-funds, and this expected net return is equal to 1.[23] Specifically, the fund investors' indifference conditions are

$$(1-f_D)\frac{R_G-\eta Z_G}{P_G}-\psi_D=(1-f_P)\frac{R_M-\eta Z_M}{P_M}-\psi_P=1. \tag{18}$$

Next, we deal with bargaining in the D-fund. After a fund investor investing ε_D in the D-fund incurs the cost $\psi_D\varepsilon_D$ and finds an appropriate D-fund, she bargains with the D-fund manager over the fee $\widehat{f}_D$. The outcome of the bargaining depends on each player's expected payoff in the event of agreement and no agreement. If the fund investor and the fund manager agree on the fee $\widehat{f}_D$, the fund investor's expected payoff is $(1-\widehat{f}_D)(R_G-\eta Z_G)\frac{\varepsilon_D}{P_G}$. If no agreement is reached, the fund investor can either find the P-fund by incurring the cost $\psi_P\varepsilon_D$ and invest with the P-fund or invest in the alternative investment opportunity. Under (18), the P-fund yields the same rate of net return 1 for the fund investor as the alternative investment opportunity so that her expected payoff is ε_D when no agreement is reached.

To specify the fund manager's expected payoff, we must provide his additional expected payoff from agreeing on the fee $\widehat{f}_D$ and obtaining the additional funds ε_D. The additional expected payoff is represented by $\widehat{f}_D(R_G-\eta Z_G)\frac{\varepsilon_D}{P_G}$.[24] However, the fund manager's gain from no agreement is zero.

Given the fund manager's (investor's) bargaining power ω_D $(1-\omega_D)$, the bargaining outcome maximizes the product of the expected payoff gains from agreement with respect to $\widehat{f}_D$:

$$\max_{\widehat{f}_D}\left[(1-\widehat{f}_D)(R_G-\eta Z_G)\frac{\varepsilon_D}{P_G}-\varepsilon_D\right]^{1-\omega_D}\left[\widehat{f}_D(R_G-\eta Z_G)\frac{\varepsilon_D}{P_G}\right]^{\omega_D}.$$

[23] This assumption forces us to neglect the case where the rates of net return from investing with the D- and P-funds are larger than 1, which is analyzed by Corum, Malenko, and Malenko (2021). However, the assumption enables us to focus on the effects that occur through the effort decisions of fund managers on multiple tasks under the negative externality released by their portfolio firms.

[24] By adding ε_D to the fund with x_{DG}, it follows from (1), (3), and (9′) that the expected payoff of the D-fund manager is $\max_{e,a}\{f_D[R_{G0}+e+\frac{f_Px_P}{c_{RP}}-\eta(Z_{G0}-\lambda a-\lambda\frac{\eta\lambda f_Px_P}{c_{ZP}+c_{CP}})]x_{DG}+\widehat{f}_D[R_{G0}+e+\frac{f_Px_P}{c_{RP}}-\eta(Z_{G0}-\lambda a-\lambda\frac{\eta\lambda f_Px_P}{c_{ZP}+c_{CP}})]\frac{\varepsilon_D}{P_G}-c_{RD}(e)-c_{CD}(a)-c_{ZS}(a)\}$. Using the envelope theorem, the derivative with respect to ε_D at $\varepsilon_D=0$ yields $\widehat{f}_D[R_{G0}+e+\frac{f_Px_P}{c_{RP}}-\eta(Z_{G0}-\lambda a-\lambda\frac{\eta\lambda f_Px_P}{c_{ZP}+c_{CP}})]\frac{1}{P_G}$, that is, $\widehat{f}_D\frac{(R_G-\eta Z_G)}{P_G}$.

The solution must satisfy

$$\widehat{f}_D(R_G - \eta Z_G)\frac{\varepsilon_D}{P_G} = \omega_D \left[(R_G - \eta Z_G)\frac{\varepsilon_D}{P_G} - \varepsilon_D\right].$$

As the D-fund fee is the same for all fund investors, we have $\widehat{f}_D = f_D$. Thus,

$$f_D = \omega_D \left(1 - \frac{P_G}{R_G - \eta Z_G}\right). \tag{19}$$

Similarly, the P-fund fee is the same for all investors, and is given by

$$f_P = \omega_P \left(1 - \frac{P_M}{R_M - \eta Z_M}\right). \tag{20}$$

4.4. Characterization of equilibrium.—

The equilibrium is defined as a solution to the following system of equations: (i) the fund managers' effort decisions (8) and (9′); market clearing conditions (10) and (13)–(17); fund investors' capital allocation conditions (18); and fee bargaining conditions (19) and (20). These equations determine the following endogenous variables: the fund managers' effort decisions, $(e_{DG}, a_{DG}, e_P, a_{PG}, a_{PB})$; the asset management fees, (f_D, f_P); the trading decisions and investment asset allocations, (x_{DG}, x_P, W_D, W_P); the total expected payoffs, $(R_G - \eta Z_G, R_M - \eta Z_M)$; and the asset prices, (P_G, P_M).

Now, we obtain the following proposition that characterizes the equilibrium.

Proposition 1: *Suppose that* $R_0 > \max(\eta Z_{B0} + L_B, \eta Z_{G0} + L_G)$ *and* $R_0 - \eta Z_{G0} - L_G > W \geq \underline{W}$, *where* $\underline{W}$ *is given by (A9) in Appendix A. Then, we have the following.*
(i) The asset management fees are $f_D = \frac{\omega_D \psi_D}{\psi_D + 1 - \omega_D}$ *and* $f_P = \frac{\omega_P \psi_P}{\psi_P + 1 - \omega_P}$, and $f_D \geq f_P$ if $\omega_D \geq \omega_P$.
(ii) The expected profit of G-stocks and the market portfolio are $R_G = \frac{\psi_D + 1 - \omega_D}{\psi_D} L_G + \eta Z_G$ and $R_M = \frac{\psi_P + 1 - \omega_P}{\psi_P} L_M + \eta Z_M$.
(iii) The expected negative externalities generated by B-firms, G-firms, and the firms included in the market portfolio satisfy the following equations:

$$Z_B + Z_G = Z_M, \tag{21}$$

$$Z_G = Z_{G0} - \eta\lambda^2 \frac{c_{RD}}{c_{ZD}+c_{CD}}(2R_G - R_M) - \eta\lambda^2 \frac{c_{RP}}{c_{ZP}+c_{CP}}(R_M - R_G - R_0), \tag{22}$$

$$\begin{aligned} Z_M = {} & Z_{G0} + Z_{B0} - \eta\lambda^2 \frac{c_{RD}}{c_{ZD}+c_{CD}}(2R_G - R_M) - \eta\lambda^2 \frac{c_{RP}}{c_{ZP}+c_{CP}}(R_M - R_G - R_0) \\ & - \eta \frac{c_{RP}}{c_{ZP}+c_{CP}}(R_M - R_G - R_0), \end{aligned} \tag{23}$$

where R_G and R_M are given above.

(iv) *The prices of G-stocks and the market portfolio are* $P_G = \frac{1-\omega_D}{\psi_D} L_G$ and $P_M = \frac{1-\omega_P}{\psi_P} L_M$.

The restrictions $R_0 > \max(\eta Z_{B0} + L_B, \eta Z_{G0} + L_G)$, $R_0 - \eta Z_{G0} - L_G > W$, and $W \geq \underline{W}$ ensure that the liquidity investors' holding ratio in each stock is positive, that is, $x_{DG} + x_P < 1$. The restriction $R_0 > \eta Z_{G0} + L_G$ guarantees that the D-fund finds it optimal to diversify equally across all G-firms. Finally, the restriction $W \geq \underline{W}$ further ensures that fund investors make a positive investment in an alternative investment opportunity such as public bonds; that is, $W_D + W_P < W$.

As $W_D + W_P < W$, fund investors' aggregate wealth is relatively large. Then, their outside options in negotiations are eventually limited by an alternative investment opportunity such as public bonds with the fixed net return 0.[25] In addition, when $\psi_D \geq \psi_P$, the fee charged by the D-fund is higher than that charged by the P-fund if the bargaining power of the D-fund manager is equal to or exceeds that of the P-fund manager.

Some recent studies indicate the limited or even counterproductive impact of D-funds on ESG because high-ESG firms have little scope for further improvement in their impact, whereas low-ESG firms, which face an increase in financing costs, must produce large negative externalities (e.g., see Hartzmark and Shue, 2023). In the present model, the limited impact of the ESG performance in G-firms in response to each fund manager's effort can be captured by supposing $\lambda < 1$.

4.5. Comparative statics.—

We examine the effects of the key parameters of the model on the expected negative externalities, the expected profits, and the asset management fees. The key parameters are the intensity of investors' ESG preferences, η, the diminishing impact of shareholder

[25] To be consistent with the assumption of $R_0 - \eta Z_{G0} - L_G > W$ that ensures $x_{DG} + x_P < 1$, we need to suppose the situation where R_0 is also sufficiently large. Hence, our analysis may be less applicable to the case where the economy faces a financial crisis such that R_0 is not sufficiently large.

ESG engagement on high-ESG firms, λ, and the effort cost complementarity of each D- and P-fund manager, c_{CD} and c_{CP}, respectively.

First, we consider how growing interest in ESG affects the ESG and pecuniary performances of firms. Then, we obtain the following proposition.

