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How Portfolio Disclosure Impacts Monitoring Spillovers Between Competing Asset Managers

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Abstract Fund managers can monitor portfolio firms to improve returns, but their incentives to engage depend on other investors' monitoring, e.g., via free riding or collaboration. In this paper, we examine how portfolio disclosure affects monitoring spillovers between competing asset managers. In our model, informed and uninformed funds use monitoring investments to compete with each other over fund flows from investors. We provide conditions for when informed and uninformed fund monitoring are strategic complements, leading to monitoring of the same firms, or strategic substitutes, leading to monitoring of different firms. We then highlight several disclosure implications of our model. Interestingly, disclosure of the informed fund's holdings facilitates monitoring complementarities across funds, above and beyond disclosure providing information to investors and firms. Overall, our results inform the debate on asset managers' incentives to invest in monitoring, and highlight the key role played by portfolio disclosure.

Keywords: Asset managers; Competition; Corporate governance; Portfolio disclosure

JEL codes: D4; G23; G34; K22; M41

1. Introduction

In recent years, asset managers have become critical players in corporate governance, and there has been an intense debate about their incentives to monitor portfolio firms (see, e.g., Bebchuk & Hirst, 2019; Brav et al., 2022). Importantly, asset managers compete on fees and portfolio risk-return tradeoffs, and can use monitoring both to influence portfolio firms' returns and to attract fund flows. Monitoring is a particularly interesting competitive dimension, because monitoring done by competing fund managers can be complementary (e.g., pushing the same investee firm to improve performance) or substitutive (e.g., via free riding on each other's monitoring or simply focusing on different firms). In addition, asset managers' monitoring incentives are likely to be affected by their information sets, including what they know about peer fund managers. In this paper, we therefore explore the monitoring implications of portfolio disclosure

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for competing asset managers. We show that disclosure of fund strategies (i.e., portfolios) can facilitate complementarity in funds' monitoring activities, altering the nature of the competitive interaction between different funds. We view the monitoring-related competitive implications of disclosure in the asset manager setting as important, given the significant resources devoted to portfolio disclosures and the substantial and evolving mandatory disclosure requirements funds face, discussed further below.

Our findings come from a stylized model focused on interactions between an informed fund and an uninformed fund, each managed by a risk-neutral manager. For simplicity, there are two publicly traded firms in the economy: 1 and 2. While the informed fund privately knows that firm 1 has a higher expected return than firm 2, the uninformed fund chooses its holdings without knowledge of which firm has the higher expected return (i.e., it does not know which firm is firm 1). These differences in information endowments lead to differences in fund portfolios: the informed fund invests in firm 1, much as an active manager concentrates their portfolio; the uninformed fund, like a passive indexer, diversifies across the two firms. Funds seek capital (i.e., flows) from a set of individual investors who vary in risk-aversion, but are otherwise homogeneous.

At the beginning of the game, fund managers invest in monitoring technologies. Monitoring in our model is a costly investment by fund managers that improves portfolio firms' expected cash flows (e.g., thoughtfully choosing policies related to voting the fund's shares). Monitoring technologies are acquired early, consistent with fund managers having to invest in understanding governance issues, hiring relevant staff, and marketing their strategies to potential investors.[1] Fund managers have access to three different monitoring technologies. The first is targeted at profitable firms and only increases the expected return of firm 1, while the second is specific to unprofitable firms and only improves firm 2's expected return. These could be, for instance, monitoring technologies that facilitate retention of top talent at high-performing firms versus reorganizing and restructuring at low-performing firms. The third, market-wide, monitoring technology increases the expected return of both firms. We can think of this third technology as 'general' governance best-practices independent of firm type. The informed fund manager invests in monitoring technologies after observing the uninformed fund manager's investment in monitoring technologies. In some sense, the uninformed fund's earlier choice captures long-term policies that govern many uninformed funds' engagement with portfolio companies (for discussion of such long-term policies, see, e.g., Novick et al., 2018, focusing on passive indexers).

After investing in monitoring technologies, funds choose fees and individual investors allocate their wealth between the funds. They may also invest directly in the firms or hold a risk-free asset. Given the capital allocation made by individual investors, the fund managers allocate their portfolios to the two firms, acting in the best interests of each fund's investors based on the information each fund manager has. Shares are supplied elastically, so the uninformed fund manager and any potential direct investors cannot use price to infer the informed fund manager's private information in the trading stage.[2] However, consistent with existing disclosure laws, portfolios may be publicly disclosed after trading (e.g., through SEC forms 13-F or N-PORT). We analyze the equilibrium of our model both without disclosure and with disclosure of the informed fund's portfolio. Disclosure allows the uninformed fund manager to invest in monitoring based

[1]This is also consistent with the mandatory disclosure of 'Proxy Voting Policies' imposed by the SEC, which implies that investment funds have to set voting policies in advance. Moreover, in the Online Appendix, we show that our results do not depend on the timing of monitoring choices and are exactly the same with ex-post instead of ex-ante monitoring choices.

[2]This assumption is consistent with uninformed passive funds pursuing rule-based investments and individual investors facing cognitive constraints that prevent them from inferring private information from stock prices.

on informed fund ownership, which can facilitate interactions between the two funds' monitoring investments. After potential disclosure, the fund managers use their investments in monitoring technologies to monitor portfolio firms. Finally, the firms' terminal cash flows are realized. The fund managers receive fees and individual investors get their investment returns net of fees.

In equilibrium, investors with large risk-aversion invest in the risk-free asset, whereas investors with small risk-aversion invest in the informed fund. Investors with intermediate risk-aversion invest in the uninformed fund. The informed fund manager invests only in firm 1 because this maximizes the risk-adjusted returns of its investors. The uninformed fund manager has no private information and therefore diversifies across firms 1 and 2 to minimize portfolio risk. Individual investors never find it optimal to directly invest in the two firms because the uninformed fund manager always sets fees at or below direct investment costs, and gross portfolio returns are the same whether investors hold both firms through the uninformed fund or directly. Given equilibrium portfolio allocations, the informed fund manager only invests in the monitoring technology for profitable firms.

To illustrate disclosure's effects on monitoring, we explore two variants of the game. First, when the informed fund's portfolio is not disclosed, the uninformed fund manager does not learn which firm is the profitable firm. The uninformed fund manager therefore only invests in the market-wide monitoring technology, because it does not require the uninformed fund manager to know the identity of the firms. The informed fund manager only invests in the monitoring technology for profitable firms, since this targets their equilibrium portfolio holdings. Furthermore, without disclosure of the informed fund's portfolio, the funds' monitoring investments are independent.

We next analyze the variant of the model in which the informed fund's portfolio is publicly disclosed. This allows the uninformed fund to make targeted, firm-specific monitoring investments. For the uninformed fund manager, investing in the monitoring technology for unprofitable firms and monitoring firm 2 takes investors from the informed fund and the risk-free asset, and reduces the informed fund manager's incentives to invest in monitoring. Investing in the monitoring technology for profitable firms and monitoring firm 1 takes investors from the risk-free asset only, and causes the uninformed fund to lose investors to the informed fund. The increase in informed fund flows leads to more investment in monitoring of firm 1, and this can lead to even more investors coming over to the uninformed fund from the risk-free asset. The market-wide monitoring technology affects both firms simultaneously, leading to a combination of the effects described above for firm-specific monitoring.

If the cost of the market-wide monitoring technology is small, the uninformed fund manager only invests in this technology and the funds' monitoring investments are independent, as in the case without disclosure of the informed fund's portfolio. Otherwise, if the cost of market-wide monitoring is large, the uninformed fund faces a tradeoff between investing in the monitoring technology for profitable firms or unprofitable firms. If the informed fund's monitoring cost is small, the effect of uninformed fund monitoring on informed fund monitoring is large. As such, the uninformed fund manager is better off investing in the monitoring technology for profitable firms, which leads to more informed fund monitoring and net flows of investors away from the risk-free asset into the managed funds. Monitoring investments are then strategic complements, and the uninformed fund has incentives to monitor the same firm as the informed fund. This result is consistent with Appel et al. (2019), who provide empirical evidence that (informed) activists are more likely to engage in costly, value-enhancing forms of monitoring when a larger share of target companies' stock is held by (uninformed) passive funds. It is also consistent with the wolf pack activism documented by Brav et al. (2022) whereby different funds work together on engagements.

Otherwise, if the informed fund's monitoring cost is large, the effect of uninformed fund monitoring on informed fund monitoring is small, which implies that the uninformed fund manager is better off investing in the monitoring technology for unprofitable firms even though the informed fund manager continues to monitor firm 1. Monitoring investments of the fund managers are then, endogenously, strategic substitutes. This result is in line with Lund (2018) and Bebchuk and Hirst (2019), who argue that competition reduces passive funds' incentives to engage in monitoring activities, as monitoring will also benefit the other competing funds.

After characterizing the baseline model's equilibrium, we derive several disclosure implications of our model by comparing our results in the two variants of the game. Absent portfolio disclosure, the uninformed fund cannot use monitoring technologies conditional on the informed fund's holdings, which eliminates the potential for monitoring complementarities. As such, portfolio disclosure facilitates complementarity in monitoring, above and beyond providing information to investors and firms. Monitoring complementarities also encourage voluntary disclosure of portfolio holdings by the informed fund when they are not mandated.

Our disclosure results provide policy implications. There is an ongoing debate on whether and which funds should publicly disclose their portfolios (Financial Times, 2020). In order to reduce 'unnecessary burdens' on smaller funds, the SEC proposed that only investors with assets of more than $3.5bn would have to submit quarterly 13F filings, raising the threshold from its current value of $100m. Hundreds of US-listed companies have come out against this proposal arguing that the SEC proposal 'limits access to information for public issuers and investors, which is the exact opposite direction of where the commission should be heading' (Taylor, 2020). More recently, the SEC voted to impose tougher disclosure rules on private funds, and a coalition of private funds subsequently challenged these rules (Financial Times, 2023). As we show, an implication of the absence of portfolio disclosure is that uninformed fund managers cannot target monitoring technologies contingent on the informed funds' portfolios. This limits the potential for interactions, including complementarities between informed and uninformed monitoring investments.

1.1. Contribution and Related Literature

Our paper contributes to the vast theoretical literature on delegated asset management. For parsimony, we center our discussion on a few papers featuring frictions and tradeoffs closely related to those we study, such as information asymmetry and competition. Berk and Green (2004) and Pástor and Stambaugh (2012) examine the economic consequences of heterogeneity in fund manager skills. Admati and Pfleiderer (1990) study the endogenous formation of mutual funds by informed agents. Several papers focus on the asset pricing implications of benchmarking and asset management (e.g., Basak & Pavlova, 2013; Buffa et al., 2022; Garleanu & Pedersen, 2018). Kashyap et al. (2023) propose a model of asset management in which benchmarking arises endogenously, and analyze its negative welfare consequences. In contrast to the aforementioned papers, our emphasis lies in exploring the corporate governance role of asset managers. Consequently, our contribution to the existing literature involves incorporating endogenous monitoring choices and examining the potential monitoring spillovers between competing asset managers.

Our paper is closely related to the literature on shareholder activism and on the governance role of asset managers. Edmans and Holderness (2017) provide a recent survey of both the theoretical and empirical strands of this literature. Prior work has shown that institutional ownership is associated with investments and managerial myopia (Bushee, 1998), earnings management (Ramalingegowda et al., 2021), and conservatism (Ramalingegowda & Yu, 2012). Consistent with our theory, Bushee et al. (2014) show that some institutions' ownership is associated with portfolio firms' governance mechanisms. Friedman and Heinle (2021) examine

whether and how asset managers' private preferences for corporate actions affect corporate governance, stock prices, and investors' portfolio decisions. Within this literature, several theoretical studies consider the trade-off between institutional owners' influence on portfolio firms via voice/engagement and exit/selling (e.g, Kahn & Winton, 1998; Maug, 1998; Mello & Repullo, 2004). Dasgupta and Piacentino (2015) show that the exit mechanism loses credibility when asset managers compete for investor capital. In this paper, we therefore focus on the voice mechanism, whereby funds influence firms via costly monitoring choices reflecting engagement rather than price pressure.

The closest related papers to ours are Brav et al. (2022) and Corum et al. (2021). First, Brav et al. (2022) show that competition for flow increases blockholders' engagement incentives and helps ameliorate the problem of insufficient engagement. Our complementarity result is consistent with the clustered shareholder activism documented by Brav et al. (2022). However, in contrast to Brav et al. (2022), our model incorporates several portfolio firms and therefore highlights whether asset managers have incentives to monitor the same firm or different firms. Second, Corum et al. (2021) examine the governance role of active and passive asset managers in a model with risk-neutral investors. They show that passive fund growth may either improve or harm governance, depending on whether it crowds out private savings or active funds. In our model, a driving force is that investors are risk-averse and the degree of risk-aversion varies across investors. Funds use their monitoring strategies to differentiate from each other and increase fee revenue. One interpretation of our model is that the uninformed (resp. informed) fund is a passive (resp. active) fund. In light of this interpretation, our key finding is that active and passive monitoring can be strategic complements, which is not the case in Corum et al. (2021). Furthermore, in contrast with the two aforementioned papers, our main focus is developing results regarding the impact of portfolio disclosure on asset managers' monitoring incentives. Overall, our insights on the governance role of asset managers, and on the implications of fund disclosure, differ substantially from those of Brav et al. (2022) and Corum et al. (2021).

