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Meg ADACHI-SATO
Hiroshi OSANO

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Research Institute for Economics and Business Administration
Kobe University
2-1 Rokkodai, Nada, Kobe 657-8501 JAPAN

Sustainable Investing Under Delegated Investment Management*

Meg Adachi-Sato† and Hiroshi Osano‡

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†Faculty of Business Administration, Osaka University of Economics, 2-2-8, Osumi, Higashiyodogawa-ku, Osaka 533-8533, Japan, and Research Institute for Economics and Business Administration (RIEB), Kobe University 2-1, Rokkodai-cho, Nada-ku, Kobe 657-8501 Japan. e-mail address: m-sato@osaka-ue.ac.jp; work phone number: +81-6-6328-2431.

‡Corresponding author. Faculty of Economics, Konan University, 8-9-1, Okamoto, Higashinada-ku, Kobe 658-8501, Japan. e-mail address: osano@kier.kyoto-u.ac.jp; work phone number: +81-78-431-3024.

Sustainable Investing Under Delegated Investment Management

Abstract

This paper examines how profit-motivated fund managers of sustainable funds 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. We consider the fund-ownership effect resulting from investor capital allocation and we clarify several implications for 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.

JEL Classification: D83, G23, G32, M14.

Keywords: delegated asset investment, ESG, passive fund, social impact, socially responsible investing, sustainable fund, fund ownership effect.

1. Introduction

Recent decades have seen a growing preference for environmental, social and governance (ESG) investments among investors, who seek nonpecuniary as well as pecuniary benefits from these investments. Consequently, numerous sustainable investments have emerged in the market.[1] However, a significant portion of sustainable investments is made by institutional investment funds, such as sustainable funds, which are managed by asset managers who have incentives to prioritize their own pecuniary gains. Such fund managers, therefore, need to engage with the market to obtain optimal outcomes in both pecuniary gains and ESG performance. In this paper, we examine how fund ownership and fund managers' costly engagement efforts affect firms' ESG performance and financial returns in the presence of fundamental environmental changes. We consider a market with a sustainable fund and a passive fund. Each fund's profit-driven managers appeal to socially responsible investors by engaging in efforts that boost both ESG and profit-oriented outcomes.

In practice, there are sustainable funds whose dominant strategy is to buy only stocks of firms with high ESG performance. In this paper, we refer to these funds as D-funds, as in divestment funds. We consider two types of D-funds: the first is active sustainable D-funds, in which fund managers actively choose firms with high ESG performance; the second is ESG-indexed D-funds, in which fund managers buy stocks of high ESG firms, targeting the index.[2] Such a strategy may bring funds into high ESG performance firms and thereby increase their market cap, while motivating firms with low ESG performance to enhance their ESG performance. However, some argue that a sustainable investing strategy that directs capital away from firms with low ESG performance to high ESG performance may be counterproductive. This is because this strategy may lead the low ESG firms to further lower their ESG performance, and it may not necessarily motivate high ESG performance firms to increase their engagement in relation to ESG performance (see for example, Hartzmark and Shue, 2022).

[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.

On the other hand, there has been significant growth in the number of passive funds, which we refer to as P-funds in this paper.[3] P-fund managers create market portfolios aligned with an index, and hence they 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 for ESG activists because the presence of these funds in the market undermines ESG activists' efforts to convince investors to avoid stocks with low ESG performance.[4] However, there is mixed empirical evidence on the governance role of P-funds.[5] Furthermore, recently, P-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.

In this research, we consider a market with i) D-fund, ii) P-fund, iii) fund investors who buy safe assets on their own and/or invest in firms only via funds, iv) liquidity investors who buy safe assets or firm shares directly but make no engagement efforts, v) firms with high-ESG scores (hereafter G-firms), and vi) firms with low-ESG scores (hereafter B-firms). D-fund only invests in G-firms, and its manager endogenously determines his engagement strategies. P-fund invests in both G- and B-firms, and its manager also endogenously determines his engagement strategies for these firms. In this paper, all G-firms are identical and all B-firms are identical that we need only consider one representative firm for each. Both investors endogenously make capital allocation decisions among assets, thereby influencing the fund ownership stakes of each firm. These ownership stakes influence the engagement efforts the fund managers make in relation to their portfolio firms: one is to improve ESG performance and the other is to improve pecuniary returns.[6] These engagement efforts may be either cost complementary or substitutable

[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, 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.