Proposition 2: *Suppose that investors' ESG preferences are strengthened (i.e., η increases).*
(i) The expected negative externality released by G-firms, Z_G, decreases if $\frac{c_{RP}}{c_{RD}} \geq \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$. However, it may increase if $\frac{c_{RP}}{c_{RD}} < \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ and if $\frac{Z_B}{Z_G}$ is sufficiently large.
(ii) The expected negative externality released by B-firms, Z_B, decreases, whereas the expected profit of B-firms, R_B, increases.
(iii) The expected negative externality released by all the firms in the market portfolio, Z_M, decreases if $\frac{c_{RP}}{c_{RD}} \geq \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$. However, it may increase if $\frac{c_{RP}}{c_{RD}} < \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ and if $\frac{Z_B}{Z_G}$ is sufficiently large.
(iv) The asset management fees of both funds are unaffected.

$\frac{c_{RP}}{c_{RD}}$ is equal to the effort cost ratio of the P-fund manager to the D-fund manager for improving firms' profits, whereas $\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ is the effort cost ratio for improving the negative externality. A larger $\frac{c_{RP}}{c_{RD}}$ (or $\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$) implies that increasing profits (or decreasing the negative externalities) of the portfolio firms is relatively less costly for the D-fund manager than for the P-fund manager. Thus, the larger $\frac{c_{RP}}{c_{RD}}$ (or $\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$) can be interpreted such that the D-fund has a greater cost advantage in improving profit (ESG performance) compared with the P-fund.

Considering this interpretation, Propositions 2(i) and 2(iii) show that when η increases, Z_G and Z_M decrease if the D-fund has a comparative cost advantage in improving *profit* performance over *ESG* performance to the P-fund (i.e., if $\frac{c_{RP}}{c_{RD}} \geq \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$). However, Propositions 2(i) and 2(iii) indicate that when η increases, Z_G and Z_M may increase if the D-fund has a comparative cost advantage over the P-fund in improving *ESG* performance over *profit* performance (i.e., if $\frac{c_{RP}}{c_{RD}} < \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$) and if the ratio of the negative externalities of B-firms to those of G-firms is sufficiently large. Proposition 2(ii) also suggests that an increase in η always decreases Z_B and increases R_B. Proposition 2(iv) states that an increase in η does not affect the fees of either the P-fund or the D-fund.

The intuition behind Proposition 2 is as follows. For convenience, we begin by con-

sidering the effect of an increase in η on the expected negative externality by taking the management fee of each fund as given. Later, we clarify the effect of an increase in η by considering its effect on the asset management fees.

Now, from the perspective of the fund manager's optimizing behavior, the effort incentive for each fund manager to reduce the negative externality in a firm depends not only directly on η but also on the fund ownership stakes in the firm, (x_{DG}, x_P), as indicated in (8) and (9′). The direct effect of an increase in η on the ESG effort incentive increases the engagement efforts for the D- and P-fund managers, (a_{DG}, a_{PG}, a_{PB}), to reduce the negative externality, thus decreasing Z_G, Z_B, and Z_M. However, an increase in η changes the fund ownership stakes in each firm, (x_{DG}, x_P), by affecting the investment allocation of the fund investors in each fund. We refer to this as the fund ownership effect.

Suppose that (Z_G, Z_M) is initially given. Then, an increase in η increases the expected disutilities of the fund investors, ηZ_G and ηZ_B. The larger values of ηZ_G and ηZ_M increase the fund investors' rates of expected gross return from each fund (note that $\partial(\frac{R-\eta Z}{P})/\partial(\eta Z) > 0$, where $P = R - \eta Z - L$). However, in equilibrium, fund investors must be indifferent between investing in each fund and the alternative investment opportunity (see (18)).

Given that Z_G is assumed to be smaller than Z_B and that η directly affects fund investors' indifference conditions, we can show that x_{DG} may increase or decrease, but that x_P must increase to restore (18). This implies that fund investors may increase or decrease their investment in the D-fund, enabling the D-fund manager to take larger or smaller stakes x_{DG} in G-firms, whereas the fund investors must increase their investment in the P-fund, inducing the P-fund manager to take larger stakes x_P in all the firms in the market portfolio. Thus, the fund ownership effect in response to an increase in η increases or decreases a_{DG}, while increasing a_{PG} and a_{PB}. Furthermore, such changes in x_{DG} and x_P do not necessarily reduce the ownership stakes held by liquidity investors in G-firms, $1 - x_{DG} - x_P$, but they reduce the ownership stakes held by liquidity investors in the market portfolio, $1 - x_P$. However, even in this situation, if the D-fund has a comparative cost advantage in improving *profit* performance over *ESG* performance to the P-fund (i.e., if $\frac{c_{RP}}{c_{RD}} \geq \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$), the fund ownership effect as a whole in response to an increase in η decreases Z_G and Z_M because the fund ownership effects on a_{PG} and a_{PB} are dominant and liquidity investors do not make any ESG engagement efforts.

Given that B-firms are bought only by the P-fund and liquidity investors, such changes in the fund ownership stakes reduce Z_B. Because the direct effect of an increase in η on the ESG effort derived at the beginning also decreases Z_G, Z_B, and Z_M, the total effect, consisting of the direct effect and the fund ownership effect in response to an increase in η, subsequently decreases Z_G, Z_B, and Z_M.

By contrast, if the D-fund has a comparative cost advantage in improving *ESG* performance over *profit* performance compared with the P-fund (i.e., if $\frac{c_{RP}}{c_{RD}} < \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$), the fund ownership effect of decreasing a_{DG} may dominate that of increasing a_{PG} and a_{PB} if $\frac{Z_B}{Z_G}$ is sufficiently large. Then, the fund ownership effect as a whole may increase Z_G and Z_M and dominate the direct effect of an increase in η on the ESG effort if $\frac{Z_B}{Z_G}$ is sufficiently large. Hence, the total effect, consisting of the direct effect and the fund ownership effect in response to an increase in η, may increase Z_G and Z_M.

In addition, even in this case, for B-firms, the fund ownership effect works only through changes in the ownership of the P-fund and liquidity investors. Consequently, combining the direct effect, we show that an increase in η always decreases Z_B and increases R_B.

Finally, we return to examining the effect of an increase in η on the asset management fee of each fund. An increase in η changes the expected gross return earned by fund investors. The reason is that an increase in η changes the expected disutilities of fund investors, ηZ, as discussed above. However, given (14), (16), (19), and (20), note that the fund investors' expected gross return rate, $(1-f)\frac{R-\eta Z}{P}$, depends on the expected profit of the portfolio firms of the fund, R, minus the expected disutility of the negative externality released by the firms, ηZ. When η increases, the effect of the increase in η on the expected disutility is canceled out by its effect on the expected profit, restoring the fund investors' capital allocation conditions (18). This implies that the change in η has no effect on the fund investors' expected gross return rate, and thus has no effect on the management fee of either fund when fund investors' bargaining power is fixed.[26]

Now, we discuss the comparative statics of λ, which represents the effectiveness of each fund manager's ESG effort in G-firms relative to that in B-firms. We have the following proposition.

[26] Under fund investors' capital allocation conditions (18), the D-fund (P-fund) investors' expected gross return rate $(1-f_D)\frac{R_G-\eta Z_G}{P_G}$ ($(1-f_P)\frac{R_M-\eta Z_M}{P_M}$) must remain constant for a fixed ψ_D (ψ_P). Combining this with (19) ((20)), we can show that both the fund fee f_D (f_P) and the expected gross return rate $\frac{R_G-\eta Z_G}{P_G}$ ($\frac{R_M-\eta Z_M}{P_M}$) must remain unaffected by the change in η.

Proposition 3: *Suppose that the improvement of the ESG performance of G-firms relative to that of B-firms in response to each fund manager's ESG effort decreases (i.e., λ decreases).*

(i) The expected negative externality and the expected profit of G-firms, Z_G and R_G, increase.

(ii) The expected negative externality and the expected profit of B-firms, Z_B and R_B, are unaffected.

(iii) The expected negative externality and the expected profit of all the firms in the market portfolio, Z_M and R_M, increase.

(iv) The asset management fees of both funds are unaffected.

Proposition 3 indicates that when λ decreases, the expected ESG performances of G-firms and of all the firms in the market portfolio are negatively affected, whereas the expected profit performances of these firms are improved. However, in the case of B-firms, neither expected ESG nor expected profit performances are affected. In addition, the asset management fees of both funds are unaffected.

The intuition for Proposition 3 is as follows. Again, we start by assuming that the management fee is fixed. Then, the lower λ directly decreases both the D-fund manager's ESG effort in G-firms (see $a_{DG} = \frac{\eta\lambda f_D x_{DG}}{c_{ZD}+c_{CD}}$) and the P-fund manager's ESG effort in G-firms (see $a_{PG} = \frac{\eta\lambda f_P x_P}{c_{ZP}+c_{CP}}$), thereby directly increasing both Z_G and Z_M.[27] However, as discussed in the case of an increase in η, we need to consider the effect of a change in the fund ownership stakes. In fact, the crucial differences between the comparative static mechanisms of η and λ are that η affects the fund investors' indifference conditions, (18), not only directly but also through changes in the fund ownership stakes, whereas λ affects (18) only through changes in the fund ownership stakes. Given this, in the case of a decrease in λ, increases in Z_G and Z_M in response to the direct effect of λ result in increases in R_G and R_M to restore (18) because a larger Z_G and Z_M (or a larger R_G and R_M) increase (or decrease) the fund investors' rate of expected gross returns from each fund (see $\partial[(1-f)\frac{R-\eta Z}{P}]/\partial Z > 0$ and $\partial[(1-f)\frac{R-\eta Z}{P}]/\partial R < 0$, where $P = R - \eta Z - L$). The increases in R_G and R_M are achieved by inducing fund investors to increase their investment in the D-fund. Such an increase in investment compels the D-fund manager to purchase a larger number of G-firm shares, thus increasing x_{DG}. The effect of the larger

[27] However, the lower λ does not affect the P-fund manager's ESG effort in B-firms.

x_{DG} raises the fund managers' efforts regarding firm profit (see $e_{DG} = \frac{f_D x_{DG}}{c_{RD}}$). Hence, R_G and R_M increase. However, the effect of the larger x_{DG} on a_{DG} does not offset the initial direct effect of decreasing a_{DG} and a_{PG}. Thus, Z_G and Z_M continue to increase.

