Corporate Governance in the Presence of Active and Passive Delegated Investment

Finance Working Paper N° 695/2020
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Abstract

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Keywords: corporate governance, delegated asset management, passive funds, index funds, competition, investment stewardship, engagement, monitoring

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1 Introduction

Institutional ownership has grown tremendously over the last decades, rising to more than 70% of US public firms. The composition of institutional ownership has also changed, with a remarkable growth in passive fund ownership. The fraction of equity mutual fund assets held by passive funds is now greater than 50% (ICI, 2022), and the Big Three index fund managers are among the largest shareholders and cast around 25% of votes in S&P 500 firms (Bebchuk and Hirst, 2019a; Lewellen and Lewellen, 2022b). How active and passive asset managers monitor and engage with their portfolio companies has thus become vital for the governance and performance of public firms. In 2018, the SEC chairman Jay Clayton encouraged the SEC Investor Advisory Committee to examine "how passive funds should approach engagement with companies," and during the 2018 SEC Roundtable on the Proxy Process, Senator Gramm noted that "what desperately needs to be discussed [in the context of index fund growth] ... is corporate governance."[1]

There is considerable debate in the literature about the governance role of passive funds. Empirical studies have produced conflicting results. On the one hand, Appel, Gormley, and Keim (2016, 2019) find that passive ownership is associated with more independent directors, fewer antitakeover defenses, and greater success of activists, and Filali Adib (2019) concludes that it promotes the passage of value-increasing proposals. On the other hand, Schmidt and Fahlenbrach (2017) and Heath et al. (2022) show that passive ownership is associated with less board independence, more CEO power, and worse pay-performance sensitivity. The debate about the passive funds' role in governance also concerns their incentives to engage.[2] Some scholars argue that passive funds "lack a financial incentive" to stay engaged, both "because passive funds seek only to match the performance of an index—not outperform it" and because "any investment in improving the performance of a company will benefit all funds that track the index equally" (Lund, 2018), whereas other scholars believe that "existing critiques of passive investors are unfounded" (Fisch et al., 2019).

Our paper contributes to this debate by providing a theoretical framework to analyze the governance role of asset managers, which helps evaluate the conflicting claims and evidence in the literature. We study the factors that determine funds' incentives to engage and show

[1] See, respectively, https://www.sec.gov/news/public-statement/statement-clayton-iac-091318 and https://www.sec.gov/files/proxy-round-table-transcript-111518.pdf.

[2] See Bebchuk and Hirst (2019b) and Lund (2018) on one side of the debate and Fisch et al. (2019) and Kahan and Rock (2020) on the other side.

that the growth of passive funds can improve governance even though their performance simply tracks the performance of the market, and despite the increasingly low fees they have been charging over time. However, whether passive fund growth is likely to benefit or hurt governance crucially depends on what the source of passive fund growth is – the declining opportunities for profitable active management or easier access to passive funds over time. Moreover, governance improvements may come at the expense of fund investors' net returns. Our analysis helps reconcile the conflicting conclusions in the existing empirical studies, and also highlights an important limitation of using these studies to understand the governance effects of passive fund growth.

In our model, fund investors decide how to allocate their capital by choosing between three options: they can save privately or invest with either an active or a passive (index) fund by incurring a search cost. Capital flows into each fund until the fund loses its comparative advantage over other investment options (Berk and Green, 2004). Asset management fees are set as a fraction of the realized value of the fund's assets under management (AUM); we analyze more general compensation contracts in an extension. The fees are set endogenously and depend on the return generated by the fund and investors' other investment opportunities. After asset allocations and fees are determined, trading takes place. Passive funds invest all their AUM in the value-weighted market portfolio. Active funds invest strategically, exploiting trading opportunities due to liquidity (retail) investors' demand: they buy stocks with low liquidity demand, i.e., those that are "undervalued," and do not invest in "overvalued" stocks with high liquidity demand. After investments are made, fund managers decide how much costly effort to exert to increase the value of their portfolio firms. Effort captures multiple actions that a fund can take to add value: interacting with the firm's management, ongoing monitoring activities, submitting shareholder proposals, or nominating directors. Another form of institutional activism is voting: the votes of large asset managers are often pivotal in proxy contests and other important votes (Brav et al., 2022). For simplicity, we refer to all these actions as monitoring and discuss them in detail in Section 6.1.

The key determinants of a fund manager's incentives to monitor are the fund's stake in the firm and the fees charged to the fund's investors: the higher the fund's stake, the more its AUM increase in value due to monitoring; and the higher the fees, the more is captured by the fund manager from this increase in value.[3] (Lewellen and Lewellen (2022a) provide empirical

[3]These properties are consistent with the empirical evidence. Heath et al. (2022) document that index funds with high expense ratios are more likely to vote against management than those with low expense

estimates of fund managers' incentives to be engaged shareholders based on the analysis of their portfolios and fees.[4]) The fund's equilibrium ownership stakes and fees, in turn, depend on the fund's AUM, the fees of other funds, and asset prices, which are all determined endogenously. Jointly analyzing these aspects and their combined effect on governance is critical because, as we show, focusing only on one aspect (e.g., only fund fees or only funds' ownership stakes) can miss other important effects and lead to different conclusions. While our model captures all these general equilibrium effects, it is very tractable, allowing us to examine their joint role for investor engagement, valuations, and investors' payoffs.