Related empirical results on the governance role of informed/active and uninformed/passive asset managers are strikingly mixed. On the one hand, Heath et al. (2022) show that, relative to active funds, index funds are less likely to vote against firm management. They also find no evidence that index funds engage with firm management to improve governance. On the contrary, higher index fund ownership leads to less independent boards and worse corporate governance. This is consistent with Schmidt and Fahlenbrach (2017), who find that increases in passive ownership lead to increases in CEO power and fewer independent director appointments. They suggest that the changed ownership structure causes higher agency costs. On the other hand, Appel et al. (2016) argue that passive funds influence firms' governance choices, resulting in more independent directors, removal of takeover defenses, and more equal voting rights. They contend that passive ownership is associated with improvements in firms' longer-term performance. In a similar vein, Filali Adib (2019) shows that index fund ownership improves corporate governance of portfolio firms by making value-creating proposals, and their passage, more likely. We demonstrate that (uninformed) passive funds' incentives to improve governance of a firm depend on (informed) active fund strategies, and whether passive and active funds' monitoring are strategic complements or strategic substitutes.

Finally, our paper contributes to the broad literature that studies the economic consequences of portfolio disclosure in a setting with delegated portfolio management. A large number of papers show that mutual funds' disclosed portfolios contain valuable information for investors (see the review of this strand of the literature in Agarwal et al., 2015). This literature also shows how portfolio disclosure is related to monitoring and governance (Evans & Fahlenbrach, 2012), copy-catting costs (Frank et al., 2004), performance (Agarwal et al., 2015; Huddart et al., 2001),

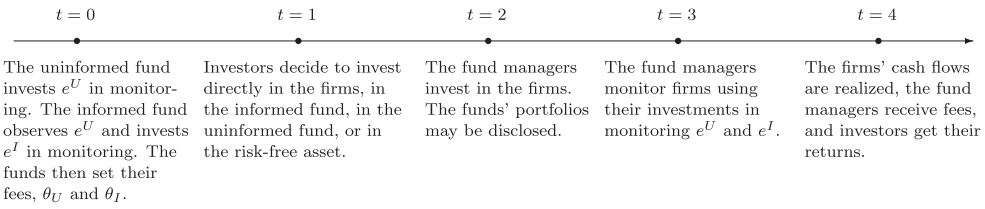

Figure 1. Timeline of the baseline model.

and window dressing behavior (Musto, 1999). More recently, studying the role of disclosure regulation, Honigsberg (2019) shows that fund disclosure rules reduce misreporting and can affect funds' internal governance. Sani et al. (2023) provide evidence that portfolio disclosure requirements for active funds affect their portfolio firms' investment decisions. Bourveau et al. (2023) and Xin et al. (2024) specifically study the impact of an increase in mutual funds' mandatory reporting frequency. Lastly, some studies analyze funds' voluntary disclosures. Cassar et al. (2018) find that tensions between agency costs faced by investors and proprietary costs faced by managers affect fund voluntary disclosures, whereas Li et al. (2023) show that voluntary portfolio disclosure increases the sensitivity of investor flows to fund performance. DeHaan et al. (2021) document that fund managers create unnecessarily complex disclosures to keep investors uninformed. We complement this literature by highlighting the consequences of portfolio disclosure on monitoring incentives of informed and uninformed funds. We also derive conditions under which funds would voluntarily disclose their portfolios.

2. Model Setup

This section describes our model setup and timing. We further discuss our key assumptions in Section 2.1. The model has five dates indexed by $t \in \{0, 1, 2, 3, 4\}$, two representative firms indexed by $j \in \{1, 2\}$, and three types of players: a continuum of risk-averse individual investors indexed by i, a risk-neutral informed fund manager (I), and a risk-neutral uninformed fund manager (U).

Figure 1 summarizes the sequence of events. Briefly, the game begins with fund managers investing in monitoring technologies and setting their fees. Individual investors then allocate capital by investing directly in firms, in the risk-free asset, or in funds. Fund managers subsequently invest capital allocated to them in the firms. At this point, funds may disclose their portfolios. Fund managers then monitor their portfolio firms, where monitoring improves cash flows that are subsequently realized and paid out to investors. Fund managers collect fees at the end of the game.

Individual investors' preferences are as follows. Investor $i \in [0, \overline{\gamma}]$ has a negative exponential utility function with coefficient of absolute risk-aversion $\gamma_i = i$: $U_i(W_i) = 1 - \exp(-\gamma_i W_i)$, where W_i represents investor i's wealth at the end of the game. The parameter $\overline{\gamma} > 0$ captures both the measure of individual investors and the coefficient of the most risk-averse individual investor in the economy. Each risk-averse individual investor is initially endowed with one unit of cash and does not have access to additional funds via borrowing. The fund managers are engaged in differentiated Bertrand competition to attract individual investors.

The shares of the two representative firms are elastically supplied and sold for \$1 per share. The fund managers and individual investors may buy shares of firm 1 and/or firm 2, and the market for each firm clears at one price. For simplicity and to make the logic as transparent as possible, we assume that the supply of shares is, like the risk-free asset, elastic, and not affected

by demand. At the end of the game, firm $j \in \{1, 2\}$ generates terminal cash flow $R_j = m_j + e_j + \zeta_j$, which consists of three parts. First, $m_j > 1$ is firm j's average cash flow without monitoring. We denote by $\Delta_m \equiv m_1 - m_2$ the difference in returns without monitoring. Second, $e_j \geq 0$ captures the funds' monitoring impact on firm j's cash flow. Third, the random variable $\zeta_j \sim N(0, \sigma^2)$ represents the risk of firm j's cash flow. We assume in the main analysis that ζ_1 is independent of ζ_2.[3]

We now describe the timing of events in more detail. At $t = 0$, the informed fund manager privately learns which firm has a larger expected return. We assume that $m_1 > m_2$ and restrict the parameters to regions in which the expected return ordering holds after taking into account equilibrium monitoring impacts, i.e., $m_1 + e_1 > m_2 + e_2$. The uninformed fund manager and individual investors do not know which firm has a larger expected return at $t = 0$. Essentially, the informed fund manager observes which firm is firm 1, while the uninformed fund manager and individual investors do not.

Next, the fund managers publicly invest in the monitoring technologies they will use at $t = 3$ to monitor the firms. Fund managers have access to three different monitoring technologies. The first (resp. second) monitoring technology is targeted at profitable (resp. unprofitable) firms and only increases the expected return of firm 1 (resp. firm 2). These could be, for instance, monitoring technologies that facilitate retention of top talent at high-performing firms versus reorganizing and restructuring at low-performing firms. The third, market-wide, monitoring technology increases the expected return of both firms. We can think of this third technology as 'general' governance best-practices independent of firm type.

The informed fund manager invests in monitoring technologies after observing the uninformed fund manager's investment in monitoring technologies. Specifically, the uninformed fund manager invests e_1^U (resp. e_2^U) in the monitoring technology targeted at profitable (resp. unprofitable) firms, and e_b^U in the monitoring technology that improves both firms. The uninformed fund's total monitoring investment is therefore given by $e^U \equiv e_1^U + e_2^U + e_b^U$. The uninformed fund manager's cost of investment in monitoring is $k_U(e_1^U + e_2^U + \tau e_b^U)^2/2$. Moreover, in equilibrium, we will show that the informed fund only invests in firm 1, which implies that the informed fund only invests in the monitoring technology targeted at profitable firms. Thus, after observing e_1^U, e_2^U, and e_b^U, the informed fund manager invests $e^I \equiv e_1^I$ in the monitoring technology targeted at profitable firms at a cost of $k_I(e_1^I)^2/2$. The parameters $k_U > 0$ and $k_I > 0$ capture monitoring investment costs that may vary by fund manager type. We assume that k_U and k_I are sufficiently large so that, in equilibrium, e^U and e^I are finite numbers, providing the relevant conditions in the Appendix. The parameter $\tau \in (1, 2)$ captures the different cost of the market-wide monitoring technology, which increases cash flows of both firms. We restrict τ to the $(1, 2)$ interval, such that the market-wide monitoring technology may be efficient for a fund investing in both firms but is inefficient for a fund investing in only one firm. After investing in their monitoring technologies, the uninformed fund manager and the informed fund manager simultaneously set their fees, θ_U and θ_I respectively.

At $t = 1$, each individual investor observes fees and monitoring investments, and decides whether to invest in the informed fund, in the uninformed fund, directly in the firms, or in the risk-free asset. The return on the risk-free asset is normalized to 0. Recall that, similar to the uninformed fund manager, investors do not know which firm has larger expected returns at $t = 0$. Given that the firms' shares are elastically supplied, a direct investor optimally diversifies, investing 0.5 units of cash in firm 1 and 0.5 units of cash in firm 2. As in Admati et al. (1994),

[3]We analyze the effect of correlated shocks in the Online Appendix. Having correlated shocks reduces the benefit of diversification and therefore reduces the attractiveness of the uninformed fund compared to the informed fund and the risk-free asset.

investors bear investment costs $d > 0$ of directly investing in the financial market. This cost captures brokerage fees and time spent by investors in portfolio construction. Below, we show that investors never directly invest in the firms in equilibrium because the uninformed fund manager always sets the fee sufficiently low, i.e., $\theta_U \leq d$. We assume for simplicity that investors have only four discrete investment options.[4]

At $t = 2$, the informed fund manager and the uninformed fund manager choose whether to invest in firm 1 and/or firm 2. As in Gârleanu and Pedersen (2022), we abstract away from agency conflicts between each fund's manager and investors. Thus, each fund manager acts in the best interests of the fund's investors once investors have invested in that fund. This is, however, nontrivial because the average risk aversion of each fund's investors depends on earlier choices as well as model parameters.

After investors' investment decisions, funds' portfolios may be publicly disclosed, e.g., through mandatory SEC filings. We derive the equilibrium with and without disclosure of the funds' portfolios. If the funds' portfolios are disclosed, the uninformed fund manager learns the identity of the profitable firm from the informed fund's disclosure. This allows the uninformed fund manager to efficiently use the monitoring technologies targeted at profitable firms and unprofitable firms. Otherwise, if the funds' portfolios are not disclosed, the uninformed fund manager does not learn the identity of the profitable firm and cannot efficiently use the monitoring technologies targeted at profitable firms and unprofitable firms.[5]

At $t = 3$, the fund managers use their investments in monitoring technologies to monitor firms. The total monitoring impact on firm 1 is $e_1 = e_1^I + ze_1^U + e_b^U$ whereas the total monitoring impact on firm 2 is $e_2 = ze_2^U + e_b^U$. If the funds' portfolios are disclosed, $z = 1$ because the uninformed fund manager can efficiently use the monitoring technology targeted at profitable (resp. unprofitable) firms for firm 1 (resp. firm 2). Otherwise, if the funds' portfolios are not disclosed, $z = 0$ because the uninformed fund manager cannot efficiently use the monitoring technologies targeted at profitable firms and unprofitable firms.[6]

At $t = 4$, all terminal cash flows are realized. The uninformed (resp. informed) fund receives fees θ_U (resp. θ_I) from each of its individual investors. Individual investors receive their investment returns net of fees.

Finally, to simplify the exposition, we make four assumptions concerning parameter values, detailed in the Appendix. Two assumptions are necessary to focus on equilibria of interest, with interior monitoring investments. The remaining two assumptions facilitate tractable analysis by ensuring that the informed fund only invests in firm 1 and that the most risk-averse investor invests in the risk-free asset.[7]

2.1. Discussion of the Main Assumptions

2.1.1. Voice versus exit

As discussed in the introduction, large shareholders can influence managers through two governance mechanisms: voice or exit (Edmans & Manso, 2011). In this paper, we solely focus on

[4]Assuming that individual investors can mix between different investment options would significantly complicate the analysis without modifying our core findings.

[5]Note that earlier portfolio disclosure would dissipate the informed fund's information advantage, while later disclosure would have no impact on monitoring.

[6]Results are unchanged as long as $0 < z \leq \frac{1}{2}$, reflecting that absent disclosure, there is a cost of doing the wrong monitoring (e.g., retention of poor talent or reorganization/firing of good talent) or a discount due to the risk of monitoring the wrong firm.

[7]As we show in the Online Appendix, the assumption that the informed fund only invests in firm 1 is without loss of generality.

the voice mechanism because some asset managers (e.g., passive index followers) can hardly use the exit mechanism to improve firms' corporate governance. Some managers may use the *threat* of exit as a monitoring strategy, which may be interpreted as a vocal mechanism (see, e.g., Gantchev et al., 2022).

2.1.2. Uninformed versus informed fund

In our model, the informed fund can be interpreted as an active stock-picking fund, whereas the uninformed fund can be interpreted as an index/passive fund.[8] We further discuss our results in light of this interpretation in Section 5. However, our model admits other interpretations. For instance, the two funds could be interpreted as two hedge funds (one better at picking stocks than the other) actively improving the corporate governance of firms in their portfolios.

2.1.3. Monitoring technology

We view monitoring technology as a tool for a fund manager to increase the competitive advantage of its fund relative to other investment options. As a result, monitoring technologies are acquired before individual investors make their investment decisions. This is consistent with fund managers having to invest ex ante in understanding governance issues, hiring relevant staff, and marketing their strategies to potential investors.[9] Couvert (2021) provides evidence that voting policies established ex ante are a major predictor of mutual funds' voting behavior. Furthermore, the SEC mandates the disclosure of 'Proxy Voting Policies,' which implies that funds have to set voting policies in advance.[10] Moreover, to focus on complementarity and substitutability in a setting with concentrated and diversified funds, we use three types of monitoring: 1, 2, and *b*, corresponding to real-world firm type specializations for 1 and 2, and market-wide best practices for *b*.