[6]The engagement efforts made by a fund manager always increase the relevant expected values. For

to each other, which can mean that the increase in engagement efforts to improve ESG performance can either reduce or increase the cost of engagement efforts to improve profits. 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, we attempt to provide answers for the following questions that may rise when the market comprises both D-funds and P-funds. First, how does growing interest in ESG among the investors affect ESG performance and pecuniary returns? In this paper, enhancing ESG performance is synonymous with reducing negative externalities. Hence, the question can be reformed as: does growing interest in ESG truly have a counterproductive effect, as pointed out by Hartzmark and Shue (2022), on reducing negative externalities and increasing pecuniary returns? Second, how does the decreasing impact of fund managers' ESG engagement efforts on G-firms affect the negative externalities and pecuniary returns of both firms? The final question is, how does the cost complementarity in fund managers' efforts between improving profit and ESG performances affect the negative externalities and pecuniary returns of both firms?

To the best of our understanding, this paper is the first theoretical study to examine how fund managers' engagement efforts towards their portfolio firms affect ESG performances and pecuniary returns across different types of firms in a market that includes D-fund, P-fund and liquidity investors. Our model is unique in that it considers how endogenous changes in fund-ownership stakes influence the two engagement efforts made by fund managers. By capturing these in our theoretical analysis, we believe our findings can answer the questions raised in the prior paragraph.

We develop 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. As in Corum, Malenko and Malenko (2021), liquidity investors only determine the stock price. When the fund investors invest their wealth in firms, they can only do so via funds. 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

example, if a fund manager increases his ESG engagement effort, the firm's expected ESG increases, and as a result, its expected negative externality decreases.

fund manager invests in firms that differ in the sustainability of their activities: the D-fund buys only the stocks of G-firms; and the P-fund invests in both G- and B-firms, which forms a value-weighted market portfolio.[7] After investing, each fund manager chooses his costly level of ownership engagement efforts.

We conduct three comparative static analyses for all three questions we explore in this paper and derive a few results in each. We obtain the results for the first question by conducting comparative statics with respect to the ESG preferences among the investors: i) growing interest in ESG always reduces the expected negative externality but raises the expected profit for B-firms. However, ii) if the D-fund manager has a comparative cost advantage over the P-fund manager in improving firms' profit performance over improving firms' ESG performance, the expected negative externality decreases for G-firms. If, on the other hand, the D-fund manager has a comparative cost advantage over the P-fund manager in improving firms' ESG performance, G-firms may exhibit more expected negative externalities under some conditions.

The results can be seen in terms of the direct effect and the fund-ownership effect. The direct effect is straightforward – as the investors' ESG preferences grow, the marginal return from making engagement effort on ESG performance increases. This is because the cost parameters of the effort are fixed. As a result, as investors' preference for ESG outcomes increases, both D- and P-fund managers make greater efforts in ESG engagement. However, there is also a fund-ownership effect, which occurs through a change in the fund-ownership stake. This involves investors' capital allocation among assets, and therefore it is more complicated than the direct effect. In our model, shares of G-firms are held by the D-fund, P-fund, and liquidity investors, while shares of B-firms are held by the P-fund and liquidity investors.

If investors shift their funds into the P-fund from the D-fund in response to their increasing preferences for ESG outcomes,[8] this reduces funds invested in the D-fund and the D-fund's investment in G-firms. Due to the reduction in the fund-ownership stake in G-firms, the D-fund manager has less incentive to make costly efforts to improve the ESG performance of G-firms. On the other hand, due to the rise in the fund ownership stake in both firms, the P-fund manager has more incentive to improve the ESG performance

[7] In internet 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.

[8] The theoretical section has a detailed model on how this shift occurs.

of firms in P-fund's portfolio. In addition, if the D-fund manager has a comparative cost advantage over the P-fund manager in improving firms' profit performance rather than their ESG performance, the D-fund manager does not contribute much to improving ESG outcomes. Therefore, the combined ESG performance resulting from the engagement efforts of both D- and P- fund managers increases, leading to a reduction in the negative externalities generated by G-firms.