Since our key goal is to analyze the governance implications of passive fund growth, we first show how such growth endogenously arises in the model. There are two key explanations for the increase in passive fund share over the last decades. The first, which we broadly refer to as "easier access to passive funds," is that passive funds have grown due to their increased inclusion in 401(K) plans, greater investor awareness about them, improved information about their fee structures, the introduction of ETFs, and increased availability of financial advisors (e.g., Coates, 2018). We capture these changes by decreasing the search cost that investors need to incur to invest with a passive fund. The second explanation is the reduction in the opportunities for profitable active management (Stambaugh, 2014), and we show that our model can generate passive fund growth through this channel as well.

Both easier access to passive funds and lower active trading opportunities lead investors to reallocate their capital from active to passive funds. As a result, the composition of shareholders changes as well, with passive funds replacing active funds in firms' ownership structures. Since passive funds charge lower fees than active funds, they have lower incentives to stay engaged, so other things equal, such changes in ownership decrease the overall level of investor monitoring. Moreover, the increased competition between active and passive funds reduces fund fees, which further reduces funds' combined incentives to monitor. Despite these negative effects, we show that passive fund growth can still improve governance, but only if the source of this growth is easier access to passive investing, rather than the reduction in active trading opportunities. Moreover, even easier access to passive investing becomes

ratios. Iliev and Lowry (2015) and Iliev, Kalodimos, and Lowry (2021) show that funds with larger equity stakes are more likely to conduct governance research and vote "actively," and Lakkis (2021) finds that fund families with larger equity stakes are more likely to oppose management.

[4]For example, Lewellen and Lewellen (2022a) estimate that for the top five index fund managers (BlackRock, State Street, Vanguard, Dimensional, and Schwab), a 1% increase in the value of their typical stockholding leads to an extra $133,000 in their annual management fees. This number is comparable to the corresponding estimate of $520,400 for activist investors, i.e., those that file Schedule 13D.

detrimental beyond a certain point, once access is easy enough.

To understand these results, note that in addition to the two negative effects above, passive fund growth can also have a positive effect: passive funds may replace retail shareholders in firms' ownership structures. Since retail shareholders have neither ability nor incentives to monitor, this change in shareholder composition, other things equal, increases investor monitoring. Why does the positive effect dominate only if the source of passive fund growth is improved access to passive funds, and only up to a certain point? Intuitively, for passive funds to primarily replace retail shareholders, and not only active funds, there must be sufficient new capital that is brought by investors into the asset management industry, i.e., sufficiently strong crowding out of investors' private savings. If passive funds grow because of lower active trading opportunities, this primarily affects investors' allocations between active and passive funds, but the overall benefits of investing through the funds (relative to private savings) do not increase much. Then, the first-order effect is the replacement of active funds in firms' ownership, and governance gets worse. In contrast, if passive funds grow because investor access to them improves (in the context of the model, investors' search costs decrease), this reduces the fundamental friction that prevents investors from investing through asset managers. Hence, passive funds primarily crowd out investors' private savings, and not only investors' allocations to active funds, and the overall capital brought into asset management grows substantially. As a result, even though active funds are still replaced in firms' ownership structures, this effect is dominated by the replacement of retail investors, and the net effect on governance is positive. We formally show why the positive effect dominates using the arguments of Berk and Green (2004): for investors to be indifferent between investing with the passive fund and their other investment options, sufficient capital must flow into the passive fund, so that the aggregate effect on governance is positive.

A similar logic explains why improving access to passive funds no longer benefits governance beyond a certain point. As access to passive funds improves, more and more investor capital flows from private savings into the fund industry, until at some point, all capital is invested through the funds. Beyond this point, easier access to passive funds no longer crowds out private savings and only crowds out investors' allocations to active funds. Therefore, the dominant effects are the replacement of active funds in firms' ownership structures and the decline in fund fees, so governance becomes worse.

Our framework has several other implications. First, we highlight a potential trade-off between governance and fund investors' net returns: if passive fund growth substantially increases fund investors' net returns, it tends to worsen governance, and vice versa. Intuitively, passive fund growth is especially beneficial to fund investors if it creates strong competition between funds and substantially decreases active and passive fund fees. However, reduced fees decrease fund managers' incentives to stay engaged and hence are detrimental to governance. Put differently, effective fund manager monitoring requires that funds earn sufficient rents from managing investors' assets, which comes at the expense of fund investors.

Second, it is often argued that passive funds are detrimental to governance due to the low fees they charge and, thereby, their low incentives to stay engaged. However, this argument does not take into account that fees do not change in isolation, and low fees are often accompanied by higher AUM. Our framework incorporates the combined effects of these factors and shows that governance can improve at the same time as fees decline. Intuitively, when fees are lower, more investor capital flows into the funds, increasing their AUM and allowing them to acquire larger ownership stakes. Larger stakes, in turn, increase funds' incentives to engage, which can outweigh the effect of lower fees.

Finally, we study another important trend observed in recent years – the strengthening of shareholder rights. Examples include the destaggering of corporate boards, the introduction of say-on-pay votes, and universal proxy cards, among others. In the context of our model, such changes can be thought of as reducing funds' monitoring costs, and we show that their effects are nuanced. While they improve governance and benefit fund investors and fund managers on the positions that are already established, they may also hurt fund investors on their future investments and weaken some funds' ability to attract capital.