Monitoring of type *b* may reflect common governance policies that could apply to multiple firms. Large diversified institutional asset managers hold large stakes in portfolio firms. Hence, they may use their stakes to push broad ideas that they think will improve long-term results for companies generally instead of using them to push specific corporate actions that would idiosyncratically improve individual companies or sectors (Levine, 2020). In the same vein, Fisch et al. (2019) argue that 'a passive investor can identify governance "best practices" that are likely to reduce the risk of underperformance with little firm-specific information, and the investment in identifying a governance improvement can be deployed across a broad range of portfolio companies.'

In addition, while we refer to the value-enhancing action as 'monitoring' throughout the paper, one could interpret this action as activism by funds or any other action that increases firm value:

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[8]It is a standard assumption in the asset management literature that fund managers vary in their information endowment (see, e.g., Prat & Dasgupta, 2006; Trueman, 1988). The informed fund and the uninformed fund could be heterogeneous because the informed fund manager is more skilled than the uninformed fund manager. Moreover, passive funds might be started in practice by managers with specialization in minimizing trading costs whereas active funds by those with potentially good algorithms or data gathering. In the Online Appendix, we show our main results are robust to the standard decreasing returns to scale assumption for the informed fund, as in Berk and Green (2004) and Pástor and Stambaugh (2012).

[9]In the Online Appendix, we discuss an alternative monitoring timing in which fund managers choose monitoring efforts after investing in portfolio firms. Our results are exactly the same with this alternative timing assumption.

[10]See the SEC rule 'Disclosure of Proxy Voting Policies and Proxy Voting Records by Registered Management Investment Companies.' As an example of such disclosure, State Street specifically describes its approach to engaging with activist investors: 'We believe it is good practice for us to speak to other investors that are running proxy contests, putting forth vote-no campaigns, or proposing shareholder proposals at investee companies' (see https://www.ssga.com/library-content/pdfs/asr-library/ssga-issuer-and-stakeholder-engagement-guideline.pdf).

engaging with management, submitting shareholder proposals, nominating directors, and voting on important decisions, such as proxy contests (Corum et al., 2021). All those actions require ex-ante investments by funds to understand important issues and act on them in a manner consistent with portfolio value maximization.[11]

2.1.4. Sequence of the game

We consider a sequential game in which the uninformed fund manager invests in its monitoring technology before the informed fund manager. In the Online Appendix, we show that both fund managers may benefit from the uninformed fund manager moving first because of potential monitoring complementarities. Hence, the sequential monitoring timing can be an equilibrium outcome in our setting.

Moreover, this timing is consistent with the fact that uninformed passive funds are usually longer-term investors than informed active funds. The longevity of index membership means that passive funds have a long-term commitment to the firms in which they invest, and are not motivated by short-term gains at the expense of long-term value (Bebchuk & Hirst, 2019; Rock & Kahan, 2019). Fisch et al. (2019) argue that passive funds may exercise their voting power with a longer-term focus because, unlike active funds, they cannot overweight and then exit a target around an activist's creation of short-term gains. Appel et al. (2016) empirically show that passive ownership is associated with improvements in governance and in firms' longer-term performance.

For simplicity, we assume fund fees are paid at the end of the game. Note that, as the firms' cash flows are normally distributed, individual investors may receive small or negative investment returns that prevent them from paying the funds' fees out of their returns. The probability that this happens is negligible if the means of the firms' cash flows are sufficiently large compared to the variances and fees. Alternatively, individual investors could receive some cash after $t = 1$, such as employment earnings, that they could use to pay the funds' fees at $t = 4$.

2.1.5. Number of firms

For simplicity, there are only two firms in our model. The two firms can be interpreted as two subsets of the equity market, particularly in light of informed and uninformed funds investing in monitoring technologies that benefit firms in a given sector. Even with two firms, however, there is a diversification benefit from investing in uninformed funds. Indeed, in equilibrium, each individual investor faces a risk/return tradeoff when choosing between the informed fund and the uninformed fund or direct investing strategies. Investing in the informed fund yields a larger expected profit, but the variance of the informed fund's concentrated portfolio is larger.

2.1.6. Competition

The uninformed fund competes with several other investment options: an informed fund, direct investment, and risk-free holdings. As discussed earlier, the uninformed fund can be interpreted as a passive fund competing with an informed active fund and other investment options. Cremers et al. (2016) provide empirical evidence that competition from passive funds leads active funds to compete via price (by decreasing their fees) and product differentiation (by generating larger alpha). In practice, the passive fund industry is very competitive (Gârleanu & Pedersen, 2022).

[11] Note that the effects of different funds' monitoring on each firm are linear and additive. Introducing interactions (e.g., decreasing returns to total monitoring, or lower costs if other funds are monitoring the same firm) would lead naturally to substitutive or complementary interactions. We omit such interactions, as our interest is in monitoring effects driven by competition rather than the functional form of monitoring impact.

One obvious reason is that tracking an index requires few resources. In our model, pure undifferentiated Bertrand competition with additional uninformed funds would lead to no monitoring from the uninformed funds because uninformed funds' fees go to zero with perfect Bertrand competition. However, as we discuss in the Online Appendix, introducing search costs (or another competitive friction) would restore positive fees and monitoring.[12] Notably, the direct cost of investing, d, can also be interpreted as capturing the cost to an investor of searching for an alternative uninformed fund. With this interpretation, a lower d implies greater competition between our modeled uninformed fund and its unmodeled alternatives. Our main analysis explicitly omits monitoring from these unmodeled funds, while the Online Appendix incorporates it.

2.1.7. Share prices

Because share prices are elastically supplied, the price is \$1 regardless of investor and fund demand. Assuming exogenous/fixed prices in the securities market is a reasonably common assumption in the literature on fund managers (see, e.g., Berk & Green, 2004; Brown & Davies, 2017; Chordia, 1996; Pástor & Stambaugh, 2012; Stein, 2005; Van Nieuwerburgh & Veldkamp, 2010). Elastic supply in the market for the firms' shares precludes learning the informed fund manager's private information from stock prices. There could be sufficient noise trade and costs of information processing such that inferring the informed fund manager's information is infeasible or prohibitively costly. In the Online Appendix, we discuss the robustness of our results to endogenous stock prices.

3. Analysis

We solve the model by backward induction. Note that events in $t = 3$ and $t = 4$ depend entirely on earlier actions, so we begin the analysis with the funds' allocations at $t = 2$ and individual investors' investment decisions at $t = 1$, taking monitoring investments and fees set by the fund managers as given. In particular, we derive the funds' equilibrium portfolios and the measure of investors investing in each of the informed fund, the uninformed fund, and the risk-free asset. Next, we solve for the equilibrium fees charged by the fund managers at $t = 0$. Finally, we derive the funds' equilibrium investments in monitoring technologies. Throughout the paper, we exploit the well-known result that the certainty-equivalent for investor i with negative exponential utility and normally-distributed terminal wealth, W_i, is $E[W_i] - \frac{\gamma_i}{2} Var[W_i]$.

The following lemma provides the unique subgame equilibrium for funds' investment strategies and investors' capital allocation, conditional on fees (θ_I, θ_U) and monitoring impacts (e_1, e_2). All proofs are in the Appendix.

Lemma 1 *If funds' fees and monitoring impacts are such that* $\theta_U \leq d$ *and* $m_2 + e_2 + \theta_I - 1 > 2\theta_U > e_2 - e_1 - \Delta_m + 2\theta_I$, *the informed fund manager invests in firm 1, whereas the uninformed fund manager invests equally between firm 1 and firm 2. Moreover, there are two cutoffs* $\gamma^- \in [0, \overline{\gamma})$ *and* $\gamma^+ \in (\gamma^-, \overline{\gamma})$ *such that investor i with risk-aversion* $\gamma_i \in [0, \gamma^-]$ *invests in the informed fund; investor i with risk-aversion* $\gamma_i \in (\gamma^-, \gamma^+]$ *invests in the uninformed fund; and investor i with risk-aversion* $\gamma_i \in (\gamma^+, \overline{\gamma}]$ *invests in the risk-free asset.*

Lemma 1 focuses on the case in which $\theta_U \leq d$ and $m_2 + e_2 + \theta_I - 1 > 2\theta_U > e_2 - e_1 - \Delta_m + 2\theta_I$, and we show in the Appendix, in the proof of Lemmas 1 and 2, that these conditions hold in equilibrium when taking into account the equilibrium fees and monitoring impacts.

[12] Garleanu and Pedersen (2018) provide an overview of the search process of finding an asset manager and illustrate the significant costs related to this process.

The first result of Lemma 1 provides the optimal investment strategies for the fund managers. The informed fund manager invests only in firm 1 because this maximizes the risk-adjusted returns of the individual investors investing in the informed fund. The informed fund's portfolio thus has a mean of $E[R_1] = m_1 + e_1$ and a variance of $Var[R_1] = \sigma^2$. In contrast, the uninformed fund manager has no private information and therefore invests equally in firm 1 and firm 2 to minimize its portfolio risk. The uninformed fund's portfolio thus has a mean of $E[\frac{1}{2}(R_1 + R_2)] = \frac{1}{2}(m_1 + m_2 + e_1 + e_2)$ and a variance of $Var[\frac{1}{2}(R_1 + R_2)] = \frac{1}{2}\sigma^2$.

Investors with large risk-aversion invest in the risk-free asset, whereas investors with small risk-aversion invest in the informed fund. Investors with intermediate risk-aversion invest in the uninformed fund. Further, the constraint $\theta_U \leq d$ implies that individual investors never invest directly in the firms. Intuitively, investors have no private information and get the same gross returns whether they invest in the two firms via the uninformed fund or directly. Hence, this investment decision is purely driven by the difference between the uninformed fund fee and direct investment costs. Without loss of generality, we assume that investors, if indifferent, choose to invest via the uninformed fund rather than directly in the market.

We now provide a sketch of the proof of the second part of Lemma 1 in which we formally derive the two cutoffs, γ^- and γ^+. An individual investor i with a coefficient of risk-aversion γ_i invests in the informed fund rather than in the uninformed fund if and only if

$$E[R_1] - \frac{\gamma_i}{2} Var[R_1] - \theta_I \geq E\left[\frac{1}{2}(R_1 + R_2)\right] - \frac{\gamma_i}{2} Var\left[\frac{1}{2}(R_1 + R_2)\right] - \theta_U,$$

which is equivalent to

$$\underbrace{m_1 + e_1 - \frac{\gamma_i}{2}\sigma^2 - \theta_I}_{\text{investor i's payoff from investing in the informed fund}} \geq \underbrace{\frac{1}{2}(m_1 + m_2 + e_1 + e_2) - \frac{\gamma_i}{4}\sigma^2 - \theta_U}_{\text{investor i's payoff from investing in the uninformed fund}}. \quad (1)$$

As a result, the cutoff γ^- is the coefficient of risk-aversion of the individual investor who is indifferent between investing in the informed or uninformed fund, such that constraint (1) is binding, i.e., $\gamma^- \equiv 2\frac{(\Delta_m + e_1 - e_2) + 2(\theta_U - \theta_I)}{\sigma^2}$. Hence, the measure of investors investing in the informed fund is given by

$$D_I \equiv \int_0^{\gamma^-} di = \frac{2(\Delta_m + e_1 - e_2 + 2(\theta_U - \theta_I))}{\sigma^2}, \quad (2)$$

which is increasing with the expected return of firm 1, decreasing with the expected return of firm 2, increasing with the uninformed fund fee, decreasing with the informed fund fee, and decreasing with the cash flow risk. Overall, the measure of investors investing in the informed fund increases with the comparative advantage of the informed fund over the uninformed fund. Note that the uninformed fund fee, θ_U, is always low enough such that the alternative investment for small risk-aversion investors is the uninformed fund, not the risk-free asset

Similarly, given $\theta_U \leq d$, an investor i with a coefficient of risk-aversion γ_i invests in the uninformed fund rather than in the risk-free asset if and only if

$$\underbrace{\frac{1}{2}(m_1 + m_2 + e_1 + e_2) - \frac{\gamma_i}{4}\sigma^2 - \theta_U}_{\text{investor i's payoff from investing in the uninformed fund}} \geq \underbrace{1}_{\text{investor i's payoff from investing in the risk-free asset}}. \quad (3)$$

Therefore, the cutoff γ^+ is the coefficient of risk-aversion of the individual investor who is indifferent between investing in the uninformed fund or the risk-free asset, such that constraint (3) binds, i.e., $\gamma^+ \equiv \frac{2(m_1 + m_2 + e_1 + e_2 - 2(\theta_U + 1))}{\sigma^2}$. Thus, the measure of investors investing in

the uninformed fund is given by

$$D_U \equiv \int_{\gamma^-}^{\gamma^+} di = 4\frac{m_2 + e_2 - (2\theta_U + 1 - \theta_I)}{\sigma^2}, \tag{4}$$

which is increasing with the expected return of firm 2, decreasing with the uninformed fund fee, increasing with the informed fund fee, and decreasing with the cash flow risk. Note that, in contrast with D_I, D_U is independent from the expected return of firm 1 because an increase in the expected return of firm 1 decreases the relative advantage of the uninformed fund over the informed fund, but increases the relative advantage of the uninformed fund over the risk-free asset.