In fact, under fund investors' capital allocation conditions (18), the effect of the lower λ increasing the expected disutility, ηZ, cancels out its effect of decreasing the expected profit, R. This implies that the change in λ does not affect fund investors' expected gross return rate, although the initial direct effect of decreasing a_{DG} and a_{PG} is retained, as is the fund ownership effect of an increase in e_{DG} through an increase in x_{DG}. Thus, the change in λ does not influence the management fee of either fund,[28] and both Z_G and Z_M continue to increase, along with R_G and R_M. In addition, as these effects do not apply to B-firms, neither Z_B nor R_B is affected as long as the management fee remains unaffected.

The cost complementarity in each fund manager's effort between improving profit and ESG performances has significant effects on the expected negative externality and the expected profit of each firm. In the context of our model, an increase in complementarity can be understood as a decrease in c_{CD} and c_{CP}.

Proposition 4: *Suppose that the cost complementarity in the D-fund manager's effort between improving profit and ESG performances is higher (i.e., c_{CD} is lower).*
(i) The expected negative externality and the expected profit of G-firms, Z_G and R_G, both decrease.
(ii) The expected negative externality and the expected profit of B-firms, Z_B and R_B, respectively, are unaffected.
(iii) The expected negative externality and the expected profit from all the firms in the market portfolio, Z_M and R_M, respectively, decrease.
(iv) The asset management fees of both funds are unaffected.

Proposition 5: *Suppose that the cost complementarity in the P-fund manager's effort between improving profit and ESG performances is higher (i.e., c_{CP} is lower). Then, statements (i), (iii), and (iv) in Proposition 4 hold, whereas the expected negative externality and the expected profit of B-firms both decrease.*

Propositions 4 and 5 show that the lower c_{CD} and the lower c_{CP} both improve expected ESG performance in G-firms and in all the firms in the market portfolio, but reduce

[28] A remark similar to that of footnote 26 holds in this case.

the expected profit performance of G-firms and of all the firms in the market portfolio. However, these propositions indicate that only the lower c_{CP} improves B-firms' expected ESG performance but harms their expected profit performance. Neither the lower c_{CD} nor the lower c_{CP} affects the asset management fees of either type of funds.

Intuitively, the mechanism by which the lower c_{CD} operates is similar to that of the higher λ, except that the lower c_{CD} directly increases *only* the D-fund manager's ESG effort. Regardless of this difference, similar to the case of the higher λ (i.e., opposite to the case of lower λ), the lower c_{CD} decreases Z_G, R_G, Z_M, and R_M, but does not affect Z_B, R_B, or the asset management fees of either fund. For the effect of the lower c_{CP}, we can apply a similar logic, except that the lower c_{CP} raises the P-fund manager's ESG effort in the market portfolio firms. Consequently, the lower c_{CP} reduces Z_B and R_B.

Several remarks regarding Propositions 2–5 are in order. First, even though growing interest in ESG may reduce fund investors' investment in the D-fund, it decreases the expected negative externality released by G-firms and in all the firms in the market portfolio if the D-fund has a comparative cost advantage over the P-fund in improving *profit* performance relative to *ESG* performance. Furthermore, growing interest in ESG always reduces the expected negative externality released by B-firms. However, if the D-fund has a comparative cost advantage over the P-fund in improving *ESG* performance relative to *profit* performance, and if the negative externalities of B-firms are sufficiently larger than those of G-firms, growing interest in ESG may have a counterproductive effect on ESG: the dominant effect is the decrease in the fund investors' allocation to the D-fund and the expected negative externality released by G-firms and all the firms in the market portfolio also increases. As some recent studies, such as Hartzmark and Shue (2022), suggest—albeit for reasons other than the limited or counterproductive impact of the D-fund on ESG—the latter result theoretically suggests the possibility of strengthening ESG preferences preventing the reduction of the expected negative externality under particular conditions.

Second, Goldstein, Kopytov, Shen, and Xiang (2022) suggest that an increase in the green investor share leads to an increase (a decrease) in the cost of capital and the expected asset returns when most investors are traditional (green) investors. Their results depend on changes in the composition of the investor base and in the price informativeness. Pástor, Stambaugh, and Taylor (2021b) indicate that a higher ESG appetite leads

green firms to become greener but reduces the expected returns of green firms. Their results depend on the shift of real investment from brown to green firms. By contrast, our results regarding the growing interest in ESG are primarily derived from changes in the fund managers' governance efforts, which are caused not only by the direct effect of strengthened ESG preferences but also by the change in the fund ownership stakes. Accordingly, our results depend on the comparative cost advantage of each fund manager in improving *ESG* performance relative to *firm profit*. Furthermore, our results suggest that growing interest in ESG may not necessarily improve expected ESG performance in G-firms or in all the firms in the market portfolio in a particular situation, where the D-fund has a comparative cost advantage over the P-fund in improving *ESG* performance relative to *firm profit* and the negative externalities of B-firms are sufficiently larger than those of G-firms. This result differs from the findings of Pástor, Stambaugh, and Taylor (2021b) because it is driven by the change in the fund ownership stakes in each firm rather than by investment shifting from brown to green firms.

Third, Proposition 3 shows that when shareholders' ESG engagement becomes less valuable for high-ESG firms, the expected ESG performance of the high-ESG firms and all the firms in the market portfolio worsens, whereas their expected profit performances improve. Although this change affects fund managers' ESG efforts toward G-firms in both the D- and P-funds, the expected ESG and profit performances in B-firms remain unaffected because neither the direct effect nor the fund ownership effect operates in B-firms. The fund ownership effect operates only through reducing fund investors' investment in the D-fund in this case.

Fourth, there is empirical support for first-order effects arising from the change in the fund ownership structure that underlies the mechanism in Propositions 2–5. Although D-funds are considered ESG-indexed funds, there is growing evidence that passive fund growth may affect information production and the information content of asset prices (see Israeli, Lee, Sridharam, 2017; Glosten, Nallareddy, and Zou, 2021; and Coles, Health, and Ringgenberg, 2022). These changes may have first-order effects on shareholders' willingness to make costly engagements in their portfolio firms.

Fifth, Corum, Malenko, and Malenko (2021) report that passive fund growth improves firm governance and increases firm returns if it replaces liquidity investors with institutional investors, whereas its effects on governance are subtler and depend on the active

and passive funds' ownership stakes if the passive fund growth primarily affects the composition of active versus passive funds. Our results regarding growing interest in ESG depend on the ownership stakes of D- and P-funds. However, our model incorporates investors' ESG preferences, the costs associated with engagement and complementarity for each fund manager in reducing the negative externality, and the costs associated with improving firm profit. Hence, our findings are contingent upon the ratio of the negative externality released by each type of firm and the comparative cost advantage of improving ESG performance relative to firm profit for each fund manager.

Sixth, Propositions 4 and 5 show that greater cost complementarity in the efforts of D-fund managers enhances expected ESG performance in both G-firms and all firms within the market portfolio, but does not affect expected ESG performance in B-firms. Conversely, greater cost complementarity in the efforts of P-fund managers enhances expected ESG performance even in B-firms. Hence, the comparative static results for such complementarities are not straightforward because we need to examine an indirect channel that operates through fund investors' capital allocations that could impede the reduction of expected negative externalities.

5. Discussions and Empirical Implications

Propositions 2–5 offer several empirical predictions regarding the effects of shareholder engagement resulting from growing interest in ESG, the relatively reduced impact of such engagement on ESG performance in G-firms, and the heightened cost complementarity of effort costs for each fund manager that impact on both the expected negative externality and the expected financial return. Although ESG performance includes various aspects, one could rely on various proxies proposed in the empirical literature that capture different ESG aspects (e.g., see Pedersen, Fitzgibbons, and Pomorski, 2021) to test the predictions of our model empirically.