If, however, in the same scenario, the D-fund manager has a comparative cost advantage over the P-fund manager in improving ESG performance over profit performance, then the D-fund manager will make a larger contribution to improving ESG performance. In this case, the fund-ownership effect caused by the shift in funds from the D-fund to the P-fund dominates the direct effect. This causes G-firms to generate more negative externalities.

Finally, for the B-firms, there is no fund-ownership effect between D- and P-funds. This means that if investors shift funds from D- to P-funds due to stronger preferences for ESG outcomes, the B-firms will always see a decline in negative externalities and an increase in the expected profit.

Our first comparative static result regarding ESG preferences yields a theoretical implication for the findings of Hartzmark and Shue (2023). They argue that ESG efforts have a limited impact on G-firms. However, we consider the fund-ownership effect, and our results show that the effect of increasing preferences for ESG outcomes on negative externalities may depend on the comparative cost advantage between D- and P-fund managers.

The results of the second question are as follows. We conduct comparative statics regarding the impacts of ESG engagement by D-fund and P-fund managers on G-firms. This question is important, because it can show whether it is worthwhile to expend effort on ESG engagement with firms that already have high ESG scores. We find that as the impact of ESG engagement weakens, i) G-firms' expected negative externality increases but so does their expected profit, and ii) neither B-firms' expected negative externality nor their expected profit is affected.

Intuitively, this decreasing impact directly weakens the incentives for both D- and P-fund managers to expend ESG efforts on G-firms. Although the increase in the D-fund's investment in G-firms causes the fund-ownership effect, this effect is exceeded by the direct effect for G-firms' ESG outcomes, while it remains for G-firms' profit outcomes.

Therefore, G-firms' expected negative externality and expected profit increase. As for B-firms, comparative statics on the impact of ESG engagement effort on G-firms do not have any direct effect on B-firms. Moreover, as the D-fund holds no shares in B-firms, there is no fund ownership effect between D- and P-funds.

The third comparative static analysis relates to cost complementarity between the ESG and profit performances of P- and D-fund managers. For G-firms whose shares are held by D- and P-fund managers, greater cost complementarity in these efforts reduces the expected negative externality, and it also reduces the expected profit. For the B-firms, we need only consider the P-fund manager, but the results are the same.

Intuitively, when cost complementarity increases for a specific fund manager, this directly strengthens their incentive to expend effort in relation to ESG, but it does not have any influence on the incentives for the other fund manager. For G-firms, this means that the mechanism is the same as for the impacts of the ESG engagement discussed above. However, the result turns out to be completely the opposite. 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.

Finally, we consider the empirical implications of our theoretical results by 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. Under this scenario, 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.

In this setting, we suggest the following. First, growing interest in ESG is likely to improve expected ESG performance but decrease expected financial returns in all firms if the cost complementarity of the D-fund manager's efforts is not sufficiently large, particularly if most of the D-funds comprise ESG-indexed funds. In particular, 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 earnings before interest, taxes, depreciation and amortization (EBITDA)

of 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 in the market portfolio. Furthermore, it causes a negative association between ESG scores and the EBITDA attained by firms with high ESG scores and by the market portfolio.

Third, given that sustainable active funds are more inclined to focus on firm-specific operational engagements compared with ESG-indexed funds, our results predict that there is a greater cost complementarity between the efforts of fund managers in sustainable active funds than between the efforts of fund managers in ESG-indexed funds. Thus, as the proportion of ESG-indexed funds in D-fund increases, ESG performance tends to decrease, while financial returns are expected to rise in firms with high ESG scores. The increase in the proportion of ESG-indexed funds in D-funds also causes a negative association between ESG scores and the EBITDA for firms with high-ESG scores and for the market portfolio. Additionally, as the cost complementarity between firm-specific engagement efforts and the creation of broad market-wide ESG standards increases, ESG performance is expected to improve, while financial returns are expected to decrease across all types of firms. The increase in the cost complementarity also causes a negative association between ESG scores and the EBITDA attained by all firms.