Next, we solve for the equilibrium fees charged by the fund managers. The informed fund manager's maximization problem is

$$\max_{\theta_I, e_1^I} \underbrace{D_I \times \theta_I}_{\text{informed fund's revenue}} - \underbrace{k_I (e_1^I)^2/2}_{\text{informed fund's monitoring cost}}, \tag{5}$$

whereas the uninformed fund manager's maximization problem is

$$\max_{\theta_U \in [0,d], e_1^U, e_2^U, e_b^U} \underbrace{D_U \times \theta_U}_{\text{uninformed fund's revenue}} - \underbrace{k_U \left(e_1^U + e_2^U + \tau e_b^U\right)^2/2}_{\text{uninformed fund's monitoring cost}}. \tag{6}$$

Individual investors receive exactly the same gross returns if they invest directly in the financial market or if they invest in the uninformed fund. Hence, the fee charged by the uninformed fund manager cannot be larger than direct investment costs, d, and, in equilibrium, there are two possible cases. If direct investment costs are sufficiently low, the uninformed fund manager sets $\theta_U = d$. Otherwise, if direct investment costs are high, the uninformed fund manager sets $\theta_U < d$ because the relevant competition is with the informed fund. In the baseline model, we focus on the former case in which $\theta_U = d$. We believe this assumption better represents the current environment in which both uninformed funds' fees and direct investment costs are low.[13] However, in the Online Appendix, we show that our main results also hold in the alternative case in which $\theta_U < d$.

Lemma 2 *For given monitoring investments, the fee charged by the informed fund manager is*

$$\theta_I = \frac{\Delta_m + e_1^I + z e_1^U - z e_2^U + 2d}{4}, \tag{7}$$

where $z = 1$ (resp. $z = 0$) with (resp. without) disclosure of the informed fund's portfolio. The fee θ_I increases with direct investment costs, d, with the difference in returns, Δ_m, with the informed fund's investment in monitoring for profitable firms, e_1^I, and with the uninformed fund's investment in monitoring for profitable firms, e_1^U. Moreover, θ_I decreases with the uninformed fund's investment in monitoring for unprofitable firms, e_2^U.

The fee charged by the informed fund manager increases in the expected return of firm 1 because the relative benefit of investing via the informed fund increases in the expected return of firm 1, which increases the measure of the informed fund's clients and their willingness to pay. In

[13] For example, passive funds' expense ratios have fallen from around 0.23% in the 2000s to less than 0.15% in recent years (Corum et al., 2021).

contrast, the fee charged by the informed fund decreases in the expected return of firm 2 because larger returns from firm 2 decrease the benefit of the informed fund's information advantage, all else equal.

Next, we solve for the fund managers' equilibrium investments in monitoring technologies. We start by deriving the informed fund manager's investment in monitoring. Substituting the equilibrium fees charged by the fund managers yields the following problem that characterizes the informed fund manager's choice of investment in monitoring technology:

$$\max_{e_1^I} \underbrace{\frac{\left(\Delta_m + e_1^I + ze_1^U - ze_2^U + 2d\right)^2}{4\sigma^2}}_{=D_I \times \theta_I} - k_I \left(e_1^I\right)^2 /2. \tag{8}$$

LEMMA 3 *For a given investment in monitoring technologies by the uninformed fund manager, e^U, the investment in the monitoring technology for profitable firms by the informed fund manager,*

$$e_1^I = \frac{\Delta_m + ze_1^U - ze_2^U + 2d}{2k_I\sigma^2 - 1}, \tag{9}$$

increases with the uninformed fund's investment in monitoring for profitable firms, e_1^U, but decreases with the uninformed fund's investment in monitoring for unprofitable firms, e_2^U.

Lemma 3 is a first step towards understanding the interaction between monitoring by the informed fund and monitoring by the uninformed fund. An increase in the uninformed fund's monitoring of firm 1 (resp. firm 2) increases the expected return of firm 1 (resp. firm 2), which increases (resp. decreases) the fee charged by the informed fund. As can be seen from the informed fund manager's maximization problem in Equation (8), this in turn increases (resp. decreases) the marginal benefit of monitoring, and increases (resp. decreases) the informed fund manager's incentives to monitor firm 1.

Similarly, substituting the equilibrium fees charged by the fund managers and, irrespective of the disclosure assumption (which enters the optimization in (10) via the parameter z), the uninformed fund manager's maximization problem becomes[14]

$$\max_{e_1^U, e_2^U, e_b^U} \underbrace{\frac{4m_1 - 3\Delta_m + e_1^I + ze_1^U + 3ze_2^U + 4e_b^U - 4 - 6d}{\sigma^2}}_{=D_U > 0} d - k_U \left(e_1^U + e_2^U + \tau e_b^U\right)^2 /2. \tag{10}$$

Before deriving the uninformed fund manager's equilibrium monitoring investments, we first formally define the notion of complementarity/substitutability in monitoring that we use throughout the rest of the paper.

Definition The informed fund's investment in monitoring, e^I, and the uninformed fund's investment in monitoring, e^U, are *complements* if and only if $\frac{\partial e^I}{\partial k_U} < 0$ and $\frac{\partial e^U}{\partial k_I} < 0$. Similarly, e^I and e^U are *substitutes* if and only if $\frac{\partial e^I}{\partial k_U} > 0$ and $\frac{\partial e^U}{\partial k_I} > 0$. Finally, e^I and e^U are *independent* if and only if $\frac{\partial e^I}{\partial k_U} = \frac{\partial e^U}{\partial k_I} = 0$.

[14]The measure of investors investing in the uninformed fund, D_U, is strictly positive because we assume that $\theta_U = d$. In the Online Appendix, with high direct investment costs, we derive the interior uninformed fund fee, and show that $\theta_U = (4m_1 - 3\Delta_m + e_1 + 3e_2 - 4)/14$. In the baseline model, we therefore have $(4m_1 - 3\Delta_m + e_1 + 3e_2 - 4)/14 > d$, which implies that $D_U > 0$.

Intuitively, the informed fund's investment in monitoring and the uninformed fund's investment in monitoring are complements (resp. substitutes) if and only if $\frac{\partial e^I}{\partial e^U} > 0$ and $\frac{\partial e^U}{\partial e^I} > 0$ (resp. $\frac{\partial e^I}{\partial e^U} < 0$ and $\frac{\partial e^U}{\partial e^I} < 0$). However, in equilibrium, both e^I and e^U are endogenously determined. Therefore, we use the cost parameters in our definition, as an increase in k_I (resp. k_U) unambiguously decreases e^I (resp. e^U).

Given this definition, we are now equipped to study the equilibrium interactions between the funds' monitoring investments. Recall that our main goal in this paper is to highlight the impact of portfolio disclosure on the fund managers' monitoring incentives. We therefore proceed in two steps: we analyze the uninformed fund manager's monitoring investments first in a benchmark model when the informed fund's portfolio is not disclosed, and then when it is made publicly observable via disclosure.

3.1. Benchmark Without Disclosure of the Informed Fund's Portfolio

Recall that, without disclosure of the funds' portfolios, the uninformed fund manager does not learn which firm is the profitable firm and cannot therefore efficiently use the monitoring technologies targeted at profitable and unprofitable firms, i.e., $z = 0$. We present the equilibrium monitoring investments in the following proposition.

PROPOSITION 1 *Without disclosure of the informed fund's portfolio, the informed fund manager invests* $e_1^I = \frac{\Delta_m + 2d}{2k_I\sigma^2 - 1}$ *in the monitoring technology for profitable firms, whereas the uninformed fund manager invests* $e^U = e_b^U = \frac{4d}{k_U\tau^2\sigma^2}$ *in the market-wide monitoring technology.*

Unsurprisingly, in the absence of additional information, the uninformed fund manager only invests in the market-wide monitoring technology, i.e., $e_1^U = e_2^U = 0$. Investing in monitoring technologies targeted only at profitable firms or unprofitable firms is inefficient for the uninformed fund manager given that they cannot be efficiently used. In contrast, the market-wide monitoring technology does not require the uninformed fund manager to know the identity of the firms. In the following corollary, we present comparative statics on the uninformed fund's monitoring investment.

COROLLARY 1 *Without disclosure of the informed fund's portfolio, the uninformed fund's monitoring investment,* e_b^U*, increases with direct investment costs, d. Moreover,* e_b^U *decreases with the uninformed fund's monitoring cost,* k_U*, with the incremental cost of market-wide monitoring,* τ*, and with the cash flow risk,* σ*.*

An increase in direct investment costs increases the fee charged by the uninformed fund, which in turn increases the uninformed fund manager's incentives to attract investors by increasing its investment in monitoring. In contrast, an increase in the uninformed fund's monitoring cost or in the cost of market-wide monitoring directly reduces the uninformed fund manager's incentives to invest in monitoring. Similarly, an increase in the cash flow risk decreases the measure of investors investing in the uninformed fund due to a reduced diversification benefit relative to the informed fund and a reduced attractiveness relative to the risk-free asset. This decreases the marginal benefit of monitoring and, therefore, decreases the uninformed fund manager's incentives to invest in monitoring technologies.

COROLLARY 2 *Without disclosure of the informed fund's portfolio, the informed fund's investment in monitoring,* e^I*, and the uninformed fund's investment in monitoring,* e^U*, are independent.*

Overall, in the model without disclosure of the informed fund's portfolio, informed and uninformed monitoring investments are neither strategic complements nor substitutes. The uninformed fund manager cannot target monitoring based on knowledge of the informed fund's portfolio, and the informed fund manager, anticipating this, ignores the uninformed fund when choosing its monitoring investment. In contrast, we next show that informed and uninformed monitoring investments can be complements or substitutes when the informed fund's portfolio is disclosed before the fund managers monitor the firms at $t = 3$.

3.2. Disclosure of the Informed Fund's Portfolio

We now analyze the variant of the model in which the informed fund's portfolio is publicly disclosed. Given disclosure of the informed fund's portfolio, Lemma 3 implies that the uninformed fund manager has greater incentives to monitor firm 1, as this also increases the informed fund manager's incentives to invest in monitoring. On the contrary, if the uninformed fund manager increases monitoring of firm 2, this decreases the informed fund manager's incentives to invest in monitoring. Proposition 2 highlights the funds' equilibrium investments in monitoring. To simplify the exposition of our results, we define the following two cutoffs on the cost of the market-wide monitoring technology, $\tau_1 \equiv \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2} > 1$ and $\tau_2 \equiv \frac{4k_I\sigma^2-2}{k_I\sigma^2} > 1$.

PROPOSITION 2 *With disclosure of the informed fund's portfolio, the informed fund manager and the uninformed fund manager invest in monitoring technologies as follows.*

- *If* $\tau \leq \min(\tau_1, \tau_2)$*, then* $e_1^U = e_2^U = 0$, $e_b^U = \frac{4d}{k_U\tau^2\sigma^2} > 0$, *and* $e_1^I = e_1^{I,b}$;
- *if* $\tau > \tau_1$ *and* $1/\sigma^2 < k_I$*, then* $e_1^U = e_b^U = 0$, $e_2^U = \frac{2(3k_I\sigma^2-2)d}{(2k_I\sigma^2-1)k_U\sigma^2}$, *and* $e_1^I = e_1^{I,2}$;
- *otherwise, if* $\tau > \tau_2$ *and* $1/\sigma^2 \geq k_I$*, then* $e_2^U = e_b^U = 0$, $e_1^U = \frac{2k_Id}{(2k_I\sigma^2-1)k_U}$, *and* $e_1^I = e_1^{I,1}$.

Moreover, we have $e_1^{I,1} \geq e_1^{I,b} \geq e_1^{I,2} \geq 0$*. The closed-form expressions for* $e_1^{I,b}$, $e_1^{I,1}$, *and* $e_1^{I,2}$ *are provided in the proof of Proposition 2.*

If the cost of the market-wide monitoring technology, τ, is small, the uninformed fund manager only invests in this technology and the funds' monitoring investments are the same as without disclosure of the informed fund's portfolio. Otherwise, if the cost of the market-wide monitoring technology is large, the uninformed fund manager invests either in the monitoring technology targeted at profitable firms or in the technology targeted at unprofitable firms.[15] For the uninformed fund manager, monitoring firm 2 takes investors from the informed fund and the risk-free asset, and reduces the informed fund manager's incentives to monitor. Monitoring firm 1 takes investors from the risk-free asset only, and causes an increase in investors to the informed fund. The increased informed fund demand leads to more monitoring of firm 1, and this can lead to even more investors coming over to the uninformed fund from the risk-free asset. If the informed fund's monitoring cost is large, the effect of uninformed fund monitoring on informed fund monitoring is small, which implies that the uninformed fund manager is better off monitoring firm 2. On the contrary, if the informed fund's monitoring cost is small, the effect of uninformed fund monitoring on informed fund monitoring is large, which implies that the uninformed fund manager is better off monitoring firm 1.

Next, we derive comparative statics on the funds' equilibrium monitoring investments to shed additional light on the drivers of the fund managers' incentives to invest in monitoring.

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[15] It is straightforward to show that the conditions across the three parts of Proposition 2 cover the entire parameter space, since $1 < k_I\sigma^2 \Leftrightarrow \tau_1 < \tau_2$.