Our paper has several implications for the empirical studies of passive funds' governance role. First, most papers in the literature exploit index (e.g., Russell) reconstitutions, studying how the resulting changes in firms' ownership structures affect governance. Our analysis suggests caution in using these studies to understand the governance effects of passive fund growth over the last decades. As we highlight, endogenous changes in passive ownership (which is the focus of our paper and corresponds to what is observed in the time-series over the last decades) can have very different governance effects than exogenous changes in the fraction of a firm owned by passive funds (e.g., due to index reconstitutions). This is because the time-series effects reflect not only changes in firms' ownership structures, but also the simultaneous changes in fund fees and AUM. Both fees and AUM have important aggregate effects on funds' incentives to engage, but stay constant in the index reconstitution setting. Furthermore, the types of investors that passive funds replace in ownership structures in the time-series – active funds or retail investors – could differ from those they replace upon index reconstitutions. For these two reasons, it is possible that passive fund growth in the time-series improves governance, whereas an increase in passive funds' ownership stakes caused by index reconstitutions hurts governance, and vice versa.

Second, the debate in the literature often focuses on differences in methodologies as a way to explain the conflicting findings. Our paper suggests another, complementary, way to reconcile the results, by looking at whether higher passive ownership in a given study results from lower retail or lower active fund ownership. As we discuss in Section 5, studies that document a positive (negative) governance effect of higher passive ownership show no corresponding changes (significant decreases) in active fund ownership, consistent with the predictions of our model.

Finally, our paper predicts cross-sectional variation in the effects of passive fund growth across firms: as we show, depending on their ownership structures, certain firms are substantially more likely to benefit from increased passive ownership than others.

Related literature. Our paper is related to the literature on shareholder activism and the interaction between shareholders' trading and monitoring decisions.[5] Our key contribution is to study activism by delegated asset managers and examine how the growth in passive funds affects governance. Given our interest in these questions, we abstract from specific details of the activism process, such as communication and negotiations with management (Levit, 2019; Corum, 2023), pushing for the sale of the firm (Burkart and Lee, 2022; Corum and Levit, 2019), information acquisition (Cocoma and Zhang, 2021), the role of the board (Cohn and Rajan, 2013), and the activist's reputation (Strobl and Zeng, 2015).

Our paper is more closely related to studies of the governance role of asset managers (see Dasgupta, Fos, and Sautner (2021) for a comprehensive survey, and Brav, Malenko, and Malenko (2023) for a survey focusing on index funds). In particular, Dasgupta and Piacentino (2015), Song (2017), Burkart and Dasgupta (2021), Brav, Dasgupta, and Mathews (2022), and Cvijanovic, Dasgupta, and Zachariadis (2022) examine whether asset managers' concerns about flows strengthen governance via exit and voice. Dasgupta and Mathews (2023) study trading and monitoring by active fund managers and show that optimal delegation contracts separate monitoring and diversification motives. Differently from all these papers,

[5] See Admati, Pfleiderer, and Zechner (1994), Kahn and Winton (1998), Maug (1998), DeMarzo and Urosevic (2006), and Edmans and Manso (2011), among many others. Edmans and Holderness (2016) provide an in-depth survey.

our focus is on the governance implications of passive fund growth and on how fund investors' decisions to delegate their capital affect funds' fees, AUM, equity stakes, and thereby funds' incentives to monitor.[6] Two other papers study, like ours, the governance role of active and passive funds in general equilibrium, but focus on different mechanisms. In Baker, Chapman, and Gallmeyer (2022), passive funds do not monitor, so a reduction in passive fund fees is detrimental to governance but increases households' diversification opportunities. In contrast, in our paper, both active and passive funds monitor, which can make passive fund growth beneficial for governance. Friedman and Mahieux (2022) examine whether passive and active fund monitoring choices are complements or substitutes. In their setting, funds commit to their monitoring levels in advance, so funds' monitoring does not depend on their fees or AUM. In contrast, our paper focuses on how funds' monitoring incentives are affected by the equilibrium fees, AUM, and ownership stakes.

The literature has also studied the effects of active and passive investing on price efficiency and welfare (e.g., Stambaugh, 2014; Brown and Davies, 2017; Jin, 2020; Lee, 2020; Bond and Garcia, 2022; Garleanu and Pedersen, 2022; Malikov, 2023).[7] In contrast, our focus is on the governance role of asset managers. In particular, while the asset payoffs in all the above papers are exogenous, the asset payoffs in our paper are determined endogenously by fund managers' monitoring decisions. Buss and Sundaresan (2020), Gervais and Strobl (2023), and Kashyap et al. (2021) also study the effects of asset managers on corporate outcomes, but through non-governance channels: the cost of capital, learning from prices, and benchmarking in fund managers' contracts.

2 Model setup

There are three types of agents: (1) fund investors, who decide how to allocate their capital; (2) fund managers, who make investment and governance decisions; and (3) liquidity investors. All agents are risk-neutral.

The timeline is illustrated in Figure 1. At date 1, each investor decides whether to invest his capital with one of the funds or outside the financial market (which we refer to as private savings), and fund fees are set. At date 2, fund managers decide how to invest their AUM,

[6] Edmans, Levit, and Reilly (2019), Levit, Malenko, and Maug (2022), and Kakhbod et al. (2023) analyze index funds in extensions of their models and focus, respectively, on the interaction between voice and exit, the index funds' role in voting, and their effect on shareholder engagement.