To discuss the empirical implications, using (12) and (16), we observe that the expected financial returns of G-stocks, B-stocks, and the market portfolio for investors, $R_G - P_G$, $R_B - P_B$, and $R_M - P_M$, are defined by

$$R_h - P_h = L_h + \eta Z_h, \qquad \text{for } h \in (G, B, M). \tag{24}$$

We start by deriving the empirical implication for the expected financial returns by comparing $R_G - P_G$ and $R_B - P_B$. In the previous sections, we assumed that Z_{B0} is sufficiently larger than Z_{G0} and that the D-fund holds only G-firms. Hence, it follows from (3), (4), and (24) that if L_G is not so different from L_B and if the ESG engagement effort of the P-fund manager in B-firms is not very large, the expected financial returns of stocks with low-ESG scores outperform those of stocks with high-ESG scores. Many empirical studies provide predictions about the relationship between ESG aspects and the financial returns of firms' operations, but they document mixed results. For example, Hong and Kacperczyk (2009), El Ghoul, Guedhami, Kwok, and Mishra (2011), Chava (2014), Zerbib (2019), Barber, Morse, and Yasuda (2021), and Bolton and Kacperczyk (2021) report a negative relationship between ESG performance and financial returns. However, Derwall, Guenster, Bauer, and Koedijk (2005), Kempf and Osthoff (2007), and Pastor, Stambaugh, and Taylor (2021a) report that stocks with better environmental prospects have higher financial returns. Green and Roth (2021) suggest that measurement issues are a significant obstacle to resolving the problem of whether firms with good ESG performance face lower financial returns. In addition, the opposite findings can be explained by the weak return predictability of the overall ESG rating (Pedersen, Fitzgibbons, and Pomorski, 2021) and the presence of uncertainty about the ESG profile (Avramov, Cheng, Lioui, and Tarelli, 2022). Indeed, until recently, the construction of ESG ratings has not been regulated or unified. Thus, the methodology of ESG ratings is opaque and proprietary.[29]

Next, we examine the empirical implication of the effect of growing interest in ESG because many practitioners and researchers question how growing interest in ESG really affects ESG performance and financial returns. As mentioned in Section 3.1, we note that the engagement effort e_{ih} (a_{ih}) exerted by the fund manager i for $i \in (D, P)$ and $h \in (G, B)$ includes any actions such as communicating with management, submitting shareholder proposals, nominating directors, and voting on proxy contests. Given this, we consider two cases, in which the D-fund is (i) a sustainable active fund; and (ii) an ESG-indexed fund.

In the first case, in their review of the literature, Brav, Malenko, and Malenko (2022) conclude that because of the differing types of costs associated with actively managed

[29] Avramov, Cheng, Lioui, and Tarelli (2022) report that there are substantial variations across different rating providers with the average rating correlation being 0.48.

funds and passive funds, and thus their probable specialization in different types of engagement, passive funds may be better positioned to exert influence by setting broad, market-wide governance standards rather than focusing on firm-specific operational improvements.[30] Given the disparity in the engagement strategies, the P-fund holds a comparative cost advantage over the D-fund in enhancing *ESG* performance relative to *profit* performance if enhancing ESG performance can be achieved to some extent by establishing broad, market-wide standards for ESG, whereas improving the profit performance of each firm necessitates more firm-specific operational engagements. In addition, the engagement effort concerning ESG may prove more valuable for firms that lag behind others on ESG. As the D-fund invests solely in G-firms, this characteristic further strengthens the comparative cost advantage of the P-fund over the D-fund in enhancing *ESG* performance relative to *profit* performance, although the parameter λ may primarily capture this feature in our model.

In contrast, the cost complementarity in the D-fund manager's efforts between improving profit and ESG performances is greater than that in the P-fund manager's efforts when the D-fund operates as a sustainable active fund. This difference arises because both efforts of the D-fund involve more firm-specific operational engagements than those of the P-fund. However, if the cost complementarity in the D-fund manager's efforts is not significantly large, such that c_{CD} is not notably smaller than c_{CP}, then the P-fund retains its comparative cost advantage over the D-fund in improving *ESG* performance relative to *profit* performance, as argued above. Accordingly, we can assume that $\frac{c_{RP}}{c_{RD}} \geq \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ if improving ESG performance can be achieved to a certain extent by setting broad, market-wide standards for ESG, and if the cost complementarity in the D-fund manager's efforts is not significantly large.

For the second case, where the D-fund is an ESG-indexed fund, the engagement activity of the D-fund is similar to that of the P-fund, except that the D-fund invests only in G-firms. If the engagement effort regarding ESG is more valuable and less costly for firms with low- vs high-ESG scores, the ESG engagement cost of the D-fund manager may be

[30] Kahn and Rock (2020) and Fish, Hamdani, and Solomon (2019) indicate that actively managed funds may have an advantage over index funds in identifying firm-specific operational or financial issues because they can specialize in collecting or acquiring such information as a by-product of their investment activities. They also argue that large passive funds are well good positioned to reap economics of scale in collecting information on broad, market-wide issues and setting market-wide standards.

larger than that of the P-fund manager (i.e., $c_{ZD} > c_{ZP}$) because the D-fund invests only in G-firms. Then, $\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ is not sufficiently large and can be smaller than $\frac{c_{RP}}{c_{RD}}$. Hence, in this case, we may assume that $\frac{c_{RP}}{c_{RD}} \geq \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ without any further conditions.

Now, considering that the strengthened ESG preference affects both η and Z_i ($i = G$, B, M) in (24), combining (24) with the above arguments and the results of Propositions 2(i)–2(iii) provides the following predictions (for the proof, see Appendix A):

Prediction 1A: If improving ESG performance can be achieved to a certain degree by setting broad, market-wide standards for ESG, and if the cost complementarity in the efforts of the D-fund manager is not significantly large, growing interest in ESG is likely to **reduce** the expected negative externalities released by firms with high-ESG scores, as well as by all the firms in the market portfolio, but also to reduce the expected financial returns of these firms. However, growing interest in ESG always **reduces** the expected negative externality by firms with low-ESG scores and their expected financial returns.

Prediction 1B: If most D-funds consist of ESG-indexed funds, growing interest in ESG is likely to **reduce** the expected negative externalities and financial returns of any type of firm.

Suppose that improving ESG performance cannot be achieved to a certain degree by setting broad, market-wide standards for ESG, and/or that the cost complementarity effect in the D-fund manager's efforts is sufficiently large. Then, Prediction 1A does not necessarily suggest that growing interest in ESG is likely to improve expected ESG performance in firms with high-ESG scores and in all the firms in the market portfolio. However, Prediction 1A also shows that growing interest in ESG always improves expected ESG performance in firms with low-ESG scores. By contrast, Prediction 1B suggests that if most D-funds comprise ESG-indexed funds, then growing interest in ESG is likely to improve expected ESG performance of any type of firm.

Now, we proceed to examine the empirical implication of the variation effect in the effectiveness of shareholder ESG engagement in G-firms relative to that in B-firms. Because such a diminishing impact is captured by a decrease in λ, it readily follows from Propositions 3(i)–3(iii), along with (24), that the following predictions are obtained.

Prediction 2: When the impact of shareholder ESG engagement in G-firms relative to B-firms is smaller, both the expected negative externalities and the expected financial

returns are **increased** for firms with high-ESG scores and all the firms in the market portfolio, but remain unaffected for firms with low-ESG scores.

Prediction 2 particularly suggests that when the impact of shareholder ESG engagement in G-firms relative to that in B-firms decreases, both the expected ESG performance and financial returns in firms with high-ESG scores and market portfolio firms increase, but those in firms with low-ESG scores remain unaffected.

Now, we discuss the empirical implication regarding the effect of the cost complementarity in each fund manager's efforts between improving profit and ESG performances. As argued above, sustainable active funds are more likely to focus on firm-specific operational involvements, whereas ESG-indexed funds and P-funds are more likely to exert influence by setting broad, market-wide governance standards. Because improving the profit performance of each firm necessitates more firm-specific operational engagements, c_{CD} is smaller (larger) when the proportion of sustainable active (ESG-indexed) funds in D-funds is higher, whereas c_{CD} and c_{CP} are smaller when the effort of firm-specific operational engagements is more complementary to the effort of setting broad, market-wide ESG governance standards. Hence, Propositions 4 and 5 along with (24) immediately yield the following predictions:

Prediction 3A: Suppose that the proportion of sustainable active (ESG-indexed) funds in D-funds increases. Then, the expected negative externalities released by firms with high-ESG scores and by all the firms in the market portfolio are **reduced (increased)**. However, the expected financial returns of firms with high-ESG scores and those of the market portfolio also **decline (increase)**.

Prediction 3B: Suppose that the effort of firm-specific operational involvements is more cost complementary with the effort of setting broad, market-wide ESG governance standards. Then, the expected negative externalities released by any type of firm **decline**. However, the expected financial returns of any type of firm also **decline**.

Combining Predictions 1A and 3A, we can suggest that if interest in ESG is not growing but if the proportion of ESG-indexed funds in D-funds increases, the expected ESG performance of firms with high-ESG scores and of all the firms in the market portfolio does not improve, whereas the expected financial returns of these firms improve.

Now, the profit of each firm in Propositions 2–5 can be interpreted as the operating

profits—that is, the EBITDA—of each firm. As a lower expected negative externality implies higher ESG scores, Propositions 2–5 provide empirical implications regarding the association between ESG scores and the EBITDA achieved by each firm.

First, Propositions 2 and 3 imply the following predictions.

Prediction 4: Growing interest in ESG leads to a positive association between ESG scores and the EBITDA attained by firms with low-ESG scores.

Prediction 5: The decreasing impact of shareholder ESG engagement on firms with high-ESG scores causes a negative association between ESG scores and the EBITDA attained in firms with high-ESG scores and in all the firms in the market portfolio.

Prediction 4 does not necessarily suggest that growing interest in ESG creates a positive association between ESG scores and the EBITDA attained by any type of firm.

Second, Propositions 4 and 5, combined with the discussion above for Predictions 3A and 3B, imply the following predictions.

Prediction 6: A higher proportion of sustainable active (ESG-indexed) funds in D-funds leads to a negative association between ESG scores and the EBITDA attained by firms with high-ESG scores and by all the firms in the market portfolio.