COROLLARY 3 *With disclosure of the informed fund's portfolio, the informed fund's investment in monitoring, e_1^I: decreases with direct investment costs, d, if and only if $k_U < \frac{3k_I\sigma^2-2}{(2k_I\sigma^2-1)\sigma^2}$, $1/\sigma^2 < k_I$, and $\tau > \tau_1$; decreases with the informed fund's monitoring cost, k_I; and increases with the uninformed fund's monitoring cost, k_U, if and only if $1/\sigma^2 < k_I$ and $\tau > \tau_1$.*

If $1/\sigma^2 < k_I$ and $\tau > \tau_1$, an increase in direct investment costs has an ambiguous effect on e_1^I. It increases the fee charged by the informed fund and therefore has a positive impact. However, it also increases the uninformed fund's monitoring of firm 2, which has a negative impact. As a result, an increase in d leads to an increase in e_1^I if and only if the former effect dominates, i.e., if and only if the uninformed fund's monitoring cost is sufficiently large. Otherwise, if $\tau \leq \min(\tau_1, \tau_2)$ or $1/\sigma^2 \geq k_I$, an increase in d unambiguously increases e_1^I because it increases the fee charged by the informed fund and it does not increase the uninformed fund's monitoring of firm 2 relative to firm 1. Further, an increase in the informed fund's monitoring cost straightforwardly reduces the informed fund manager's incentives to invest in monitoring. The sign of the comparative static with respect to the uninformed fund's monitoring cost depends on the impact of uninformed monitoring on the informed fund's investment in monitoring. If the informed fund's monitoring cost and the cost of market-wide monitoring are both large, the uninformed fund manager is better off monitoring firm 2, which implies that the informed fund's monitoring investment increases with the uninformed fund's monitoring cost. In contrast, if the informed fund's monitoring cost is small and the cost of market-wide monitoring is large, the uninformed fund manager is better off monitoring firm 1, which implies that the informed fund's monitoring investment decreases with the uninformed fund's monitoring cost. Lastly, when the cost of market-wide monitoring is small, the uninformed fund's monitoring cost has no impact on e_1^I.

COROLLARY 4 *With disclosure of the informed fund's portfolio, the uninformed fund's investment in monitoring, e^U, increases with direct investment costs, d, and decreases with the uninformed fund's monitoring cost, k_U. Further, e^U increases with the informed fund's monitoring cost, k_I, if and only if $1/\sigma^2 < k_I$ and $\tau > \tau_1$.*

An increase in direct investment costs increases the fee charged by the uninformed fund, which provides additional monitoring incentives. Moreover, an increase in the uninformed fund's monitoring cost straightforwardly reduces the uninformed fund manager's incentives to invest in monitoring. Finally, increases in k_I decrease informed monitoring. If both the informed fund's monitoring cost, k_I, and the cost of market-wide monitoring, τ, are large, the decrease in informed monitoring has a positive effect on uninformed monitoring of firm 2. Otherwise, if either the informed fund's monitoring cost or the cost of market-wide monitoring is small, the decrease in informed monitoring has a weakly negative effect on uninformed monitoring of firm 1.

Having derived the comparative statics, we next formally state the equilibrium complementarity/substitutability in the funds' monitoring investments using our previously stated definition.

COROLLARY 5 *With disclosure of the informed fund's portfolio, the complementarity/substitutability in the funds' monitoring is as follows.*

- *If $\tau \leq \min(\tau_1, \tau_2)$, the informed fund's investment in monitoring, $e^I = e_1^I$, and the uninformed fund's investment in monitoring, $e^U = e_b^U$, are independent;*
- *if $1/\sigma^2 < k_I$ and $\tau > \tau_1$, the informed fund's investment in monitoring, $e^I = e_1^I$, and the uninformed fund's investment in monitoring, $e^U = e_2^U$, are substitutes;*

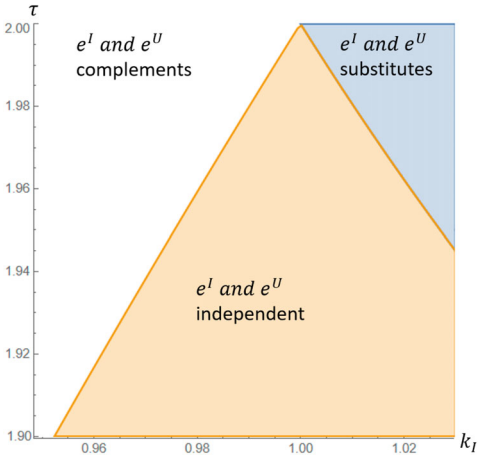

Figure 2. Complementarity and substitutability of informed monitoring investment, e^I, and uninformed monitoring investment, e^U, with portfolio disclosure as functions of k_I and τ. Parameter values are: $k_U = 3$, $\sigma = 1$, $\overline{\gamma} = 12$, $d = 1$, $m_1 = 2$, and $m_2 = 5/4$.

- *otherwise, if* $1/\sigma^2 \geq k_I$ *and* $\tau > \tau_2$*, the informed fund's investment in monitoring,* $e^I = e_1^I$*, and the uninformed fund's investment in monitoring,* $e^U = e_1^U$*, are complements.*

Corollary 5 follows directly from Proposition 2 and the associated comparative statics. Interestingly, with disclosure of the informed fund's portfolio, there can be non-trivial interactions between informed and uninformed monitoring investments. If the costs of market-wide monitoring, τ, and informed fund monitoring, k_I, are both large, then informed and uninformed monitoring investments are substitutes. Otherwise, if the cost of market-wide monitoring is large and the informed fund's monitoring cost is small, informed and uninformed monitoring investments are complements. Figure 2 illustrates Corollary 5 using a numerical example. Overall, while informed and uninformed monitoring are independent in the absence of portfolio disclosure, Figure 2 shows that there are interesting interactions among the funds' monitoring incentives when the informed fund's portfolio is publicly disclosed. We further explore the disclosure implications of our model in the next section.

4. Disclosure Implications

Having characterized the baseline model's equilibrium, we now derive disclosure implications. There is an ongoing debate on whether and which funds should publicly disclose their portfolios (Financial Times, 2020, 2023). As discussed in the introduction, the SEC has recently proposed and implemented changes to fund disclosure rules. Our results show that, without portfolio disclosure, the uninformed fund manager cannot target monitoring technologies contingent on the informed fund's portfolio. This limits the potential for interactions, including complementarities between informed and uninformed monitoring investments. In this section, we therefore study how portfolio disclosure affects the fund managers' monitoring impacts. We focus the analysis on the equilibrium monitoring impacts in this section as they capture the real effects of monitoring on firms' cash flows. Recall that the informed fund's monitoring impact is given by e_1^I, whereas the uninformed fund's monitoring impact is $ze_1^U + ze_2^U + 2e_b^U$.

LEMMA 4 *The effect of portfolio disclosure on monitoring impacts is as follows.*

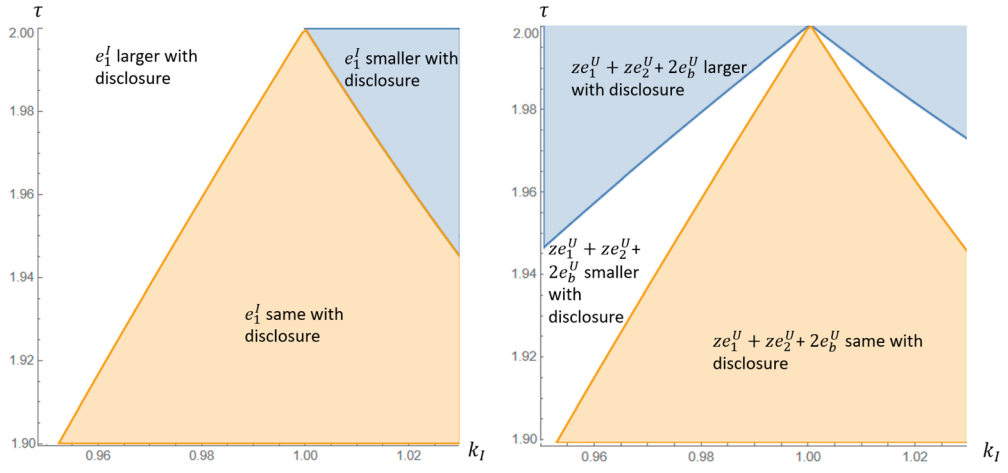

Figure 3. Effects of portfolio disclosure on informed and uninformed monitoring impacts as functions of k_I and τ. Parameter values are the same as in Figure 2.

- *If* $\tau \leq \min(\tau_1, \tau_2)$*, the impacts of the informed fund's monitoring,* e_1^I*, and the uninformed fund's monitoring,* $ze_1^U + ze_2^U + 2e_b^U$*, are the same with disclosure and without disclosure;*
- *if* $1/\sigma^2 < k_I$ *and* $\tau > \tau_1$*, the impact of the informed fund's monitoring,* e_1^I*, is larger without disclosure. The impact of the uninformed fund's monitoring,* $ze_1^U + ze_2^U + 2e_b^U$*, is larger with disclosure if and only if* $\tau^2 > 2\tau_1$*.;*
- *otherwise, if* $1/\sigma^2 \geq k_I$ *and* $\tau > \tau_2$*, the impact of the informed fund's monitoring,* e_1^I*, is larger with disclosure. The impact of the uninformed fund's monitoring,* $ze_1^U + ze_2^U + 2e_b^U$*, is larger with disclosure if and only if* $\tau^2 > 2\tau_2$*.*

Figure 3 illustrates Lemma 4 using the same numerical example as in Figure 2. First, if the cost of market-wide monitoring is small, the uninformed fund manager never invests in firm-specific monitoring technologies. Thus, disclosure of the informed fund's portfolio does not affect the fund managers' monitoring impacts. Second, if the costs of both market-wide monitoring and the informed fund's monitoring are large, i.e., if $\tau > \tau_1$ and $1/\sigma^2 < k_I$, the informed fund's monitoring impact is larger without disclosure because the funds' monitoring investments are substitutes. The uninformed fund's monitoring impact is larger with disclosure if and only if the cost of market-wide monitoring is relatively large. Third, if the cost of market-wide monitoring is large and the informed fund's monitoring cost is small, i.e., if $\tau > \tau_2$ and $1/\sigma^2 \geq k_I$, the informed fund's monitoring impact is larger with disclosure because of the complementarity between the funds' monitoring investments. The uninformed fund's monitoring impact is larger with disclosure if and only if the cost of market-wide monitoring is relatively large. Interestingly, our analysis predicts that disclosure of the informed fund's portfolio may either increase or decrease the informed fund's gross performance, which is equal to firm 1's cash flows minus its stock price.

Next, we compare the fund managers' total monitoring impact with and without disclosure of the informed fund's portfolio.

PROPOSITION 3 *The fund managers' total monitoring impact,* $e_1 + e_2$*, is larger without disclosure of the informed fund's portfolio than with disclosure if and only if* $1/\sigma^2 < k_I$ *and* $\tau_1^2 < \tau^2 < \tau_1 \frac{2k_I\sigma^2 - 1}{k_I\sigma^2 - 1}$.

Proposition 3 is an intuitive consequence of Lemma 4. If the cost of market-wide monitoring is small, the fund managers' monitoring investments do not depend on the disclosure of the informed fund's portfolio. Thus, disclosure of the informed fund's portfolio does not affect the fund managers' total monitoring impact. Moreover, if both the cost of market-wide monitoring and the informed fund's monitoring cost are large, i.e., if $1/\sigma^2 < k_I$ and $\tau > \tau_1$, portfolio disclosure has an ambiguous effect on total monitoring impact because it decreases the informed fund's monitoring impact but may increase the uninformed fund's monitoring impact. As a result, in the latter case, if the cost of market-wide monitoring is not too large, i.e., $\tau^2 < \tau_1 \frac{2k_I\sigma^2-1}{k_I\sigma^2-1}$, total monitoring impact is larger without disclosure because the disclosure effect on informed monitoring dominates. Otherwise, if the cost of market-wide monitoring is very large, i.e., $\tau^2 \geq \tau_1 \frac{2k_I\sigma^2-1}{k_I\sigma^2-1}$, total monitoring impact is larger with disclosure because the disclosure effect on uninformed monitoring dominates. Lastly, if the informed fund's monitoring cost is small and the cost of market-wide monitoring is large, i.e., if $1/\sigma^2 \geq k_I$ and $\tau > \tau_2$, total monitoring impact is larger with disclosure because of the complementarity between the funds' monitoring investments.

COROLLARY 6 *Both the informed fund manager and the uninformed fund manager are better off (i.e., have a larger expected utility) with disclosure of the informed fund's portfolio than without disclosure if and only if* $1/\sigma^2 \geq k_I$ *and* $\tau > \tau_2$.

Intuitively, both funds are better off with disclosure of the informed fund's portfolio when the funds' monitoring investments are complements. In contrast, when the funds' monitoring investments are substitutes, the informed fund is better off without disclosure of its portfolio. Otherwise, when the funds' monitoring investments are independent, disclosure does not affect the funds' expected utilities. Lastly, we analyze the informed fund manager's voluntary disclosure decision when disclosure is not mandated in the following corollary.

COROLLARY 7 *The informed fund manager voluntarily discloses its portfolio if and only if* $1/\sigma^2 \geq k_I$ *and* $\tau > \tau_2$. *Further, when voluntary disclosure is possible, total monitoring impact by the fund managers is larger without mandatory disclosure if and only if* $1/\sigma^2 < k_I$ *and* $\tau_1^2 < \tau^2 < \tau_1 \frac{2k_I\sigma^2-1}{k_I\sigma^2-1}$.