[7] Cuoco and Kaniel (2011), Basak and Pavlova (2013), and Buffa, Vayanos, and Woolley (2022) study the asset pricing implications of benchmarking and asset management contracts in general.

and trading takes place. At date 3, each fund manager decides how much effort to exert in each firm in his portfolio. Finally, at date 4, all firms pay off, and the payoffs are split between fund managers and their investors according to the asset management fees decided upon at date 1. We next describe each of these stages in more detail.

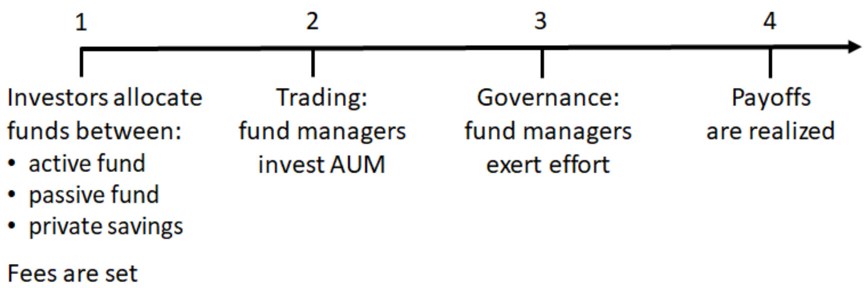

Figure 1. Timeline of the model.

Fund managers and fund investors

There are two types of fund managers: active and passive. While the active fund manager optimally chooses his investment portfolio, the passive fund is restricted to holding a value-weighted index of stocks. In our basic model, there is one fund of each type, and we extend the model to a general number of funds in Section 1.4.4 of the online appendix.

Assets in financial markets can be accessed by fund investors only through the funds. Each fund manager offers to invest the capital of fund investors in exchange for a fee. The equilibrium fee is determined by fund investors' other investment opportunities, as described in detail below. In the basic model, the fee is assumed to be an (endogenous) fraction of the fund's realized value of AUM at date 4 (as in Pastor and Stambaugh, 2012), to capture the contractual arrangements observed in the mutual fund industry; this assumption is relaxed in Section 1.4.1 of the online appendix. In particular, let f_A and f_P denote the fee as the percentage of AUM charged by the active and passive fund, respectively (we conjecture and later verify that each fund charges the same fee to all its investors). Then, if the realized value of fund manager i's portfolio at date 4 is $\tilde{Y}_i$, he keeps $f_i\tilde{Y}_i$ and distributes $(1 - f_i)\,\tilde{Y}_i$ among fund investors in proportion to their original investments in the fund.

There is a mass of risk-neutral investors with combined capital (wealth) W. Each investor has an infinitesimal amount of capital. At date 1, each investor decides whether to invest in the financial market by delegating his capital to one of the fund managers, or whether to invest outside the financial market (private savings). The latter can be interpreted as immediate consumption, savings at a bank, or simply keeping money under the mattress. We normalize the return from private savings to one.

We follow Garleanu and Pedersen (2018, 2022) in modeling investors' capital allocation decisions and the setting of fees: as in Garleanu and Pedersen (2018, 2022), fund investors incur a search cost to find fund managers and then bargain with fund managers over the fees. In particular, if an investor with wealth ε incurs cost $\psi_A \varepsilon$ ($\psi_P \varepsilon$), he finds an active (passive) fund manager and can invest with him.[8] These costs can be interpreted as the costs of searching for relevant information, such as the fund's portfolio characteristics, investment process, and fee structure, and spending the time to understand it. For passive fund investors, a key component of these costs is finding out the fund's fee structure; such costs are likely larger for less financially sophisticated investors.[9] Consistent with this, Hortaçsu and Syverson (2004) conclude that investors' search frictions contribute to explaining the sizable dispersion in fees across different S&P 500 index funds despite their financial homogeneity, and Choi, Laibson, and Madrian (2010) show, in an experimental setting, that search costs for fees play an important role in decisions to invest across similar S&P 500 index funds. Some sources of index fund growth have been their increased inclusion in 401(k) plans, improved disclosures about their fees, and ETF growth. These changes can be interpreted as a decrease in ψ_P, so we will vary ψ_P as one of the parameters to generate passive fund growth.

We assume that $\psi_A \geq \psi_P$. Intuitively, it takes more time and effort to understand the investment strategy and fee structure of an active fund, compared to an index fund. Since active funds in our model exploit trading opportunities and thus outperform passive funds, fund investors face a trade-off between earning a higher rate of return on their portfolio but at a higher search cost vs. a lower rate of return at a lower cost (if $\psi_A < \psi_P$, no investor would invest with the passive fund in equilibrium). In a richer model with heterogeneity of skill among active fund managers, ψ_A could be interpreted as the cost of searching for skill.

If an investor incurs the search cost and finds fund manager $i \in \{A, P\}$, the two negotiate fee f_i via Nash bargaining, as in Garleanu and Pedersen (2018, 2022). Fund managers have bargaining power η, and fund investors have bargaining power $1 - \eta$. Modeling fee setting

[8]Alternatively, we could assume that all investors have the same amount of wealth, in which case the proportionality of the search cost to wealth would be a normalization.