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. Internet Appendix A provides the proofs of all propositions. Internet 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) investigate how the growth of passive funds, shown by lower search costs for P-fund investors, influences fund managers' governance incentives to increase the profits of their portfolio firms.[9] In 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 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.

Several papers examine the impact of socially responsible investors providing additional capital for sustainable investments when firms face financing constraints, in the context of interactions between socially responsible and traditional profit-focused investors. 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,

[9] 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.

and they set out alternative strategies for socially responsible investors that result in higher social welfare and higher financial returns. Oehmke and Opp (2024) study the optimal financial arrangement for a socially responsible fund engaging with entrepreneurs interested in ESG when for-profit financial capital is available. They show that the overall surplus is maximized in an economy with a balanced presence of both socially responsible and for-profit financial capital. Landier and Lovo (2024) consider a model in which investors have heterogeneous preferences for social performance, and entrepreneurs face decisions about whether to produce goods that release emissions and whether to comply with the conditions set by a socially responsible fund aiming to maximize its size. They then examine the impact of three strategies employed by the socially responsible fund: (i) the simple exclusion of the polluting sector, (ii) reducing individual firm emissions through direct investment in the polluting sector, and (iii) reducing individual firm emissions via the supply chain.

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. They ask whether such labeling is socially optimal. Hartzmark and Shue (2022) find that current sustainable investment strategies mainly reward green firms for trivial reductions in their already low levels of negative externalities.

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. In this scenario, 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, unlike similar

studies, we examine the interaction between fund investors reallocating investments across assets and fund managers shifting their engagement efforts across tasks, considering the presence of D- and P-funds. This interaction may cause the growing interest in ESG to fail to effectively improve 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 Internet 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 environment 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.

We assume that the realized profit and negative externality of each firm are observable at time 1. However, noise terms prevent fund investors from directly stipulating the unobservable efforts of their fund managers by merely observing the realized profit and negative externality.

More specifically, the expected profit of firm G_j is represented by

$$R_{G_j} = R_0 + \sum_{i \in \Upsilon_{G_j}} e_{iG_j}, \tag{1}$$

where R_0 is the base profit without shareholder engagement, e_{iG_j} is the amount of unob-

servable effort exerted by shareholder i to improve the profit of firm G_j, and Υ_{G_j} is the set of shareholders of firm G_j. Similarly, the expected profit of firm B_j is

$$R_{B_j} = R_0 + \sum_{i \in \Upsilon_{B_j}} e_{iB_j}, \tag{2}$$

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

The expected negative externality released by firm G_j is given by

$$Z_{G_j} = Z_{G0} - \lambda \sum_{i \in \Upsilon_{G_j}} a_{iG_j}, \tag{3}$$

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

$$Z_{B_j} = Z_{B0} - \sum_{i \in \Upsilon_{G_j}} a_{iB_j}, \tag{4}$$

where Z_{B0} is the negative externality of B-firms without shareholder engagement, and a_{iB_j} is the amount of unobservable effort exerted by shareholder i to improve the ESG performance of firm B_j. 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).

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 Internet 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 of $\frac{1}{2}c_{Ri}(e_{ih_j})^2 + \frac{1}{2}c_{Ci}(a_{ih_j})^2$ for $i \in (D, P)$ and $h \in (G, B)$ to improve profit performance. He also incurs a private cost of $\frac{1}{2}c_{Zi}(a_{ih_j})^2$ for $i \in (D, P)$ and $h \in (G, B)$ to improve ESG performance. We assume that $c_{Ri} > 0$ 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 $c_{Zi} + c_{C\,i} > 0$. This 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 if $c_{Ci} < 0$ ($c_{Ci} > 0$).

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

[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 Internet Appendix B.1 for further details.

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 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]

[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.

[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

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] 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

9 in their text. Furthermore, in our model, the positive search costs, $(\psi_D, \psi_P) > 0$, ensure that the fund investors' indifference conditions, (17), can be compatible with the Nash bargaining outcomes, (18) and (19), under the equity pricing rule, (13) and (15).

[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.