The informed fund manager wants to disclose (leading to discretionary disclosure) when monitoring investments are complementary. Interestingly, while the extant literature mainly suggests that increasing portfolio disclosure hurts investment funds and their investors, Corollary 7 shows that informed funds may actually benefit from voluntarily disclosing their portfolios.[16] In addition, if the informed fund's monitoring cost is large and the cost of market-wide monitoring is intermediate, i.e., if $1/\sigma^2 < k_I$ and $\tau_1^2 < \tau^2 < \tau_1 \frac{2k_I\sigma^2-1}{k_I\sigma^2-1}$, removing mandatory disclosure would lead to a larger total monitoring impact and no voluntary disclosure by the informed fund because disclosures in this region facilitate substitutive monitoring that has negative incentive spillovers.

5. Empirical and Policy Implications

This section discusses the main empirical predictions and policy implications of our results in light of the existing literature. Our complementarity result in Proposition 2 is consistent with the

[16]Li et al. (2023) study the determinants and effects of US active equity mutual funds' voluntary portfolio disclosure policies. They find that voluntary disclosure varies positively with institutional ownership and load fees, unimodally with past performance, and negatively with investment risk-taking and portfolio illiquidity.

clustered shareholder activism or wolf pack activism documented by Brav et al. (2022) and others (see, e.g., Artiga González & Calluzzo, 2019; Becht et al., 2017). Specifically, Brav et al. (2022) show that competition for flow increases blockholders' engagement incentives and helps ameliorate the problem of insufficient engagement. In our model, the funds could be interpreted as an informed activist and an uninformed activist. While Brav et al. (2022) only focuses on one portfolio firm, funds in our model may choose to monitor the same firms or different firms. Specifically, our results suggest that the existence of activist stock pickers who engage in monitoring can provide incentives to uninformed funds to invest in the development of potentially targeted monitoring expertize. Of course, the key ingredient that we study is portfolio disclosure, which allows the uninformed funds to target their monitoring at the right types of firms.

Moreover, in our model, the informed fund can also be interpreted as an actively managed fund, whereas the uninformed fund can be interpreted as an index/passive fund.[17] With this characterization, the result in Proposition 2 sheds some light on the debate regarding passive funds' monitoring incentives (see, e.g., Brav et al., 2023). Our results show that, taking into account the impact of uninformed fund monitoring on informed fund monitoring, there may be a complementarity effect, which implies that the uninformed fund may have incentives to monitor the same firms as the informed fund. This result is consistent with Appel et al. (2019), who provide empirical evidence that activists are more likely to engage in costly, value-enhancing forms of monitoring when a larger share of target companies' stock is held by passive funds. However, we also show that the uninformed fund may have incentives to avoid monitoring firms that are included in the informed fund's portfolio, consistent with substitutive monitoring. This substitutability result is in line with Lund (2018) and Bebchuk and Hirst (2019), who argue that competition reduces passive funds' incentives to engage in monitoring activities, as monitoring will also benefit the other competing funds.[18]

We can draw a parallel between the main insight from Corum et al. (2021) and our key result in Proposition 2. Corum et al. (2021) demonstrate that, if passive funds crowd out investors' private savings, active funds continue to engage in governance, and the impact of passive fund growth on monitoring is positive. However, if passive funds crowd out investors' allocations to active funds, the competition for investor capital reduces active funds' fees and assets under management, and this decreases active funds' incentives to engage in governance. In our model, when the funds' monitoring investments are substitutes, the uninformed fund manager monitors firm 2 and crowds out investors' allocations to the risk-free asset and to the informed fund. This reduces the informed fund manager's monitoring incentives. When the funds' monitoring investments are complements, however, the uninformed fund manager monitors firm 1 and only crowds out investors' allocations to the risk-free asset. This increases the informed fund manager's monitoring incentives. In contrast to Corum et al. (2021), in our model, the uninformed fund's monitoring of firm 2 always attracts investors from the informed fund and the risk-free

[17] As noted by Fisch et al. (2019),passive funds, by their very nature, must hold both the good and bad companies in their index. They do not have the option of exit and thus lack the active funds' ability to generate alpha through investment choices. Passive investors also do not have the firm-specific information or expertize necessary to address operational issues. Instead, passive investors compete against active funds by using their voice and seeking to improve corporate governance.

[18] One caveat with this interpretation is that our results may only apply to major passive asset managers such as the Big Three. Indeed, in their recent review of the literature, Brav et al. (2023) argue that there are important differences between small passive funds and large passive funds. They argue that the empirical evidence is consistent with the fact that the monitoring incentives of small passive funds are substantially weaker than those of large passive funds. See also our discussion of the governance role of passive funds in Section 1.1, contrasting Heath et al. (2022) and Schmidt and Fahlenbrach (2017) with Appel et al. (2016) and Filali Adib (2019).

asset, while monitoring of firm 1 causes the uninformed fund to attract investors from the risk-free asset but lose investors to the informed fund. Thus, our key finding that, when the active fund's portfolio is disclosed, informed and uninformed monitoring can be strategic complements is absent in Corum et al. (2021).

Finally, our results inform the ongoing debate about the disclosure of funds' portfolios. The SEC recently voted to impose tougher disclosure rules on private funds, and a coalition of private funds subsequently challenged these rules (Financial Times, 2023). As we show, an implication of the absence of portfolio disclosure is that uninformed fund managers cannot target monitoring technologies contingent on the informed funds' portfolios. This limits the potential for interactions, including complementarities between informed and uninformed monitoring investments.

6. Conclusion

In this paper, we shed light on the ongoing debate on how competition between asset managers affects corporate governance. An increasing share of households invest through information-insensitive passive funds rather than through active funds or directly in markets. This shift has concentrated a growing portion of publicly traded equity in the hands of the sponsors that operate index funds, particularly the Big Three (BlackRock, State Street, and Vanguard). They have almost quadrupled their collective ownership stake in S&P 500 companies over the past two decades and in aggregate cast an average of about 25% of the votes at S&P 500 companies (Hirst & Bebchuk, 2019). Regulators, scholars, and practitioners have expressed concerns about the lack of incentives that passive funds have to invest in corporate governance. We contribute to this debate by analyzing the monitoring incentives faced by informed/active and uninformed/passive funds, with specific implications around the impact of portfolio disclosure on asset managers' incentives to engage in monitoring.

We show that even uninformed funds, who can be viewed as passive investment allocators, find monitoring portfolio firms optimal in equilibrium, given that investments in monitoring can be used to attract portfolio investors. We further provide conditions for when uninformed and informed fund monitoring are strategic complements, leading to monitoring of the same firms, or substitutes, leading to monitoring of different firms. Our model yields several important disclosure implications. Disclosure of the informed fund's portfolio is an important antecedent to monitoring complementarities across funds. These are potentially important disclosure effects, above and beyond disclosure providing information to investors and firms. Interestingly, monitoring complementarities can also in and of themselves encourage voluntary disclosure of portfolio holdings when such disclosures are not mandated.

Lastly, our model may be used as a springboard to study other important aspects of asset management that we did not capture. For instance, we focus on governance via the voice mechanism. Even though some asset managers can hardly use the exit mechanism to improve portfolio firms' corporate governance (e.g., passive index followers), for other asset managers the exit mechanism may be as important as the voice mechanism. How the exit mechanism may be used by competing asset managers is an interesting avenue we leave to future research. We have also not considered how strategic trading in the face of price impact would influence the funds' incentives or ability to monitor firms. Arguably, in illiquid markets, informed funds may not be able to completely use their informational advantage, as stock prices may reveal their private information to uninformed funds and individual investors. Extending our model to include strategic trading may thus shed light on the feedback effect between stock prices and funds' monitoring activities.

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Appendix

A.1. Assumptions

Our analysis assumes the following:

$$k_U > \frac{2(3k_I\sigma^2 - 2)d}{(\Delta_m + 2d)(2k_I\sigma^2 - 1)\sigma^2}, \tag{A1}$$

$$k_I > \frac{2}{3\sigma^2}, \tag{A2}$$

$$m_1 + e_1^* - m_2 - e_2^* > 2d, \tag{A3}$$

and

$$m_1 + m_2 + e_1^* + e_2^* - \frac{\overline{\gamma}}{2}\sigma^2 < 2. \tag{A4}$$

The assumptions in (A1) and (A2) guarantee that the monitoring costs are sufficiently large so that equilibrium monitoring investments are interior. The assumption in (A3) implies that, in equilibrium, the expected return of firm 1 is sufficiently large compared to the expected return of firm 2 so that the informed fund only invests in firm 1. This assumption is consistent with the fact that actively-managed funds have more concentrated portfolios and invest in fewer companies than broad-based index funds (Rock & Kahan, 2019). Lastly, the assumption in (A4) rules out a corner solution and ensures that the most risk-averse investor invests in the risk-free asset.

The assumptions in (A3) and in (A4) are expressed as functions of the endogenous monitoring impacts, e_1^* and e_2^*, derived below. Given the equilibrium monitoring impacts, which can

be substituted in, it is straightforward to verify that the assumption in (A3) is satisfied if k_I is sufficiently small, whereas the assumption in (A4) is satisfied if $\overline{\gamma}$ is sufficiently large.

Specifically, the assumption in (A3) is satisfied if

$$m_1 + \frac{d(4 - 2k_U\sigma^2 + 2k_I\sigma^2(2k_U\sigma^2 - 3)) + k_U\Delta_m\sigma^2(2k_I\sigma^2 - 1)}{k_U\left(2k_I\sigma^2 - 1\right)^2\sigma^2}$$
$$- m_2 - \frac{2\left(3k_I\sigma^2 - 2\right)d}{\left(2k_I\sigma^2 - 1\right)k_U\sigma^2} > 2d.$$

The assumption in (A4) is satisfied if

$$m_1 + m_2 + \frac{d(4 - 2k_U\sigma^2 + 2k_I\sigma^2(2k_U\sigma^2 - 3)) + k_U\Delta_m\sigma^2(2k_I\sigma^2 - 1)}{k_U\left(2k_I\sigma^2 - 1\right)^2\sigma^2}$$
$$+ \frac{2\left(3k_I\sigma^2 - 2\right)d}{\left(2k_I\sigma^2 - 1\right)k_U\sigma^2} - \frac{\overline{\gamma}}{2}\sigma^2 < 2.$$

and

$$m_1 + m_2 + \frac{8d}{\tau^2 k_U\sigma^2} + \frac{\Delta_m + 2d}{2k_I\sigma^2 - 1} - \frac{\overline{\gamma}}{2}\sigma^2 < 2.$$

A.2. Proofs

Proof of Lemmas 1 and 2. We derive the equilibrium assuming that the informed fund manager only invests in firm 1 and the uninformed fund manager equally invests in firm 1 and firm 2. We then show at the end of the proof that this is indeed the optimal strategy for the fund managers. We first prove the existence of the two cutoffs $\gamma^- \in [0, \overline{\gamma}]$ and $\gamma^+ \in [\gamma^-, \overline{\gamma}]$. Consider an individual investor i with a coefficient of risk-aversion γ_i. The gross expected return from investing in the informed fund is

$$E[R_1] - \frac{\gamma_i}{2}Var[R_1] \tag{A5}$$

whereas the gross expected return from investing in the uninformed fund is

$$E\left[\frac{1}{2}(R_1 + R_2)\right] - \frac{\gamma_i}{2}Var\left[\frac{1}{2}(R_1 + R_2)\right]. \tag{A6}$$

Recall that the return from investing in the risk-free asset is 0. At one extreme, if $\gamma_i = 0$, then

$$E[R_1] - \frac{\gamma_i}{2}Var[R_1] > E\left[\frac{1}{2}(R_1 + R_2)\right] - \frac{\gamma_i}{2}Var\left[\frac{1}{2}(R_1 + R_2)\right].$$

On the contrary, at the other extreme, if $\gamma_i = \overline{\gamma}$, then

$$E\left[\frac{1}{2}(R_1 + R_2)\right] - \frac{\gamma_i}{2}Var\left[\frac{1}{2}(R_1 + R_2)\right] < 1.$$

This last inequality follows from the assumption in (A4). Finally, the gross expected returns (A5) and (A6) are linear and decreasing in γ_i, which proves the existence of $\gamma^- \in [0, \overline{\gamma}]$ and $\gamma^+ \in [\gamma^-, \overline{\gamma}]$.