[9]See Section III.B in Hortaçsu and Syverson (2004) for a detailed discussion of search frictions in the context of index funds, and Appendix B in Garleanu and Pedersen (2018) for a description of investors' search process and the associated costs.

via bargaining leads to a very tractable setup, which allows us to derive the equilibrium in closed form and analyze many extensions. In Section 6.2, we discuss how this assumption helps abstract from second-order considerations in the fee-setting process, and why our main effects would also arise in other models of imperfect competition between funds.

We denote by W_A and W_P the AUM of the active and passive fund, respectively, after investors make their capital allocation decisions.

Assets and trading

There is a continuum of measure one of firms, indexed by $j \in [0, 1]$. Each firm's stock is in unit supply. The date-4 payoff of firm j, i.e., its fundamental value, is:

$$R_j = R_0 + \sum_{i=1}^{M_j} e_{ij}, \tag{1}$$

where R_0 is the baseline payoff without shareholder monitoring, M_j is the number of shareholders of firm j, and e_{ij} is the amount of "effort" exerted by shareholder i in firm j at date 3, as described below. In general, shareholders' efforts could be either complements (e.g., if monitoring by a shareholder is more successful when other shareholders also push for similar changes) or substitutes (e.g., if monitoring by a shareholder makes other shareholders' monitoring redundant). Assuming that efforts are additive allows us to abstract from this ambiguity and make the key driving forces more transparent.

The initial owners of each firm are assumed to have low enough valuations to be willing to sell their shares at date 2 regardless of the price. For example, we can think of these initial owners as venture capitalists who would like to exit the firm, and we normalize their valuations to zero. Thus, the supply of shares in the market is always one. There are three types of traders who initially do not hold any shares and hold the entire supply after trading at date 2: the active fund, the passive fund, and competitive liquidity investors.

The trading model is broadly based on Admati, Pfleiderer, and Zechner (1994), augmented by passive fund managers:[10] (1) the active fund is strategic in that it takes into account the impact of its trading on the price; (2) the passive fund follows the mechanical rule of investing its AUM in a value-weighted portfolio of all stocks; (3) competitive liquidity in-

[10] We extend Admati, Pfleiderer, and Zechner (1994) to a continuum of firms, multiple shareholders that can take actions (rather than one), and we introduce active and passive delegated asset management. In addition, differently from their paper, in which agents are risk-averse, we assume that agents are risk-neutral, and trading occurs not due to risk-sharing motives but because of heterogeneous private valuations.

vestors have rational expectations in their assessment of asset payoffs and trade anticipating the equilibrium effort of fund managers; and (4) the price is set to clear the market (i.e., a Walrasian trading mechanism). It can be microfounded by the following game, which is formalized in the online appendix. First, the active and passive fund each submits a market order, then liquidity investors submit their demand schedules as a function of the price, and the equilibrium price is the price that clears the market. Short sales are not allowed.

More specifically, for each stock, there is a large mass of competitive risk-neutral liquidity investors (noise traders), who can each submit any demand of up to one unit. Liquidity investors value an asset at its common valuation, given by (1), perturbed by an additional private value component. In particular, liquidity investors' valuation of stock j is $R_j - Z_j$, where Z_j captures liquidity demand driven by hedging needs or investor sentiment. Stocks with large Z_j have relatively low demand from liquidity investors, while stocks with small Z_j have relatively high demand. The role of different realizations of Z_j for different stocks is to create potential gains from active portfolio management.

In the basic model, we assume that Z_j are i.i.d. (across stocks) draws from a binary distribution: $\Pr(Z_j = Z_L) = \Pr(Z_j = Z_H) = \frac{1}{2}$, where $Z_L > Z_H$. We refer to these two types of stocks as L-stocks and H-stocks, i.e., stocks with low and high liquidity demand, respectively. Thus, the L-stocks are relatively more underpriced than the H-stocks. The realizations of Z_j are publicly observed for all j. We assume that $\frac{Z_L+Z_H}{2} > 0$, which automatically also implies $Z_L > 0$ (Z_H could be either positive or negative).[11] Thus, the market portfolio and, even more so, the L-stocks, are undervalued by liquidity investors, which enables fund managers to realize gains from trade by buying these stocks.

The active fund in our model generates higher returns than the passive fund by buying the most underpriced stocks (L-stocks). Lower opportunities for profitable active management have been proposed as another reason for the growth in passive funds (Stambaugh, 2014), so we will vary $Z_L - Z_H$ as another key parameter to generate passive fund growth.

In Sections 1.4.2 and 1.4.3 of the online appendix, we generalize this setup in three directions. First, we allow liquidity investors to have heterogeneous valuations. Second, we allow the proportions of L- and H-stocks to be different from $\frac{1}{2}$. Finally, we allow the misvaluation of the firm's stock to change with funds' trading and monitoring decisions.

[11] If $\frac{Z_L+Z_H}{2} = 0$, then given the search cost ψ_P, investors would never invest in the passive fund because they are risk-neutral and there is no notion of risk and diversification in our model. We can think of the assumption $\frac{Z_L+Z_H}{2} > 0$ as a reduced form way to capture the benefits of investing in the market portfolio.