Prediction 7: A higher cost complementarity regarding the effort of firm-specific operational involvements with the effort of setting broad, market-wide ESG governance standards in each fund causes a negative association between ESG scores and the EBITDA attained by any type of firm.

To the best of our knowledge, Predictions 1–7 have not yet been tested. Regarding Predictions 1A, 1B, and 4, although many empirical studies report the expected financial returns of assets, they focus on cross-sectional analyses. In contrast, Predictions 1A, 1B, and 4 provide time-series predictions created by the effect of growing interest in ESG. Testing of the other predictions, using cross-sectional and panel data analyses continues to be required. To test Predictions 2 and 5, we need to identify the impact of shareholder ESG engagement on each firm, which may be estimated using the method of Hartzmark and Shue (2022). To test Predictions 3A, 3B, 6A, and 6B, differences in the accessibility and plausibility of ESG data in different industries and/or the growing accessibility and variety of ESG proxies may be used to identify the cross-sectional differences and the time-series changes in ESG engagement costs.

6. Conclusion

This paper explores how profit-motivated managers of various types of sustainable funds with divestment strategies and passive funds govern their portfolio firms when these funds aim to attract capital from socially responsible investors. We analyze a multitask situation in which the manager of each fund must determine the level of costly engagement effort to mitigate negative externalities and increase pecuniary returns in his portfolio firms, considering the cost complementarity in these efforts. We allow for variations in the impact of shareholder ESG engagement in high-ESG firms.

Considering the fund ownership effect resulting from investor capital allocation, we derive the following implications:

(i) Growing interest in ESG is likely to improve the expected ESG performance of firms with high-ESG scores and all the firms in the market portfolio, but to aggravate their expected financial returns if the D-fund has a comparative cost advantage in improving firms' *profit* performance over their *ESG* performance compared with the P-fund. However, the growing interest in ESG may not contribute to improving the expected ESG performance or to aggravating expected financial returns in these firms in a particular situation. Conversely, for firms with low-ESG scores, growing interest in ESG always improves expected ESG performance but aggravates expected financial returns. Indeed, if most of the D-funds consist of ESG-indexed funds, growing interest in ESG is likely to reduce the expected negative externalities and financial returns of any type of firm.

(ii) The decreasing impact of shareholder ESG engagement on firms with high-ESG scores reduces the expected ESG performance but improves the expected financial returns of firms with high-ESG scores and all the firms in the market portfolio. However, it does not affect the expected ESG performance or expected financial returns of firms with low-ESG scores.

(iii) The greater cost complementarity in each fund manager's efforts between improving the profit and ESG performances improves the expected ESG performance as a whole, but reduces the expected financial returns of any type of firm. Furthermore, the higher proportion of ESG-indexed funds in D-funds reduces the expected ESG performance but improves the expected financial returns of firms with high-ESG scores and all the firms in the market portfolio.

In this paper, we focus on the fund manager's multitask incentive problem in engaging in the management of his portfolio firms, and fund investors' investment allocation problems. To elucidate these problems, we abstract from the tax and interest payments of the portfolio firms. Thus, in our model, the EBITDA and net income are indistinguishable. However, in conducting empirical research, net income may be a more adequate measure of the profit of the portfolio firms for the fund manager. Hence, the tax and interest payment considerations would be an interesting extension of the empirical analysis in future research.

Appendix A

Proof of Proposition 1: We first derive statements (i), (ii), and (iv). Substituting P_G from (14) and f_D from (19) into (18), we obtain

$$(1+\psi_D-\omega_D)L_G=\psi_D(R_G-\eta Z_G),$$

which means $R_G=\frac{\psi_D+1-\omega_D}{\psi_D}L_G+\eta Z_G$. Then, (14) yields $P_G=\frac{1-\omega_D}{\psi_D}L_G$. Thus, it follows from (19) that $f_D=\frac{\omega_D\psi_D}{\psi_D+1-\omega_D}$. Similarly, using (16), (18), and (20), we can derive the solution: $f_P=\frac{\omega_P\psi_P}{\psi_P+1-\omega_P}$, $R_M=\frac{\psi_P+1-\omega_P}{\psi_P}L_M+\eta Z_M$, and $P_M=\frac{1-\omega_P}{\psi_P}L_M$. In addition, if $\omega_D\geq\omega_P$, then $\psi_D\geq\psi_P$ implies that $f_D\geq f_P$.

Next, we verify statement (iii). As the D-fund holds only the stock of G-firms, it follows from (1) and (2) with $R_M=R_G+R_B$, $e_{PG}=e_{PB}=e_P$, $E\widetilde{R}_G=R_G$, and $E\widetilde{R}_B=R_B$ that

$$R_M-R_G=R_0+e_P, \tag{A1}$$

and

$$2R_G-R_M=e_{DG}. \tag{A2}$$

It is also found from (3) and (4) with $Z_M=Z_G+Z_B$, $E\widetilde{Z}_G=Z_G$, and $E\widetilde{Z}_B=Z_B$ that

$$Z_G=Z_{G0}-\lambda a_{DG}-\lambda a_{PG}, \tag{A3}$$

and

$$Z_M=Z_{G0}+Z_{B0}-\lambda a_{DG}-\lambda a_{PG}-a_{PB}. \tag{A4}$$

Substituting a_{DG} and e_{DG} from (8) and a_{PG}, a_{PB}, and e_P from (9′) into (A3) and (A4) and rearranging them with (8), (9′), (A1) and (A2), we obtain (22) and (23).

In the remaining part, we show that under the conditions of this proposition, (a) liquidity investors hold at least some shares in each type of stock, that is, $x_{DG}+x_P<1$, (b) fund investors make a positive investment in an alternative investment opportunity such as public bonds, that is, $W_D+W_P<W$, and (c) the D-fund finds it optimal to diversify equally across all G-firms.

We first prove (a). Given that the D-fund holds only the stock of G-firms, it follows

from (1)–(4) and (13)–(16) with $R_M = R_G + R_B$ and $e_{PG} = e_{PB} = e_P$ that

$$x_{DG} + x_P = \frac{W_D}{P_G} + \frac{W_P}{P_M}. \tag{A5}$$

Note that

$$P_G = R_0 + e_{DG} + e_P - \eta Z_G - L_G \geq R_0 - \eta Z_{G0} - L_G > 0,$$

$$P_M = 2R_0 + e_{DG} + 2e_P - \eta Z_M - L_M \geq R_0 - \eta Z_{G0} - L_G > 0,$$

because we focus on the cases of $(e_{DG}, a_{DG}) > 0$ and $(e_P, a_{PG}, a_{PB}) > 0$ and because $R_0 > \max(\eta Z_{B0} + L_B, \eta Z_{G0} + L_G) > 0$. Given $W_D + W_P < W$ derived below, (A5) leads to

$$x_{DG} + x_P \leq \frac{W_D + W_P}{R_0 - \eta Z_{G0} - L_G} < \frac{W}{R_0 - \eta Z_{G0} - L_G}.$$

It follows from the condition $W < R_0 - \eta Z_{G0} - L_G$ that $x_{DG} + x_P < 1$.

We next proceed to prove (b). Rearranging (8) and (9′) with (A1) and (A2), we have

$$x_{DG} = \frac{c_{RD}}{f_D}(2R_G - R_M), \tag{A6}$$

$$x_P = \frac{c_{RP}}{f_P}(R_M - R_G - R_0). \tag{A7}$$

It is found from (13), (15), (A6), and (A7) with $R_G = \frac{\psi_D + 1 - \omega_D}{\psi_D} L_G + \eta Z_G$, $R_M = \frac{\psi_P + 1 - \omega_P}{\psi_P} L_M + \eta Z_M$, (A3), and (A4) that

$$\begin{aligned}
&W_D + W_P \\
&= P_G x_{DG} + P_M x_P = \frac{P_G c_{RD}}{f_D}(2R_G - R_M) + \frac{P_M c_{RP}}{f_P}(R_M - R_G - R_0) \\
&= \frac{P_G c_{RD}}{f_D}\left(2\frac{\psi_D + 1 - \omega_D}{\psi_D} L_G - \frac{\psi_P + 1 - \omega_P}{\psi_P} L_M + \eta Z_{G0} - \eta\lambda a_{DG} - \eta\lambda a_{PG} - \eta Z_{B0} + \eta a_{PB}\right) \\
&+ \frac{P_M c_{RP}}{f_P}\left(\frac{\psi_P + 1 - \omega_P}{\psi_P} L_M - \frac{\psi_D + 1 - \omega_D}{\psi_D} L_G - R_0 + \eta Z_{B0} - \eta a_{PB}\right).
\end{aligned} \tag{A8}$$

Define

$$\underline{W} \equiv \frac{1 - \omega_D}{\psi_D} \frac{\psi_D + 1 - \omega_D}{\omega_D \psi_D} L_G c_{RD} \left[2\frac{\psi_D + 1 - \omega_D}{\psi_D} L_G - \frac{\psi_P + 1 - \omega_P}{\psi_P} L_M + \eta Z_{G0}\right]$$

$$+\frac{1-\omega_P}{\psi_P}\frac{\psi_P+1-\omega_P}{\omega_P\psi_P}L_M c_{RP}\left(\frac{\psi_P+1-\omega_P}{\psi_P}L_M-\frac{\psi_D+1-\omega_D}{\psi_D}L_G-R_0+\eta Z_{B0}\right). \tag{A9}$$

Then, given $P_G=\frac{1-\omega_D}{\psi_D}L_G$, $P_M=\frac{1-\omega_P}{\psi_P}L_M$, $f_D=\frac{\omega_D\psi_D}{\psi_D+1-\omega_D}$, and $f_P=\frac{\omega_P\psi_P}{\psi_P+1-\omega_P}$ with the assumption of $Z_{B0}>a_{PB}$, comparing (A8) with (A9) verifies that $W_D+W_P<W$ if $W\geq\underline{W}$.