We now formally derive the cutoffs γ^- and γ^+. An individual investor i with a coefficient of risk-aversion γ_i invests in the informed fund if and only if

$$m_1 + e_1 - \frac{\gamma_i}{2}\sigma^2 - \theta_I \geq \frac{1}{2}(m_1 + m_2 + e_1 + e_2) - \frac{\gamma_i}{4}\sigma^2 - \theta_U.$$

As a result, the cutoff γ^- is the coefficient of risk-aversion of the individual investor who is indifferent between investing in the informed fund and in the uninformed fund, i.e.,

$$\gamma^- = \frac{(m_1 - m_2 + e_1 - e_2) + 2(\theta_U - \theta_I)}{\frac{1}{2}\sigma^2}.$$

Hence, the measure of investors investing in the informed fund is given by

$$D_I = \int_0^{\gamma^-} di = \frac{(m_1 - m_2 + e_1 - e_2) + 2(\theta_U - \theta_I)}{\frac{1}{2}\sigma^2} \tag{A7}$$

Similarly, an investor i with a coefficient of risk-aversion γ_i invests in the uninformed fund rather than in the risk-free asset if and only

$$\frac{1}{2}(m_1 + m_2 + e_1 + e_2) - \frac{\gamma_i}{4}\sigma^2 - \theta_U \geq 1.$$

As a result, the cutoff γ^+ is the coefficient of risk-aversion of the individual investor who is indifferent between investing in the uninformed fund and in the risk-free asset, i.e.,

$$\gamma^+ = \frac{2(m_1 + m_2 + e_1 + e_2 - 2(\theta_U + 1))}{\sigma^2}.$$

Hence, the measure of investors investing in the uninformed fund is given by

$$\begin{aligned} D_U &= \int_{\gamma^-}^{\gamma^+} di = \frac{2(m_1 + m_2 + e_1 + e_2 - 2(\theta_U + 1))}{\sigma^2} - \frac{(m_1 - m_2 + e_1 - e_2) + 2(\theta_U - \theta_I)}{\frac{1}{2}\sigma^2} \\ &= 4\frac{m_2 + e_2 - (2\theta_U + 1 - \theta_I)}{\sigma^2}. \end{aligned}$$

In addition, the measure of investors investing in the risk-free asset is given by

$$D_R \equiv \int_{\gamma^+}^{\overline{\gamma}} di = \frac{\overline{\gamma}\sigma^2 - 2(m_1 + m_2 + e_1 + e_2 - 2(\theta_U + 1))}{\sigma^2}. \tag{A8}$$

Note that the assumption in (A4) implies that, in equilibrium, the measures of investors D_I, D_U, and D_R are strictly positive.

After deriving the measure of investors investing in the informed fund, in the uninformed fund, and in the risk-free asset, we solve for the equilibrium fees θ_I and θ_U set by the fund managers at $t = 0$. First, the informed fund manager's maximization problem is $\max_{\theta_I} D_I \times \theta_I - k_I(e_1^I)^2/2$. Substituting the measure of investors investing in the informed fund derived in Equation (A7)

into the informed fund manager's objective function yields

$$\max_{\theta_I} \frac{(m_1 - m_2 + e_1 - e_2) + 2(\theta_U - \theta_I)}{\frac{1}{2}\sigma^2}\theta_I - k_I \left(e_1^I\right)^2/2.$$

The first-order condition with respect to θ_I yields

$$\theta_I = \frac{\left(m_1 - m_2 + e_1^I + e_1^U - e_2^U\right) + 2\theta_U}{4}. \tag{A9}$$

Next, the uninformed fund manager's maximization problem is $\max_{\theta_U} D_U \times \theta_U - \frac{k_U}{2}(e_1^U + e_2^U + \tau e_b^U)^2$. Taking the first-order condition with respect to θ_U yields

$$\theta_U = \min\left(d, \frac{m_1 + 3m_2 + e_1 + 3e_2 - 4}{14}\right).$$

Having derived the endogenous fees, we now check that the conditions $m_2 + e_2 + \theta_I - 1 > 2\theta_U > e_2 - e_1 - \Delta_m + 2\theta_I$ always hold. First, $2\theta_U > e_2 - e_1 - \Delta_m + 2\theta_I$ is equivalent to

$$2\theta_U > e_2 - e_1 - \Delta_m + 2\frac{(\Delta_m + e_1 - e_2) + 2\theta_U}{4},$$

which is equivalent to $2\theta_U > e_2 - e_1 - \Delta_m$, which is always satisfied given that $m_1 + e_1 > m_2 + e_2$ by assumption. Second, $m_2 + e_2 + \theta_I - 1 > 2\theta_U$ is equivalent to

$$m_2 + e_2 + \frac{(m_1 - m_2 + e_1 - e_2) + 2\theta_U}{4} - 1 > 2\theta_U,$$

which is equivalent to $3m_2 + 3e_2 + m_1 + e_1 - 4 > 6\theta_U$. If $\theta_U = \frac{m_1 + 3m_2 + e_1 + 3e_2 - 4}{14}$, then this last condition is equivalent to

$$\frac{4}{7}(3m_2 + 3e_2 + m_1 + e_1 - 4) > 0,$$

which is always satisfied given that $m_1 > m_2 > 1$. Otherwise, if $\theta_U = d$, then $3m_2 + 3e_2 + m_1 + e_1 - 4 > 6\frac{m_1 + 3m_2 + e_1 + 3e_2 - 4}{14} > 6d$, which implies that the condition is also satisfied.

Lastly, we derive the fund managers' investment strategies. The uninformed fund manager has no private information. As a result, the uninformed fund manager minimizes the risk of the uninformed fund's portfolio by investing equally in the two firms. Moreover, we check that the equilibrium is such that the informed fund manager only invests in firm 1. Assume that the informed fund manager chooses a portfolio consisting of a fraction $x \in [0, 1]$ of firm 1 and a fraction $1 - x$ of firm 2. The informed fund's portfolio thus has a mean of

$$E[xR_1 + (1 - x)R_2] = x(m_1 + e_1) + (1 - x)(m_2 + e_2)$$

and a variance of

$$Var[xR_1 + (1 - x)R_2] = x^2\sigma^2 + (1 - x)^2\sigma^2.$$

An individual investor i with a coefficient of risk-aversion γ_i invests in the informed fund if and only if

$$x(m_1 + e_1) + (1 - x)(m_2 + e_2) - \frac{\gamma_i}{2}(x^2\sigma^2 + (1 - x)^2\sigma^2) - \theta_I$$

$$\geq \frac{1}{2}(m_1 + m_2 + e_1 + e_2) - \frac{\gamma_i}{4}\sigma^2 - \theta_U.$$

The indifference cutoff is defined such that

$$\gamma^{ind} = \frac{(2x-1)(m_1 - m_2 + e_1 - e_2) + 2(\theta_U - \theta_I)}{\frac{1}{2}(2x-1)^2\sigma^2}.$$

The informed fund manager's maximization problem becomes

$$\max_{\theta_I} \frac{(2x-1)(m_1 - m_2 + e_1 - e_2) + 2(\theta_U - \theta_I)}{\frac{1}{2}(2x-1)^2\sigma^2}\theta_I - k_I\frac{(e_1^I)^2}{2}.$$

Thus, the equilibrium fee is

$$\theta_I = \frac{(2x-1)(m_1 - m_2 + e_1 - e_2) + 2\theta_U}{4}.$$

Next, we solve for the informed fund manager's equilibrium choice of x. Consider the average investor investing in the informed fund, i.e, $\gamma_i = \frac{\gamma^{ind}}{2}$. The fraction x of investment in firm 1 that maximizes the utility of this average investor is such that

$$\max_x x(m_1 + e_1) + (1-x)(m_2 + e_2) - \frac{\gamma^{ind}}{4}\left(x^2\sigma^2 + (1-x)^2\sigma^2\right).$$

The first-order condition with respect to x gives $x = \frac{1}{2} + \frac{m_1 + e_1 - m_2 - e_2}{\gamma^{ind}\sigma^2}$. Substituting $\gamma^{ind} = \frac{(2x-1)(m_1 - m_2 + e_1 - e_2) + 2(\theta_U - \theta_I)}{\frac{1}{2}(2x-1)^2\sigma^2}$ into the previous equality, we get

$$\begin{aligned} x(2x-1)(m_1 - m_2 + e_1 - e_2) + 2x(\theta_U - \theta_I) = {} & \frac{1}{2}(m_1 - m_2 + e_1 - e_2)(2x-1)^2 \\ & + \frac{1}{2}(2x-1)(m_1 - m_2 + e_1 - e_2) + \theta_U - \theta_I. \end{aligned}$$

Substituting $\theta_U = d$ and $\theta_I = \frac{(2x-1)(m_1 - m_2 + e_1 - e_2) + 2\theta_U}{4}$ into the previous equality and solving for x, we get $x = \frac{1}{2}$ or $x = \frac{1}{2} + \frac{d}{m_1 - m_2 + e_1 - e_2}$. At $x = \frac{1}{2} + \frac{d}{m_1 - m_2 + e_1 - e_2}$, we have $\gamma^{ind} < \gamma^+$ if and only if

$$\frac{(m_1 - m_2 + e_1 - e_2)^2}{d\sigma^2} < \frac{2\,(m_1 + m_2 + e_1 + e_2 - 2(d+1))}{\sigma^2},$$

which is equivalent to $(m_1 - m_2 + e_1 - e_2 - d)^2 < -3d^2 - 4d$, which is never satisfied. Thus, the equilibrium is a corner solution. In particular, $x = 1$ is the unique equilibrium if, at $x = 1$, $\frac{1}{2} + \frac{m_1 + e_1 - m_2 - e_2}{\gamma^{ind}\sigma^2} \geq 1$, which is equivalent to $m_1 + e_1 - m_2 - e_2 \geq 2d$. The assumption in (A3) therefore implies that $x^* = 1$. ■

Proof of Lemma 3. The informed fund manager's maximization problem is given by the equation in (8). Taking the first-order condition with respect to e_1^I, we get

$$e_1^I = \frac{\Delta_m + ze_1^U - ze_2^U + 2d}{2k_I\sigma^2 - 1}. \tag{A10}$$

The comparative statics are immediate. ■

Proof of Proposition 1. Substituting the equilibrium informed monitoring (A10) into the uninformed fund manager's maximization problem yields

$$\max_{e_1^U, e_2^U, e_b^U} \frac{2(m_1 + 3m_2 + 4e_b^U - 4 - 6d)k_I\sigma^2 - 4(m_2 + e_b^U - 1 - 2d)}{(2k_I\sigma^2 - 1)\sigma^2} d - \frac{k_U}{2}\left(e_1^U + e_2^U + \tau e_b^U\right)^2.$$

Taking the first-order condition with respect to e_b^U, we get

$$\tau k_U \left(e_1^U + e_2^U + \tau e_b^U\right) = \frac{4d}{\sigma^2}.$$

Hence, the uninformed fund manager chooses $e_b^U = \frac{4d}{\tau^2 k_U \sigma^2}$ and $e_1^U = e_2^U = 0$, and we get $e_1^I = \frac{\Delta_m + 2d}{2k_I\sigma^2 - 1}$. ■

Proof of Corollary 1. Direct consequence of Proposition 1. ■

Proof of Corollary 2: Direct consequence of Proposition 1. ■

Proof of Proposition 2. Substituting the equilibrium informed monitoring (A10) into the uninformed fund manager's maximization problem yields

$$\max_{e_1^U, e_2^U, e_b^U} \frac{2(m_1 + 3m_2 + e_1^U + 3e_2^U + 4e_b^U - 4 - 6d)k_I\sigma^2 - 4(m_2 + e_2^U + e_b^U - 1 - 2d)}{(2k_I\sigma^2 - 1)\sigma^2} d$$
$$- \frac{k_U}{2}\left(e_1^U + e_2^U + \tau e_b^U\right)^2.$$

First, taking the first-order condition with respect to e_1^U, we get

$$k_U \left(e_1^U + e_2^U + \tau e_b^U\right) = \frac{2dk_I}{2k_I\sigma^2 - 1}.$$

Second, taking the first-order condition with respect to e_2^U, we get

$$k_U \left(e_1^U + e_2^U + \tau e_b^U\right) = \frac{6k_I\sigma^2 - 4}{(2k_I\sigma^2 - 1)\sigma^2} d.$$

Third, taking the first-order condition with respect to e_b^U, we get

$$\tau k_U \left(e_1^U + e_2^U + \tau e_b^U\right) = \frac{4d}{\sigma^2}.$$

The uninformed fund manager is strictly better off with $e_b^U = \frac{4d}{\tau^2 k_U \sigma^2}$ and $e_1^U = e_2^U = 0$ than with $e_1^U = \frac{2dk_I}{k_U(2k_I\sigma^2 - 1)}$ and $e_b^U = e_2^U = 0$ if and only if $\frac{k_I^2}{(1-2k_I\sigma^2)^2} - \frac{4}{\tau^2\sigma^4} < 0$. Moreover, the uninformed fund manager is strictly better off with $e_b^U = \frac{4d}{\tau^2 k_U \sigma^2}$ and $e_1^U = e_2^U = 0$ than with $e_2^U = \frac{6k_I\sigma^2 - 4}{(2k_I\sigma^2 - 1)k_U\sigma^2} d$ and $e_b^U = e_1^U = 0$ if and only if $\frac{(2-3k_I\sigma^2)^2}{(1-2k_I\sigma^2)^2} - \frac{4}{\tau^2} < 0$. Finally, the uninformed fund manager is strictly better off with $e_1^U = \frac{2dk_I}{k_U(2k_I\sigma^2 - 1)}$ and $e_2^U = e_b^U = 0$ than with $e_2^U = \frac{6k_I\sigma^2 - 4}{(2k_I\sigma^2 - 1)k_U\sigma^2} d$ and $e_b^U = e_1^U = 0$ if and only if $k_I\sigma^2 < 1$.

Therefore, we obtain the following three cases:

- if $\tau \leq \frac{4k_I\sigma^2-2}{k_I\sigma^2}$ and $\tau \leq \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, then $e_1^U = e_2^U = 0$, $e_b^U = \frac{4d}{k_U\tau^2\sigma^2} > 0$;
- if $1 < k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, then $e_1^U = e_b^U = 0$, $e_2^U = \frac{2(3k_I\sigma^2-2)d}{(2k_I\sigma^2-1)k_U\sigma^2}$;
- otherwise, if $1 \geq k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{k_I\sigma^2}$, then $e_2^U = e_b^U = 0$, $e_1^U = \frac{2dk_I}{(2k_I\sigma^2-1)k_U}$.