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

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 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]

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

[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,

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.—

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-firms, and that the sum of the expected profit and the expected disutility from the negative externality of the G-firms 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-firms and the B-firms, and that the sum of the expected profit and the expected disutility from the negative externality of firm h

whereas liquidity investors submit a limit order reflecting their valuation of each stock.

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

is $R_h - \eta Z_h$ for $h \in (G, B)$.

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

$$e_{DG} = \frac{f_D x_{DG}}{c_{RD}} \text{ and } a_{DG} = \frac{\eta \lambda f_D x_{DG}}{c_{ZD} + c_{CD}}, \tag{7}$$

$$e_{Ph} = \frac{f_P x_{Ph}}{c_{RP}} \text{ and } a_{Ph} = \frac{\eta \lambda_h f_P x_{Ph}}{c_{ZP} + c_{CP}}, \qquad \text{for } h \in (G, B), \tag{8}$$

where $\lambda_G = \lambda$ and $\lambda_B = 1$. Next, (7) and (8) imply the following for the fund manager's efforts for $i \in (D, P)$ and $h \in (G, B)$: (i) the more the fund manager holds the shares of his portfolio firms (i.e., an increase in x_{ih}) and/or the higher the management fee (i.e., an increase in f_i), the more the engagement efforts regarding both firm profit and ESG performance are exerted; (ii) the higher the degree of investors' ESG preference (i.e., increase in η), the more effort regarding ESG performance is exerted for all firms; (iii) the more effective the effort regarding the ESG performance of G-firms (i.e., increase in λ), the more effort on ESG performance is exerted for G-firms; and (iv) the higher the cost complementarity between efforts regarding firm profit and ESG performance for the fund manager (i.e., decrease in $c_{C\,i}$), the more effort regarding ESG performance is exerted.

4.2. Trading decisions.—

In making their trading decisions, liquidity investors and fund managers rationally anticipate the fund managers' effort decisions given by (7) and (8).

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), (7), and (8) that the liquidity investors' assessment of the stock of G-firms is

$$R_G - \eta Z_G - L_G = R_0 + \frac{f_D x_{DG}}{c_{RD}} + \frac{f_P x_{PG}}{c_{RP}} - \eta \left(Z_{G0} - \lambda \frac{\eta \lambda f_D x_{DG}}{c_{ZD} + c_{CD}} - \lambda \frac{\eta \lambda f_P x_{PG}}{c_{ZP} + c_{CP}} \right) - L_G. \tag{9}$$

Similarly, using (2), (4), and (8), liquidity investors' assessment of the stock of B-firms is

$$R_B - \eta Z_B - L_B = R_0 + \frac{f_P x_{PB}}{c_{RP}} - \eta \left(Z_{B0} - \frac{\eta f_P x_{PB}}{c_{ZP} + c_{CP}} \right) - L_B. \tag{10}$$

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:

$$P_h = R_h - \eta Z_h - L_h, \qquad \text{for } h \in (G, B), \tag{11}$$

where $R_h - \eta Z_h - L_h$ for $h \in (G, B)$ is given by (9) and (10). 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 (9) and (10), 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

$$x_{DG} = \frac{W_D}{P_G}. \tag{12}$$

Because of (11), note that

$$P_G = R_G - \eta Z_G - L_G. \tag{13}$$

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

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

any $h \in (G, B)$ and is equal to

$$x_P = \frac{W_P}{P_M}. \tag{14}$$

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 (9)–(11) with $x_{Ph} = x_P$ for any $h \in (G, B)$ that

$$P_M = R_M - \eta Z_M - L_M, \tag{15}$$

where

$$\begin{aligned} R_M - \eta Z_M - L_M = {} & R_0 + \frac{f_D x_{DG}}{c_{RD}} + \frac{f_P x_P}{c_{RP}} - \eta \left(Z_{G0} - \lambda \frac{\eta \lambda f_D x_{DG}}{c_{ZD} + c_{CD}} - \lambda \frac{\eta \lambda f_P x_P}{c_{ZP} + c_{CP}} \right) \\ & + R_0 + \frac{f_P x_P}{c_{RP}} - \eta \left(Z_{B0} - \frac{\eta f_P x_P}{c_{ZP} + c_{CP}} \right) - L_M. \end{aligned} \tag{16}$$