Finally, we prove (c). Indeed, applying a procedure similar to the proof of Lemma 2 in Online Appendix of Corum, Malenko, and Malenko (2021) under the condition $R_0>\eta Z_{G0}+L_G$ and the assumption of a quadratic cost function, we can show that the D-fund finds it optimal to diversify equally across all G-firms. ‖

Proof of Propositions 2–5: Substituting $R_G=\frac{\psi_D+1-\omega_D}{\psi_D}L_G+\eta Z_G$ and $R_M=\frac{\psi_P+1-\omega_P}{\psi_P}L_M+\eta Z_M$ into (22) and (23) of Proposition 1(iii), we show that Z_G, Z_B, and Z_M are determined by solving the following simultaneous equations

$$Z_B+Z_G=Z_M, \tag{A10}$$

$$Z_G=Z_{G0}-\Gamma_1-\Gamma_2, \tag{A11}$$

$$Z_M=Z_{G0}+Z_{B0}-\Gamma_1-\Gamma_2-\Gamma_3, \tag{A12}$$

where

$$\Gamma_1\equiv\eta\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}}\left(2\frac{\psi_D+1-\omega_D}{\psi_D}L_G+2\eta Z_G-\frac{\psi_P+1-\omega_P}{\psi_P}L_M-\eta Z_M\right),$$

$$\Gamma_2\equiv\eta\lambda^2\frac{c_{RP}}{c_{ZP}+c_{CP}}\left(\frac{\psi_P+1-\omega_P}{\psi_P}L_M+\eta Z_M-\frac{\psi_D+1-\omega_D}{\psi_D}L_G-\eta Z_G-R_0\right),$$

$$\Gamma_3\equiv\eta\frac{c_{RP}}{c_{ZP}+c_{CP}}\left(\frac{\psi_P+1-\omega_P}{\psi_P}L_M+\eta Z_M-\frac{\psi_D+1-\omega_D}{\psi_D}L_G-\eta Z_G-R_0\right).$$

Totally differentiating (A10)–(A12) with respect to Z_B, Z_G, Z_M, η, λ, c_{CD}, c_{CP}, and ψ_P

yields

$$\begin{bmatrix} 1 & 1 & -1 \\ 0 & 1+\frac{\partial\Gamma_1}{\partial Z_G}+\frac{\partial\Gamma_2}{\partial Z_G} & \frac{\partial\Gamma_1}{\partial Z_M}+\frac{\partial\Gamma_2}{\partial Z_M} \\ 0 & \frac{\partial\Gamma_1}{\partial Z_G}+\frac{\partial\Gamma_2}{\partial Z_G}+\frac{\partial\Gamma_3}{\partial Z_G} & 1+\frac{\partial\Gamma_1}{\partial Z_M}+\frac{\partial\Gamma_2}{\partial Z_M}+\frac{\partial\Gamma_3}{\partial Z_M} \end{bmatrix} \begin{bmatrix} dZ_B \\ dZ_G \\ dZ_M \end{bmatrix}$$

$$= \begin{bmatrix} 0 \\ -\frac{\partial\Gamma_1}{\partial\eta}-\frac{\partial\Gamma_2}{\partial\eta} \\ -\frac{\partial\Gamma_1}{\partial\eta}-\frac{\partial\Gamma_2}{\partial\eta}-\frac{\partial\Gamma_3}{\partial\eta} \end{bmatrix} d\eta + \begin{bmatrix} 0 \\ -\frac{2\Gamma_1}{\lambda}-\frac{2\Gamma_2}{\lambda} \\ -\frac{2\Gamma_1}{\lambda}-\frac{2\Gamma_2}{\lambda} \end{bmatrix} d\lambda + \begin{bmatrix} 0 \\ \frac{\Gamma_1}{c_{ZD}+c_{CD}} \\ \frac{\Gamma_1}{c_{ZD}+c_{CD}} \end{bmatrix} dc_{CD}$$
$$+ \begin{bmatrix} 0 \\ \frac{\Gamma_2}{c_{ZP}+c_{CP}} \\ \frac{\Gamma_2+\Gamma_3}{c_{ZP}+c_{CP}} \end{bmatrix} dc_{CP} + \begin{bmatrix} 0 \\ -\frac{\partial\Gamma_1}{\partial\psi_P}-\frac{\partial\Gamma_2}{\partial\psi_P} \\ -\frac{\partial\Gamma_1}{\partial\psi_P}-\frac{\partial\Gamma_2}{\partial\psi_P}-\frac{\partial\Gamma_3}{\partial\psi_P} \end{bmatrix} d\psi_P. \tag{A13}$$

Given (A6) and (A7) with $R_G = \frac{\psi_D+1-\omega_D}{\psi_D}L_G + \eta Z_G$ and $R_M = \frac{\psi_P+1-\omega_P}{\psi_P}L_M + \eta Z_M$, note that $\Gamma_1 = \eta\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}}(2R_G - R_M) = \frac{\eta\lambda^2 f_D x_{DG}}{c_{ZD}+c_{CD}}$, $\Gamma_2 = \eta\lambda^2\frac{c_{RP}}{c_{ZP}+c_{CP}}(R_M - R_G - R_0)$ $= \frac{\eta\lambda^2 f_P x_P}{c_{ZP}+c_{CP}}$, and $\Gamma_3 = \eta\frac{c_{RP}}{c_{ZP}+c_{CP}}(R_M - R_G - R_0) = \frac{\eta f_P x_P}{c_{ZP}+c_{CP}}$. It follows from (8) and (9′) that the assumption $(e_{DG}, a_{DG}) > 0$ and $(e_P, a_{PG}, a_{PB}) > 0$ means that $\Gamma_1 > 0$, $\Gamma_2 > 0$, and $\Gamma_3 > 0$.

Now, solving (A13), we show

$$\frac{dZ_B}{d\eta} = -\frac{1}{\Delta}\left(\eta Z_B\frac{c_{RP}}{c_{ZP}+c_{CP}} + \frac{\Gamma_3}{\eta}\right)\left(1+\eta^2\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}}\right) < 0, \tag{A14}$$

$$\begin{aligned}\frac{dZ_G}{d\eta} = &-\frac{\eta\lambda^2 Z_G}{\Delta}\frac{c_{RD}}{c_{ZD}+c_{CD}}\left(1+\eta^2\frac{c_{RP}}{c_{ZP}+c_{CP}}\right) - \frac{\eta\lambda^2 Z_B}{\Delta}\frac{c_{RD}}{c_{ZP}+c_{CP}}\left(\frac{c_{RP}}{c_{RD}} - \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}\right) \\ &- \frac{\Gamma_1}{\eta\Delta} - \frac{\Gamma_1}{\eta\Delta}\eta^2\frac{c_{RP}}{c_{ZP}+c_{CP}} - \frac{\Gamma_2}{\eta\Delta} - \frac{\Gamma_2}{\eta\Delta}\eta^2\frac{c_{RD}}{c_{ZD}+c_{CD}} \\ &< 0, \qquad \text{if } \frac{c_{RP}}{c_{RD}} - \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}} > 0,\end{aligned} \tag{A15}$$

$$\frac{dZ_M}{d\eta} = -\frac{\eta\lambda^2 Z_G}{\Delta}\frac{c_{RD}}{c_{ZD}+c_{CD}}\left(\eta^2\frac{c_{RP}}{c_{ZP}+c_{CP}}+1\right) - \frac{\eta Z_B}{\Delta}\left[\eta^2\lambda^2\frac{c_{RP}}{c_{ZP}+c_{CP}}\frac{c_{RD}}{c_{ZD}+c_{CD}}\right.$$

$$+\lambda^2\left(\frac{c_{RP}}{c_{ZP}+c_{CP}}-\frac{c_{RD}}{c_{ZD}+c_{CD}}\right)+\frac{c_{RP}}{c_{ZP}+c_{CP}}\Bigg]-\frac{\Gamma_1}{\eta\Delta}-\frac{\Gamma_1}{\eta\Delta}\eta^2\frac{c_{RP}}{c_{ZP}+c_{CP}}$$
$$-\frac{\Gamma_3}{\eta\Delta}-\frac{\Gamma_3}{\eta\Delta}\left(2\eta^2\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}}+\lambda^2\right)<0, \qquad \text{if } \frac{c_{RP}}{c_{RD}}>\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}, \tag{A16}$$

$$\frac{dZ_B}{d\lambda}=0, \qquad \frac{dZ_h}{d\lambda}=-\frac{2(\Gamma_1+\Gamma_2)}{\lambda\Delta}\left(1+\eta^2\frac{c_{RP}}{c_{ZP}+c_{CP}}\right)<0, \qquad h=G,M, \tag{A17}$$

$$\frac{dZ_B}{dc_{CD}}=0; \qquad \frac{dZ_h}{dc_{CD}}=\frac{\Gamma_1}{(c_{ZD}+c_{CD})\Delta}(1+\eta^2\frac{c_{RP}}{c_{ZP}+c_{CP}})>0, \qquad h=G,M, \tag{A18}$$