Governance stage

Denote by x_{ij} the number of shares held by fund i in firm j. After establishing his stake in the firm, the fund manager decides on the amount of effort to exert. If he is of type $i \in \{A, P\}$ and exerts effort e, he increases firm value by e and bears a private cost $c_i(e) = \frac{c_i}{2}e^2$. This cost is not shared with fund investors, capturing what happens in practice (although the equilibrium fees charged to fund investors will be indirectly affected by these costs). Thus, if the fund manager charges fee f_i, holds x_{ij} shares, and exerts effort e_{ij}, his payoff from firm j, up to a constant that does not depend on e_{ij}, is:

$$f_i x_{ij} e_{ij} - \frac{c_i}{2} e_{ij}^2. \tag{2}$$

We think of effort as any action that shareholders can take to increase value: engaging with management, submitting shareholder proposals, nominating directors, and voting on important decisions, such as proxy contests. We assume that

$$c_P \geq c_A,$$

so as not to give the passive fund a comparative advantage in monitoring. This assumption is consistent with the common criticism that passive funds lack firm-specific information to propose operational or financial improvements, and we discuss the role of this assumption in Section 6.1. All our results hold if active and passive funds have the same costs ($c_A = c_P$).

In Section 1.4.5 of the online appendix, we generalize the monitoring technology in two ways. First, we allow funds to be more effective at monitoring if their ownership stakes are larger. Second, we consider general (non-quadratic) cost functions $c_i(e)$.

3 Analysis

We solve the model by backward induction, starting with funds' monitoring decisions.

3.1 Governance stage

Given fund manager i's payoff (2), the first-order condition implies that his optimal effort is

$$e_{ij} = \frac{f_i x_{ij}}{c_i}. \tag{3}$$

The fund manager exerts more effort if he owns a higher fraction of the firm (x_{ij}) or if he collects higher fees from fund investors (f_i). Eq. (3) reflects two layers of the free-rider problem. First, $x_{ij} < 1$ manifests a free-rider problem among shareholders: the fund manager underinvests in effort because other shareholders benefit from it. Second, $f_i < 1$ manifests a free-rider problem between the fund manager and fund investors: the fund manager bears the full cost of effort but shares its benefits with fund investors.

3.2 Trading stage

Liquidity investors. If liquidity investors expect the active and passive fund to hold x_{Aj} and x_{Pj} shares of stock j, their valuation of the stock is $R_j(x_{Aj}, x_{Pj}) - Z_j$, where

$$R_j(x_{Aj}, x_{Pj}) = R_0 + \frac{f_A x_{Aj}}{c_A} + \frac{f_P x_{Pj}}{c_P}. \tag{4}$$

Each liquidity investor finds it optimal to buy stock j if and only if his valuation exceeds the price, i.e., $R_j(x_{Aj}, x_{Pj}) - Z_j \geq P_j$. Recall that the active fund, passive fund, and liquidity investors hold the entire supply of shares after trading. We focus on the parameter range for which liquidity investors hold at least some shares in each firm. This happens when the funds' combined AUM, $W_A + W_P$, are not too high, so that funds' combined demand for the stock is lower than the supply, $x_{Aj} + x_{Pj} < 1$ (a sufficient condition for this to hold is given in Proposition 1 below). Then, the price of stock j is given by:

$$P_j = R_j - Z_j. \tag{5}$$

Equation (5) has intuitive properties. First, the price is lower if liquidity investors' demand is lower (i.e., Z_j is higher), e.g., if there is lower hedging demand or lower investor sentiment. Second, the price is higher if $R_j = R_j(x_{Aj}, x_{Pj})$ is higher, i.e., if either the active or the passive fund holds more shares. This is because all else equal, higher fund ownership implies higher expected monitoring and thus a higher payoff. We assume that $R_0 > Z_L$, which ensures that the price of each stock is always positive.

Since market participants incorporate the expected governance improvements into the price, the fund does not make profits on its monitoring efforts. This is similar to Admati, Pfleiderer, and Zechner (1994), DeMarzo and Urosevic (2006), and Grossman and Hart (1980), where the activist's (raider's) future value improvement is incorporated into the price. Nevertheless, the fund manager in our model exerts effort in equilibrium because once investments are made, exerting effort increases his payoff (see Section 3.1).

Equation (5) also implies that as funds' ownership increases, the return $\frac{R_j}{P_j}$ decreases. Thus, there are decreasing returns to scale from investment.

Passive fund. The passive fund is restricted to investing its AUM W_P into the value-weighted portfolio of stocks. We denote this market portfolio by index M, and note that its price (i.e., the total market capitalization) is $P_M \equiv \int_0^1 P_j dj = \frac{P_L+P_H}{2}$. The passive fund buys x_{Pj} units of stock j to ensure that the proportion of its AUM invested in this stock $(\frac{x_{Pj}P_j}{W_P})$ equals the weight of this stock in the market portfolio $(\frac{P_j}{P_M})$. It follows that x_{Pj} is the same for all stocks and equals:

$$x_P = \frac{W_P}{P_M}. \tag{6}$$

Active fund. The active fund optimally decides how to allocate its AUM between stocks of type L and H. We focus on the case where the active fund finds it optimal to only buy L-stocks, and to diversify equally across all L-stocks (a sufficient condition for this to hold is given in Proposition 1). Intuitively, stocks with higher liquidity demand are "overpriced" relative to stocks with lower liquidity demand, and the active fund finds it optimal to buy only the relatively cheaper stocks. As a result, the active fund holds a less diversified portfolio than the passive fund, consistent with practice. Since the fund's total AUM (W_A) are allocated evenly among mass $\frac{1}{2}$ of L-stocks, the fund's investment in each L-stock is:

$$x_{AL} = \frac{2W_A}{P_L}. \tag{7}$$

Equilibrium at the trading and governance stages. We can now derive the equilibrium payoffs and prices as functions of funds' AUM (W_A, W_P) and fees (f_A, f_P). Denote the liquidity demand for the market portfolio by $Z_M \equiv \frac{Z_L+Z_H}{2}$ and the payoff of the market portfolio by $R_M \equiv \frac{R_L+R_H}{2}$. Since the active fund only invests in L-stocks (holding x_{AL} in each) and the passive fund invests in both L- and H-stocks (holding x_P in each), the equilibrium prices and payoffs of L-stocks and the market are given by:

$$
\begin{aligned}
P_L &= R_L - Z_L, && (8)\\
P_M &= R_M - Z_M, && (9)\\
R_L &= R_0 + \frac{f_A x_{AL}}{c_A} + \frac{f_P x_P}{c_P}, && (10)\\
R_M &= R_0 + \frac{1}{2}\frac{f_A x_{AL}}{c_A} + \frac{f_P x_P}{c_P}, && (11)
\end{aligned}
$$

where x_P and x_{AL} are given by (6) and (7), respectively.

3.3 Capital allocation by investors and fee setting

Investors choose between saving privately and investing with an active or passive fund. Consider an investor with wealth ε. The active fund invests the investor's wealth into L-stocks: it buys $\frac{\varepsilon}{P_L}$ of L-stocks, where the payoff of each stock is R_L. Since the investor incurs a cost $\psi_A \varepsilon$ to find the active fund and pays fee f_A, his payoff from investing with the active fund is $(1 - f_A) R_L \frac{\varepsilon}{P_L} - \psi_A \varepsilon$, so his net return is $(1 - f_A) \frac{R_L}{P_L} - \psi_A$. Similarly, the investor's net return from investing with the passive fund is $(1 - f_P) \frac{R_M}{P_M} - \psi_P$.

Our baseline analysis focuses on the case where the equilibrium AUM of each fund are positive; a sufficient condition for this to hold is given in Proposition 1 (we relax this assumption in Section 1.5 of the online appendix). This implies that capital flows into the funds until, in equilibrium, investors earn the same rate of return from investing with the active and passive fund, which we denote by λ:

$$\lambda \equiv (1 - f_A) \frac{R_L}{P_L} - \psi_A = (1 - f_P) \frac{R_M}{P_M} - \psi_P. \qquad (12)$$

Consider the setting of fees. Suppose that an investor with wealth ε has already incurred the cost $\psi_A \varepsilon$ and now bargains with the active fund manager over the fee, $\tilde{f}_A$. To determine the Nash bargaining solution, we find each party's payoff upon agreeing and upon negotiations failing. The investor's payoff from agreeing on fee $\tilde{f}_A$ is $(1 - \tilde{f}_A) R_L \frac{\varepsilon}{P_L}$, and his payoff if negotiations fail is $\lambda \varepsilon$ (since he can incur the cost $\psi_P \varepsilon$ and invest with the passive fund instead). Next, from the fund manager's perspective, getting additional AUM ε has a first-order effect on his utility via the fees, but only a second-order effect via a change in effort.[12] Hence, the fund manager's additional payoff from agreeing on fee $\tilde{f}_A$ and getting additional AUM ε is $\tilde{f}_A R_L \frac{\varepsilon}{P_L}$, and his payoff if negotiations fail is zero. Given the fund manager's bargaining power η, fee $\tilde{f}_A$ is determined by the Nash bargaining solution:

$$\max_{\tilde{f}_A} \left((1-\tilde{f}_A) R_L \frac{\varepsilon}{P_L} - \lambda\varepsilon \right)^{1-\eta} \left(\tilde{f}_A R_L \frac{\varepsilon}{P_L} \right)^{\eta}. \tag{13}$$

Since the total surplus created from bargaining is $R_L \frac{\varepsilon}{P_L} - \lambda\varepsilon$, the fee must be such that the fund manager gets fraction η of this surplus:

$$\tilde{f}_A R_L \frac{\varepsilon}{P_L} = \eta \left(R_L \frac{\varepsilon}{P_L} - \lambda\varepsilon \right). \tag{14}$$

This implies that the active fund fee for all investors is the same, $\tilde{f}_A = f_A$, as conjectured previously. This fee is determined by the fixed point equation

$$f_A = \eta \left(1 - \lambda \frac{P_L}{R_L} \right). \tag{15}$$

Similarly, the passive fund fee is the same for all investors, $\tilde{f}_P = f_P$, and satisfies:

$$f_P = \eta \left(1 - \lambda \frac{P_M}{R_M} \right). \tag{16}$$

To solve for the equilibrium fees, net return λ, and funds' AUM, we next consider investors' decisions on how to allocate their capital. Since we focus on the case where the AUM of each fund are positive, there are two possible cases, depending on the parameters.