Note that from (8) and (14), e_{Ph} is the same for any $h \in (G, B)$. Thus, (8) is rewritten so that

$$e_P = \frac{f_P x_P}{c_{RP}} \text{ and } a_{Ph} = \frac{\eta \lambda_h f_P x_P}{c_{ZP} + c_{CP}}, \qquad \text{for } h \in (G, B), \tag{8$'$}$$

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 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

$$(1 - f_D)\frac{R_G - \eta Z_G}{P_G} - \psi_D = (1 - f_P)\frac{R_M - \eta Z_M}{P_M} - \psi_P = 1. \tag{17}$$

Next, we explain the bargaining between the D-fund and a fund investor. After the 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 (17), 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

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

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

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 $\widehat{f}_D$:

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

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,

$$f_D=\omega_D\left(1-\frac{P_G}{R_G-\eta Z_G}\right). \tag{18}$$

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

$$f_P=\omega_P\left(1-\frac{P_M}{R_M-\eta Z_M}\right). \tag{19}$$

4.4. Characterization of equilibrium.—

The equilibrium is defined as a solution to the following system of equations: (i) the fund managers' effort decisions (7) and (8′); market clearing conditions (9) and (12)–(16); fund investors' capital allocation conditions (17); and fee bargaining conditions (18) and (19). 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).

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 Internet 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-firms 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 market portfolio satisfy the following equations:

$$Z_B + Z_G = Z_M, \tag{20}$$

$$Z_G = Z_{G0} - \eta\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}}(2R_G - R_M) - \eta\lambda^2\frac{c_{RP}}{c_{ZP}+c_{CP}}(R_M - R_G - R_0), \tag{21}$$

$$\begin{aligned} Z_M = Z_{G0} + Z_{B0} - \eta\lambda^2\frac{c_{RD}}{c_{ZD}+c_{CD}}(2R_G - R_M) - \eta\lambda^2\frac{c_{RP}}{c_{ZP}+c_{CP}}(R_M - R_G - R_0) \\ - \eta\frac{c_{RP}}{c_{ZP}+c_{CP}}(R_M - R_G - R_0), \end{aligned} \tag{22}$$

where R_G *and* R_M *are given above.*
(iv) *The prices of G-firms 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

[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.

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 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 sum of the expected negative externalities released by G-firms and B-firms 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 considering 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.

Next, 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 (7) and (8′). 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 (17)).

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 (17). 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 (13), (15), (18), and (19), 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 (17). 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]

We now 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.

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 sum of the expected negative externalities and the expected profits of G-firms and B-firms, 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 the market portfolio are negatively affected, whereas their expected pecuniary returns are improved. However, in the case of B-firms, neither expected ESG performances nor expected pecuniary returns 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, (17), not only directly but also through changes in the fund ownership stakes, whereas λ affects (17) only through changes in the fund ownership stakes. Given this, in the case

[26] Under fund investors' capital allocation conditions (17), 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 (18) ((19)), 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.
[27] However, the lower λ does not affect the P-fund manager's ESG effort in B-firms.

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 (17) 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 shares of G-firms, thus increasing x_{DG}. The effect of the larger 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 (17), 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 increases (i.e., c_{CD} decreases).*
(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, are unaffected.
(iii) The sum of the expected negative externalities and the expected profits from G-firms and B-firms, Z_M and R_M, respectively, decrease.
(iv) The asset management fees of both funds are unaffected.