$$\begin{aligned}
\frac{dZ_B}{dc_{CP}}&=\frac{\Gamma_3}{(c_{ZP}+c_{CP})\,\Delta}(1+\eta^2\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}})>0,\\
\frac{dZ_G}{dc_{CP}}&=\frac{\Gamma_2}{(c_{ZP}+c_{CP})\,\Delta}(1+\eta^2\frac{c_{RD}}{c_{ZD}+c_{CD}})>0,\\
\frac{dZ_M}{dc_{CP}}&=\frac{\Gamma_3}{(c_{ZP}+c_{CP})\,\Delta}(1+\lambda^2+2\eta^2\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}})>0,
\end{aligned} \tag{A19}$$

$$\frac{dZ_B}{d\psi_P}=\frac{(1-\omega_P)\eta L_M}{(\psi_P)^2\Delta}\left(\frac{c_{RP}}{c_{ZP}+c_{CP}}+\eta^2\lambda^2\frac{c_{RP}}{c_{ZP}+c_{CP}}\frac{c_{RD}}{c_{ZD}+c_{CD}}\right)>0, \tag{A20}$$

$$\frac{dZ_G}{d\psi_P}=\frac{(1-\omega_P)\eta\lambda^2 L_M}{(\psi_P)^2\Delta}\frac{c_{RD}}{c_{ZP}+c_{CP}}\left(\frac{c_{RP}}{c_{RD}}-\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}\right)\gtreqless 0, \quad \text{if and only if } \frac{c_{RP}}{c_{RD}}\gtreqless\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}, \tag{A21}$$

$$\frac{dZ_M}{d\psi_P}=\frac{(1-\omega_P)\eta L_M}{(\psi_P)^2\Delta}\frac{c_{RD}}{c_{ZP}+c_{CP}}\left[(1+\lambda^2)\frac{c_{RP}}{c_{RD}}+\eta^2\lambda^2\frac{c_{RP}}{c_{ZD}+c_{CD}}-\lambda^2\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}\right]>0,$$
$$\text{if and only if } \frac{c_{RP}}{c_{RD}}>\frac{\lambda^2}{1+\lambda^2+\eta^2\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}}}\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}, \tag{A22}$$

where $\Delta=1+\eta^2\left(\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}}+\frac{c_{RP}}{c_{ZP}+c_{CP}}+\eta^2\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}}\frac{c_{RP}}{c_{ZP}+c_{CP}}\right)>0$. It follows from (A14)–(A19) that the results of the expected negative externalities in Propositions 2–5 are obtained. In (A15) and (A16), note that $\frac{\Gamma_1}{\eta\Delta}$, $\frac{\Gamma_2}{\eta\Delta}$, and $\frac{\Gamma_3}{\eta\Delta}$ express the direct effects of η on the ESG effort incentives of the D- and P-fund managers, whereas the other terms represent the fund ownership effects of η on these ESG effort incentives.

Given Proposition 1(ii), we have

$$\frac{dR_h}{d\eta}=Z_h+\eta\frac{dZ_h}{d\eta}, \qquad h=G,M, \tag{A23}$$

$$\frac{dR_h}{d\lambda} = \eta \frac{dZ_h}{d\lambda}, \qquad h = G, M, \tag{A24}$$

$$\frac{dR_h}{dc_{Ci}} = \eta \frac{dZ_h}{dc_{Ci}}, \qquad h = G, M, \text{ and } i = D, P, \tag{A25}$$

$$\frac{dR_G}{d\psi_P} = \eta \frac{dZ_G}{d\psi_P}; \qquad \frac{dR_M}{d\psi_P} = -\frac{(1-\omega_P)L_M}{(\psi_P)^2} + \eta \frac{dZ_M}{d\psi_P}. \tag{A26}$$

In addition,

$$\frac{dR_B}{d\chi} = \frac{dR_M}{d\chi} - \frac{dR_G}{d\chi}, \qquad \chi = \eta, \lambda, c_{CD}, c_{CP}, \psi_P. \tag{A27}$$

Inspecting (A23)–(A25) and (A27) with (A14)–(A19), we prove the results of the expected profits in Propositions 2–5.

Finally, it follows from Proposition 1(i) that

$$\frac{df_i}{d\eta} = \frac{df_i}{d\lambda} = \frac{df_i}{dc_{Zj}} = 0, \qquad i = D, P; \ j = D, P, \tag{A28}$$

$$\frac{df_D}{d\psi_P} = 0; \qquad \frac{df_P}{d\psi_P} = \frac{\omega_P(1-\omega_P)}{(\psi_P + 1 - \omega_P)^2} > 0. \tag{A29}$$

It follows from (A28) that the results of the asset management fees in Propositions 2–5 are verified. ‖

Proof of Predictions 1A and 1B: Comparing Proposition 1(ii) with (24), we show that $\frac{d(R_i - P_i)}{d\eta} = \frac{dR_i}{d\eta}$ for $i = G, B, M$. Hence, it follows from Propositions 2(i)–2(iii) that the statements of Predictions 1A and 1B are obtained. ‖

Appendix B

B.1. Multiple D- and P-funds.—

Our basic model can be extended to the case of multiple funds in which there are N_D D-funds and N_P P-funds. All N_D D-funds only invest in and diversify the stocks of G-firms, whereas all N_P P-funds invest in the market portfolio. As we focus on symmetric equilibria, the same type funds choose the same effort and bargaining strategies and the same fund size. Then, under a quadratic cost function of efforts, we can show that all of our propositions continue to hold by applying the discussion of Corum, Malenko, and Malenko (2021).

B.2. Non-sustainable funds and non-socially responsible investors.—

We can consider a third type of fund as a non-sustainable fund (N-fund), which invests only in B-firms. The fund manager of the N-fund invests in B-firms on behalf of investors and is interested purely in his monetary payoffs. There is also a large mass of non-socially responsible investors, who have no ESG preference and are purely interested in their monetary payoffs. Then, we can discuss whether our results are robust to these changes. For convenience, fund investors and liquidity investors in the basic model are denoted as socially responsible investors.

For simplicity, we assume that socially responsible investors, due to their ESG preferences, avoid investing in the N-fund. Conversely, non-socially responsible investors base their investment decisions on whether to invest in the N-fund or alternative opportunities such as public bonds.[31] We denote their aggregate wealth as W^+, which is given exogenously. Each investor of this category must search for and vet the N-fund manager, incurring a search cost $\psi_N \varepsilon_N$, where ε_N represents the investment amount in the N-fund and is normalized to adjust the scale of ψ_N. Subsequently, upon finding the N-fund manager, negotiation of the fee f_N occurs through generalized Nash bargaining.

Under these assumptions, we begin with the scenario where the fund manager of the N-fund has no governance role in his portfolio firms. This setup reflects the N-fund's primary objective of seeking higher financial returns primarily through arbitrage trading. Then, the basic model is modified as follows. As shown in Section 4.4, in the basic model, the endogenous variables consisting of the effort decisions, $(e_{DG}, a_{DG}, e_P, a_{PG}, a_{PB})$, the asset management fees, (f_D, f_P), the trading decisions and investment asset allocations, (x_{DG}, x_P, W_D, W_P), the total expected payoffs of the D- and P-funds, $(R_G - \eta Z_G, R_M - \eta Z_M)$, and the asset prices, (P_G, P_M), are determined by (8), (9′), (10), and (13)–(20). In this extended model, we additionally need to determine the asset management fee of the N-fund, f_N, the holding shares of the N-fund in B-firms, x_{NB}, the investment amount of the N-fund in B-firms, W_N, and the price of B-firms, P_B.

[31] Non-socially responsible investors, driven solely by monetary payoffs, seek assets with the highest rate of expected net return among the D-fund, the N-fund, the P-fund, and alternatives like public funds. However, we can show that the N-fund offers the highest rate of expected net return if non-socially responsible investors allocate a positive portion of their wealth to the N-fund.

First, P_B is given by (12). Second, for W_N and fixed W^+, x_{NB} satisfy

$$x_{NB} = \frac{W_N}{P_B} \leq \frac{W^+}{P_B}. \tag{B1}$$

Third, the N-fund fee f_N is determined by generalized Nash bargaining between the N-fund manager and non-socially responsible investors. Because both agents are purely interested in their pecuniary returns, their concern is to distribute $R_B \frac{\varepsilon}{P_B}$ in this case. Hence, it follows from the discussion at the end of Section 4.3 that

$$f_N = \omega_N \left(1 - \frac{P_B}{R_B}\right), \tag{B2}$$

where ω_N is the bargaining power of the N-fund manager and R_B is given by (2) for e_P determined from the above-mentioned equation system of the basic model.

The remaining problem is to show how W_N is chosen by non-socially responsible investors. As non-socially responsible investors decide whether they invest in the N-fund or the alternative investment opportunity such as public bonds, we need to specify the expected payoff of non-socially responsible investors attained by investing in the N-fund. This expected payoff is represented by

$$(1 - f_N)\frac{R_B}{P_B} - \psi_N. \tag{B3}$$

Because R_B and P_B are given by (2), (4), and (12) for e_P and a_{PB} determined from the above-mentioned equation system of the basic model, it follows from (B2) that the value of (B3) may not be generically equal to 1; thus, it may be smaller than 1 or larger than 1. Hence, if (B3) is larger than 1, non-socially responsible investors invest their entire wealth in the N-fund, that is, $W_N = W^+$. Otherwise, they do not invest in the N-fund, that is, $W_N = 0$.