Lastly, we get the expression of e_1^I by substituting the values of e_1^U, e_2^U, and e_b^U in (A10):

- if $\tau \leq \frac{4k_I\sigma^2-2}{k_I\sigma^2}$ and $\tau \leq \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, $e_1^I = e_1^{I,b} \equiv \frac{\Delta_m+2d}{2k_I\sigma^2-1}$;
- if $1 < k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, $e_1^I = e_1^{I,2} \equiv \frac{d(4-2k_U\sigma^2+2k_I\sigma^2(-3+2k_U\sigma^2))+k_U\Delta_m\sigma^2(-1+2k_I\sigma^2)}{k_U(2k_I\sigma^2-1)^2\sigma^2}$;
- otherwise, if $1 \geq k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{k_I\sigma^2}$, $e_1^I = e_1^{I,1} \equiv \frac{2dk_I+k_U(2d+\Delta_m)(-1+2k_I\sigma^2)}{k_U(2k_I\sigma^2-1)^2}$.

Note that, if $1 < k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, then $e_1^I \leq 0$ if and only if $k_U \leq \frac{6k_I\sigma^2d-4d}{(\Delta_m+2d)(2k_I\sigma^2-1)\sigma^2}$, which contradicts the assumption in (A1). As a result, in equilibrium, we have $e_1^I > 0$. ■

Proof of Corollary 3. First, if $\tau \leq \frac{4k_I\sigma^2-2}{k_I\sigma^2}$ and $\tau \leq \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, we have $e_1^I = \frac{\Delta_m+2d}{2k_I\sigma^2-1}$ and the comparative statics are immediate. Second, from Proposition 2, we know that, if $1 < k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$,

$$\begin{aligned} e_1^I &= \frac{d(4-2k_U\sigma^2+2k_I\sigma^2(-3+2k_U\sigma^2))+k_U\Delta_m\sigma^2(-1+2k_I\sigma^2)}{k_U\left(2k_I\sigma^2-1\right)^2\sigma^2} \\ &= 2\frac{2-3k_I\sigma^2}{k_U\left(2k_I\sigma^2-1\right)^2\sigma^2}d + \frac{\Delta_m+2d}{2k_I\sigma^2-1}. \end{aligned}$$

Moreover,

$$\frac{\partial e_1^I}{\partial d} = 2\frac{2-3k_I\sigma^2}{k_U\left(2k_I\sigma^2-1\right)^2\sigma^2} + \frac{2}{2k_I\sigma^2-1} > 0,$$

is equivalent to $k_U > \frac{3k_I\sigma^2-2}{(2k_I\sigma^2-1)\sigma^2}$. Further, it is straightforward to check that e_1^I is decreasing in k_I, and increasing in k_U. Third, from Proposition 2, we know that, if $1 \geq k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{k_I\sigma^2}$,

$$\begin{aligned} e_1^I &= \frac{2dk_I+k_U(2d+\Delta_m)(-1+2k_I\sigma^2)}{k_U\left(2k_I\sigma^2-1\right)^2} \\ &= \frac{2k_Id}{k_U\left(2k_I\sigma^2-1\right)^2} + \frac{2d+\Delta_m}{2k_I\sigma^2-1}. \end{aligned}$$

As a result, it is straightforward to check that e_1^I is decreasing in k_I, and decreasing in k_U. ■

Proof of Corollary 4: First, if $\tau \leq \frac{4k_I\sigma^2-2}{k_I\sigma^2}$ and $\tau \leq \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, we have $e_b^U = \frac{4d}{k_U\tau^2\sigma^2}$ and the comparative statics are immediate. Second, if $1 < k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, then

$$\begin{aligned} \frac{\partial e_2^U}{\partial d} &= \frac{6k_I\sigma^2-4}{k_U\left(2k_I\sigma^2-1\right)\sigma^2} > 0, \\ \frac{\partial e_2^U}{\partial k_I} &= \frac{6\sigma^2\left(2k_I\sigma^2-1\right)-\left(6k_I\sigma^2-4\right)2\sigma^2}{k_U\left(2k_I\sigma^2-1\right)^2\sigma^2}d > 0, \end{aligned}$$

$$\frac{\partial e_2^U}{\partial k_U} = -\frac{6k_I\sigma^2 - 4}{k_U^2\left(2k_I\sigma^2 - 1\right)\sigma^2}d < 0.$$

Third, if $1 \geq k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{k_I\sigma^2}$, then

$$\frac{\partial e_1^U}{\partial d} = \frac{2k_I}{k_U\left(2k_I\sigma^2 - 1\right)} > 0,$$
$$\frac{\partial e_1^U}{\partial k_I} = \frac{2d\left(2k_I\sigma^2 - 1\right) - 4k_I\sigma^2 d}{k_U\left(2k_I\sigma^2 - 1\right)^2\sigma^2} < 0,$$
$$\frac{\partial e_1^U}{\partial k_U} = -\frac{2k_I d}{k_U^2\left(2k_I\sigma^2 - 1\right)} < 0.$$

■

Proof of Corollary 5. Direct consequence of Corollaries 3 and 4. ■

Proof of Lemma 4. If $\tau \leq \min(\frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}, \frac{4k_I\sigma^2-2}{k_I\sigma^2})$, Propositions 1 and 2 jointly imply that the funds' monitoring impacts are the same with disclosure and without disclosure of the funds' portfolios: $e_b^U = \frac{4d}{\tau^2 k_U\sigma^2}$, $e_1^U = e_2^U = 0$, and $e_1^I = \frac{\Delta_m+2d}{2k_I\sigma^2-1}$.

If $1 < k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, the informed fund monitoring impact is larger with disclosure than without disclosure if and only if

$$\frac{d(4 - 2k_U\sigma^2 + 2k_I\sigma^2(-3 + 2k_U\sigma^2)) + k_U\Delta_m\sigma^2(-1 + 2k_I\sigma^2)}{k_U\left(2k_I\sigma^2 - 1\right)^2\sigma^2} > \frac{\Delta_m + 2d}{2k_I\sigma^2 - 1},$$

which is not satisfied. Moreover, the uninformed fund monitoring impact is larger with disclosure than without disclosure if and only if

$$\frac{2\left(3k_I\sigma^2 - 2\right)d}{\left(2k_I\sigma^2 - 1\right)k_U\sigma^2} > \frac{8d}{\tau^2 k_U\sigma^2},$$

which is equivalent to $\frac{3k_I\sigma^2-2}{2k_I\sigma^2-1} > \frac{4}{\tau^2}$.

Otherwise, if $1 \geq k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{k_I\sigma^2}$, the informed fund monitoring impact is larger with disclosure than without disclosure if and only if

$$\frac{2dk_I + k_U(2d + \Delta_m)(-1 + 2k_I\sigma^2)}{k_U\left(2k_I\sigma^2 - 1\right)^2} > \frac{\Delta_m + 2d}{2k_I\sigma^2 - 1},$$

which is always satisfied. Moreover, the uninformed fund monitoring impact is larger with disclosure than without disclosure if and only if

$$\frac{2dk_I}{\left(2k_I\sigma^2 - 1\right)k_U} > \frac{8d}{\tau^2 k_U\sigma^2},$$

which is equivalent to $\frac{k_I}{2k_I\sigma^2-1} > \frac{4}{\tau^2\sigma^2}$. ■

Proof of Proposition 3. Total monitoring impact without disclosure of the informed fund's portfolio is $\frac{8d}{\tau^2 k_U\sigma^2} + \frac{\Delta_m+2d}{2k_I\sigma^2-1}$. First, if $\tau \leq \min(\frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}, \frac{4k_I\sigma^2-2}{k_I\sigma^2})$, total monitoring impact is the

same with disclosure and without disclosure. Second, if $1 < k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, monitoring impact by the uninformed fund manager with disclosure is $\frac{2(3k_I\sigma^2-2)d}{(2k_I\sigma^2-1)k_U\sigma^2}$. Hence, if $1 < k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, total monitoring impact is smaller without disclosure of the informed fund's portfolio if and only if

$$\frac{2\left(3k_I\sigma^2-2\right)d}{\left(2k_I\sigma^2-1\right)k_U\sigma^2}+\frac{m_1-m_2-e_2^U+2d}{2k_I\sigma^2-1}>\frac{8d}{\tau^2k_U\sigma^2}+\frac{\Delta_m+2d}{2k_I\sigma^2-1},$$

which is equivalent to

$$\frac{3k_I\sigma^2-2}{\left(2k_I\sigma^2-1\right)k_U\sigma^2}\times\frac{k_I\sigma^2-1}{2k_I\sigma^2-1}>\frac{2}{\tau^2k_U\sigma^2},$$

which is equivalent to

$$\tau^2(3k_I\sigma^2-2)(k_I\sigma^2-1)>2\left(2k_I\sigma^2-1\right)^2.$$

Third, if $1 \geq k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{k_I\sigma^2}$, total monitoring impact with disclosure is

$$\frac{2dk_I}{\left(2k_I\sigma^2-1\right)k_U}+\frac{m_1-m_2+e_1^U+2d}{2k_I\sigma^2-1}.$$

Hence, if $1 \geq k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{k_I\sigma^2}$, total monitoring impact is smaller without disclosure of the informed fund's portfolio if and only if

$$\frac{2dk_I}{\left(2k_I\sigma^2-1\right)k_U}+\frac{m_1-m_2+e_1^U+2d}{2k_I\sigma^2-1}>\frac{8d}{\tau^2k_U\sigma^2}+\frac{\Delta_m+2d}{2k_I\sigma^2-1},$$

which is equivalent to

$$\frac{k_I}{\left(2k_I\sigma^2-1\right)k_U}\times\frac{k_I\sigma^2}{2k_I\sigma^2-1}>\frac{2}{\tau^2k_U\sigma^2},$$

which is equivalent to $\tau^2k_I^2\sigma^4 > 2(2k_I\sigma^2-1)^2$. The condition $\tau > \frac{4k_I\sigma^2-2}{k_I\sigma^2}$ implies that

$$\tau^2>\tau>\frac{4k_I\sigma^2-2}{k_I\sigma^2}>\frac{4k_I\sigma^2-2}{k_I\sigma^2}\times\frac{2k_I\sigma^2-1}{k_I\sigma^2}.$$

■

Proof of Corollary 6. First, if $\tau \leq \min(\frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}, \frac{4k_I\sigma^2-2}{k_I\sigma^2})$, the funds' monitoring impacts are the same with disclosure and without disclosure. Hence, both funds have the same expected utility with disclosure and without disclosure.

Second, if $1 < k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{3k_I\sigma^2-2}$, the uninformed fund manager is strictly better off with $e_b^U = \frac{4d}{\tau^2k_U\sigma^2}$ and $e_1^U = e_2^U = 0$ than with $e_2^U = \frac{6k_I\sigma^2-4}{(2k_I\sigma^2-1)k_U\sigma^2}d$ and $e_b^U = e_1^U = 0$ if and only if

$$\frac{(2-3k_I\sigma^2)^2}{(1-2k_I\sigma^2)^2}-\frac{4}{\tau^2}<0,$$

which is not satisfied. In addition, the informed fund manager is strictly better off with $e_b^U = \frac{4d}{\tau^2k_U\sigma^2}$ and $e_1^U = e_2^U = 0$ than with $e_2^U = \frac{6k_I\sigma^2-4}{(2k_I\sigma^2-1)k_U\sigma^2}d$ and $e_b^U = e_1^U = 0$ if and only if

$$\frac{2dk_I(3k_I\sigma^2-2)(k_U\Delta_m\sigma^2(2k_I\sigma^2-1)+d(2-2k_U\sigma^2+k_I\sigma^2(4k_U\sigma^2-3)))}{k_U^2\sigma^4(2k_I\sigma^2-1)^3}>0,$$

which is always satisfied.

Third, if $1 \geq k_I\sigma^2$ and $\tau > \frac{4k_I\sigma^2-2}{k_I\sigma^2}$, the uninformed fund manager is strictly better off with $e_b^U = \frac{4d}{\tau^2 k_U \sigma^2}$ and $e_1^U = e_2^U = 0$ than with $e_1^U = \frac{2dk_I}{k_U(2k_I\sigma^2-1)}$ and $e_b^U = e_2^U = 0$ if and only if

$$\frac{k_I^2}{(1-2k_I\sigma^2)^2} - \frac{4}{\tau^2\sigma^4} < 0,$$

which is not satisfied. In addition, the informed fund manager is strictly better off with $e_b^U = \frac{4d}{\tau^2 k_U \sigma^2}$ and $e_1^U = e_2^U = 0$ than with $e_1^U = \frac{2dk_I}{k_U(2k_I\sigma^2-1)}$ and $e_b^U = e_2^U = 0$ if and only if

$$\frac{2dk_I^2(k_U\Delta_m(-1+2k_I\sigma^2) + d(k_I - 2k_U + 4k_Ik_U\sigma^2))}{k_U^2(-1+2k_I\sigma^2)^3} < 0,$$

which is never satisfied. ■

Proof of Corollary 7. Direct consequence of Proposition 3 and Corollary 6. ■