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

Proposition 5: *Suppose that the cost complementarity in the P-fund manager's effort between improving profit and ESG performances increases (i.e., c_{CP} decreases). 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 decrease in c_{CD} or c_{CP} or both, improve expected ESG performance in G-firms and in the market portfolio, but reduce the expected profit performance of G-firms and of the market portfolio. However, these propositions indicate that only the decrease in 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 decrease in c_{CD} operates is similar to that of the increase in λ, except that the decrease in c_{CD} directly increases *only* the D-fund manager's ESG effort. Regardless of this difference, similar to the case of the increase in λ (i.e., opposite to the case of the decrease in λ), the decrease in c_{CD} reduces 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. We can apply a similar logic for the effect of the decrease in c_{CP}, except that the decrease in c_{CP} raises the P-fund manager's ESG effort in the market portfolio firms. Consequently, the decrease in 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 also the sum of the expected negative externalities released by G-firms and B-firms, 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. As a result, the expected negative externality released by G-firms and the sum of the expected negative externalities released by G-firms and B-firms increase. 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, we suggest that growing interest in ESG may not necessarily improve expected ESG performance in G-firms or 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 of 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 is said to improve firm governance and increases firm returns if liquidity investors are replaced by institutional investors as a result of passive fund growth. However, passive fund growth has a subtle effect on firm governance but affects the fund ownership stake between the active and passive funds if 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 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 increased 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 (11) and (15), we observe that the expected financial returns for the investors of G-firms, $R_G - P_G$, B-firms $R_B - P_B$, and the market portfolio $R_M - P_M$ are defined by

$$R_h - P_h = L_h + \eta Z_h, \qquad \text{for } h \in (G, B, M). \tag{23}$$

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 (23) 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]

[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.

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 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

[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.

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 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 (23), combining (23) with the above arguments and the results of Propositions 2(i)–2(iii) provides the following predictions (for the proof, see Internet 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 the sum of the expected negative externalities released by both firms with high- and low-ESG scores, but also is likely 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 all firms.

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 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 all firms.

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 (23), that the following predictions are obtained.

Prediction 2: When the impact of shareholder ESG engagement in G-firms relative to B-firms decreases, both the expected negative externalities and the expected financial returns are **increased** for firms with high-ESG scores and the market portfolio. Firms with low-ESG scores are unaffected.

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 (23) 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 the market portfolio are **reduced (increased)**. However, the expected financial returns of firms with high-ESG scores and 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 **decline** for all firms. However, the expected financial returns also **decline** for all firms.

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 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 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 all firms.

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 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 for all firms.

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 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 and the fund ownership effect which occurs through a change in the fund-ownership stake.

We obtain the following implications:

i) Growing ESG preferences among the investors always reduces the expected negative externality but raises the expected profit for low-ESG firms. However, if the D-fund manager has a comparative cost advantage over the P-fund manager in improving firms' profit performance over improving firms' ESG performance, the expected negative externality decreases for high-ESG firms. If, on the other hand, the D-fund manager has a comparative cost advantage over the P-fund manager in improving firms' ESG performance, high-ESG firms may exhibit more expected negative externalities under some conditions.

ii) Regarding the impacts of ESG engagement by D-fund and P-fund managers on high-ESG firms, we find that as the impact of ESG engagement weakens, high-ESG firms' expected negative externality increases but so does their expected profit, and neither the

expected negative externality nor the expected profit is affected for the low-ESG firms.

iii) For high-ESG firms whose shares are held by D- and P-fund managers, greater cost complementarity in these efforts reduces the expected negative externality, and it also reduces the expected profit. For the low-ESG firm, we need only consider the P-fund manager, but the results are the same.

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.

Internet Appendix A

Proof of Proposition 1: We first derive statements (i), (ii), and (iv). Substituting P_G from (13) and f_D from (18) into (17), 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, (13) yields $P_G=\frac{1-\omega_D}{\psi_D}L_G$. Thus, it follows from (18) that $f_D=\frac{\omega_D\psi_D}{\psi_D+1-\omega_D}$. Similarly, using (15), (17), and (19), 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 (7) and a_{PG}, a_{PB}, and e_P from (8′) into (A3) and (A4) and rearranging them with (7), (8′), (A1) and (A2), we obtain (21) and (22).

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 (12)–(15) 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 (7) and (8′) 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 (12), (14), (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 (21) and (22) 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 (7) and (8′) 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 (23), 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. ‖

Internet 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 (7), (8′), (9), and (12)–(19). 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 (11). 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 (11) 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 sum of the expected negative externalities released by G-firms and B-firms, 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 (17)). To restore (17), 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 (7) and (8′). 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 the market portfolio (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 the sum of the expected negative externalities released by G-firms and B-firms. 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 all firms.

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