In either case, even in this extended model, the endogenous variables in the basic model are still determined in the exactly same way as in the main text. Consequently, none of our main results are affected because Proposition 1 still holds in this extended model.

We next examine the case in which the fund manager of the N-fund exerts governance effort e_{NB} to increase the profit of B-firms by incurring a private engagement cost

$c_{RN}(e_{NB})$, where $c_{RN}(e) = \frac{c_{RN}}{2}e^2$. Then, as the negative externality released by each firm is affected by a fund ownership effect because of a change in e_{NB}, we cannot derive our main results generally. However, if socially responsible investors' ESG preference, η, is not large, R_B and P_B are almost taken as exogenous because R_B and P_B are almost unaffected by Z_B. Thus, the effect of a change in e_{NB} is not large. Similarly, if the bargaining power of the N-fund manager, ω_N, is not large, and/or if the wealth of non-socially responsible investors, W^+, is not large, the effect of a change in e_{NB} is not large because e_{NB} is not large in this case. Then, our main results are almost certainly true in these cases.

B.3. Effect of P-fund growth.—

It has been discussed frequently that ESG investing is harmed by P-fund growth because P-funds automatically invest their money in firms with lower ESG scores unlike D-funds. However, as has been argued in this paper, P-funds have an ability to monitor their portfolio firms and force the management of the firms to improve their ESG performance. Hence, to investigate the above problem, we must analyze P-fund growth by incorporating the P-fund manager's engagement with their portfolio firms. A decrease in ψ_P can be thought of as indicating easy access to the P-fund over time and bring about P-fund growth because it reflects more investor awareness about the fund and improved disclosure about the investment strategy and the fee structure of the fund.[32]

We then have the following proposition.[33]

Proposition 6: *Suppose that access to the P-fund becomes easier (i.e., ψ_P is lower).*
(i) The expected negative externality released by G-firms, Z_G, decreases if $\frac{c_{RP}}{c_{RD}} > \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ but increases otherwise. The expected profit of G-firms, R_G, decreases if $\frac{c_{RP}}{c_{RD}} > \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ but increases otherwise.
(ii) The expected negative externality released by B-firms, Z_B, decreases, whereas the expected profit of B-firms, R_B, increases.
(iii) The expected negative externality released by all the firms in the market portfolio, Z_M, decreases if $\frac{c_{RP}}{c_{RD}} > (1 + \lambda^2 + \eta^2\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}})^{-1}\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ but increases otherwise.
(iv) The asset management fee of the D-fund, f_D, is unaffected, whereas that of the P-fund,

[32] Corum, Malenko, and Malenko (2021) provide the same interpretation of a decrease in the search cost.

[33] The result of the expected negative externality of each firm is obtained from (A20)–(A22). The results of the expected profits of G-firms and B-firms are derived from (A26) and (A27).

f_P, decreases.

The intuition behind Proposition 6 is easily understandable by dividing the effect of ψ_P into two parts: the fund fee effect and the fund ownership effect. We begin by discussing the effect of the lower ψ_P on f_D and f_P. The effect of the lower ψ_P on f_P follows from an effect of the decrease in the rate of expected gross return earned by the P-fund. The reason is that the lower ψ_P increases fund investors' rate of expected net return of the P-fund from which ψ_P is deducted. In equilibrium, however, fund investors are indifferent between investing in the P-fund and the alternative investment opportunity (see (18)). To restore (18), fund investors increase their investment in the P-fund until fund investors' rate of expected gross return from the P-fund decreases so that their rate of expected net return returns to 1. A decrease in fund investors' rate of expected gross return from the P-fund then leads to a lower f_P because the P-fund manager's bargaining power ω_P is assumed to be fixed. Indeed, in the expression for the fund fee in Proposition 1(i), this effect is featured as a dependence of f_P on ψ_P. However, the lower ψ_P has no effect on the D-fund fee because it does not affect fund investors' expected net return from the D-fund exclusive of the search cost ψ_D.

Indeed, to examine the effect of the lower ψ_P on the expected negative externality, we need to consider both the fund fee effect and the fund ownership effect. Note that the effort incentive for each fund manager to reduce the negative externality depends on the fund fee and the fund ownership stakes for fixed η, λ, c_{ZD}, c_{CD}, c_{ZP}, and c_{CP}, as indicated in (8) and (9′). For the effect through the fund fee, a decrease in ψ_P reduces the P-fund fee f_P, but does not affect the D-fund fee f_D, as discussed above. This weakens the effort incentive for the P-fund manager to reduce the negative externality in all the firms in the market portfolio and thus increases Z_G and Z_M. However, it has no effect on the effort incentive for the D-fund manager to reduce the negative externality in G-firms.

A decrease in ψ_P also changes the fund ownership stakes in firms. If ψ_P decreases, fund investors increase their investment in the P-fund, W_P, because their expected net return from the P-fund increases, as argued above. This enables the P-fund manager to take increasingly large stakes x_P in all the firms in the market portfolio. The increase in x_P reduces the stakes held by the D-fund, x_{DG}, and those held by liquidity investors, $1 - x_{DG} - x_P$, in G-firms, while it also reduces the stakes held by liquidity investors, $1 - x_P$, in the market portfolio. Note that the D-fund does not buy the market portfolio. The effect of

the decrease in x_{DG} of the D-fund in G-firms reduces the engagement effort of the D-fund manager in G-firms and thus increases Z_G and Z_M. However, the effect of the decrease in $1 - x_{DG} - x_P\,(1 - x_P)$ of liquidity investors in G-firms (in the market portfolio) reduces Z_G (both Z_G and Z_M). The reason is that if the P-fund replaces liquidity investors in G-firms' ownership (in the market portfolio ownership), this effect decreases Z_G (both Z_G and Z_M) because liquidity investors do not make any engagement efforts.

In evaluating the effects of the lower ψ_P on Z_G (Z_M), note that the total effects through changes in the fund fees and the fund ownership stakes depend on the difference in $\frac{c_{RP}}{c_{RD}}$ and $\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ $((1 + \lambda^2 + \eta^2\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}})^{-1}\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}})$. Accordingly, the lower ψ_P reduces Z_G (Z_M) as long as $\frac{c_{RP}}{c_{RD}}$ is larger than $\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ $((1 + \lambda^2 + \eta^2\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}})^{-1}\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}})$. However, for Z_B, the total effects of the lower ψ_P do not include any effect through a change in the stakes held by the D-fund. As the effect of replacing liquidity investors is dominant, the lower ψ_P always reduces Z_B.

To investigate the effect of the lower ψ_P on the expected profit, note that the expected profit is positively associated with the expected negative externality in G-firms and in market portfolio firms (see Proposition 1(ii)). Then, for R_G, we show that the lower ψ_P decreases R_G as long as $\frac{c_{RP}}{c_{RD}}$ is larger than $\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$. However, for R_M, there exists an additional direct effect of the lower ψ_P on the effort incentive for the P-fund manager through the P-fund fee to increase the profit, which increases R_M. Hence, the effect of the lower ψ_P on R_M is ambiguous. For R_B, as the effect of replacing liquidity investors is dominant, the lower ψ_P always increases R_B.

The theoretical implication of Proposition 6 is that because P-fund growth affects fund investors' capital allocation and then changes the fund ownership stakes, the effect of P-fund growth on the expected negative externality strongly depends on the comparative cost advantage between each fund in improving ESG or profit performance, like the effect of growing interests in ESG. Accordingly, despite the recent argument about the P-fund not contributing to ESG, P-fund growth does not necessarily avoid the reduction in the expected negative externality.

Given the argument in Section 5, it easily follows from Propositions 6(i)–6(iii) along with (24) that the following predictions are obtained:[34]

Prediction 7A: If improving ESG performance can be achieved to a certain degree by

[34]Note that $\frac{c_{RP}}{c_{RD}} > \frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$ implies $\frac{c_{RP}}{c_{RD}} > (1 + \lambda^2 + \eta^2\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}})^{-1}\frac{c_{ZP}+c_{CP}}{c_{ZD}+c_{CD}}$.

setting broad, market-wide standards of ESG, and if the cost complementarity in the D-fund manager's efforts is not sufficiently large, the growth in P-funds is likely to **reduce** the expected negative externalities released by firms with high-ESG scores and by all the firms in the market portfolio. However, it is also likely to **reduce** the expected financial returns of these firms. Nonetheless, the growth in P-funds always **reduces** the expected negative externalities released by firms with low-ESG scores and their expected financial returns.

Prediction 7B: If most D-funds consist of ESG-indexed funds, the growth of P-funds is likely to reduce the expected negative externalities and expected financial returns of any type of firm.

These predictions suggest that P-fund growth does not necessarily hinder the improvement in ESG performance, contrary to the argument of environmental activists.

Given Proposition 6, the argument in Section 5 also leads to the following prediction:

Prediction 8: P-fund growth causes a negative association between ESG scores and EBITDA attained in firms with high-ESG scores. However, it brings about a positive association between ESG scores and EBITDA attained in firms with low-ESG scores.

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Time 0				Time 1
Fund investors allocate their wealth between a D-fund, a P-fund, and outside investment opportunities. Fund investors search for fund managers.	Fund investors and fund managers negotiate a management fee.	Fund managers invest the delegated amount of fund investors' wealth. Liquidity investors trade.	Fund managers exert their efforts regarding ESG and profit performances.	Payoffs are realized.

Figure 1. Timing of the model