In the first case, investors earn a low rate of return and are indifferent between all three options: saving privately (which earns a return of one), investing with the active fund, and with the passive fund. Then, $\lambda = 1$ in (12), so investors' indifference conditions imply:

$$(1-f_A) \frac{R_L}{P_L} - \psi_A = 1, \tag{17}$$

$$(1-f_P) \frac{R_M}{P_M} - \psi_P = 1. \tag{18}$$

[12]See Section 6.2 for a discussion of this property. The reason why the effect of ε via a change in effort is second-order is the envelope theorem: the active fund manager's payoff is $\max_e \{ \frac{1}{2} [f_A x_{AL} \left(R_0 + e + c_P'^{-1}(f_P x_P) \right) + \tilde{f}_A \frac{2\varepsilon}{P_L} \left(R_0 + e + c_P'^{-1}(f_P x_P) \right) - c_A(e)] \}$, and by the envelope theorem, the derivative with respect to ε at $\varepsilon = 0$ is $\tilde{f}_A \frac{1}{P_L} \left(R_0 + c_A'^{-1}(f_A x_{AL}) + c_P'^{-1}(f_P x_P) \right) = \tilde{f}_A \frac{R_L}{P_L}$.

In the second case, investors are indifferent between investing with the active fund and the passive fund, but both options strictly dominate private savings, i.e., $\lambda > 1$. Then, the investor indifference conditions (17) and (18) are replaced by: (i) the indifference condition between investing with the active and passive fund,

$$(1 - f_A)\,\frac{R_L}{P_L} - \psi_A = (1 - f_P)\,\frac{R_M}{P_M} - \psi_P, \tag{19}$$

and (ii) the condition that the combined funds' AUM are equal to total investor wealth W:

$$W_A + W_P = W. \tag{20}$$

3.4 Equilibrium

The equilibrium $(f_A, f_P, x_{AL}, x_P, P_L, P_M, R_L, R_M)$ is the solution to the following system of equations: (i) market clearing and optimal monitoring decisions (8)-(11); (ii) fee negotiation conditions (15)-(16); and (iii) investor capital allocation conditions: (17)-(18) in the case of $\lambda = 1$, and (19)-(20) in the case of $\lambda > 1$. This equilibrium is characterized in Proposition 1.

Proposition 1 (equilibrium). *Suppose $z_1 < \frac{Z_M}{Z_L} < z_2$ and $w_1 < W < w_2$, where z_i, w_i are given by (32)-(33) in the appendix. Then the equilibrium is as follows.*

(i) *The asset management fees are $f_A = \frac{\eta\psi_A}{\psi_A+\lambda(1-\eta)}$ and $f_P = \frac{\eta\psi_P}{\psi_P+\lambda(1-\eta)}$, and $f_A \geq f_P$.*

(ii) *The payoffs of the L-stocks and the market portfolio are $R_L = (1 + \frac{1-\eta}{\psi_A+(\lambda-1)(1-\eta)})Z_L$ and $R_M = (1 + \frac{1-\eta}{\psi_P+(\lambda-1)(1-\eta)})Z_M$.*

(iii) *The prices of the L-stocks and the market portfolio are $P_L = \frac{1-\eta}{\psi_A+(\lambda-1)(1-\eta)}Z_L$ and $P_M = \frac{1-\eta}{\psi_P+(\lambda-1)(1-\eta)}Z_M$.*

(iv) *There exists $\bar{W}$, such that if $W \geq \bar{W}$, the investors' net return satisfies $\lambda = 1$, whereas if $W < \bar{W}$, λ strictly decreases in W and satisfies the fixed point equation:*

$$W = \frac{c_A}{f_A}\,(R_L - R_M)\,P_L + \frac{c_P}{f_P}\,(2R_M - R_L - R_0)\,P_M. \tag{21}$$

The restrictions on parameters in Proposition 1 ensure that we consider the interesting case, i.e., one in which both funds raise positive AUM, do not together hold the entire supply of shares, and the active fund finds it optimal to invest in L-stocks and not in H-stocks.[13] For the remainder of the paper, we assume that these assumptions hold.

The equilibrium has the following properties. If aggregate investor wealth is limited ($W < \bar{W}$), fund managers compete for investors' capital and offer relatively low fees, allowing investors to earn a net return of $\lambda > 1$. If investor wealth is large ($W \geq \bar{W}$), investors' outside options in negotiations are limited, which increases the fees charged by fund managers and decreases investors' net return, $\lambda = 1$. The active fund outperforms the passive fund before fees, $\frac{R_L}{P_L} \geq \frac{R_M}{P_M}$, due to its ability to invest strategically in the most undervalued stocks. As a consequence, and consistent with practice, the fee charged by the active fund is higher than the fee charged by the passive fund: $f_A \geq f_P$ (recall that $\psi_A \geq \psi_P$).

3.5 Passive fund growth

Our model can generate the dynamics of the asset management industry over time. Specifically, the following trends have been noted over the past decades (French, 2008; Stambaugh, 2014; Investment Company Institute, 2022): (1) the fraction of mutual fund assets that are passively managed has substantially increased; (2) the combined AUM of mutual funds have grown; (3) the fees paid by mutual fund investors have fallen.

As discussed earlier, the literature has proposed two key explanations for these trends, and the rise in passive funds in particular. The first (e.g., Coates (2018), section B.1.v) is improved access to passive funds due to a combination of several factors: their growing inclusion in 401(k) plans, increased investor awareness about them, the increased ability to find fund information on the Internet, better disclosures about their fee structures, the introduction of ETFs, and greater availability of financial advisors. These factors can be broadly captured by a decrease in the search cost ψ_P. The second proposed reason is the reduced opportunities for profitable active management (Stambaugh, 2014). In the context of our model, this can be captured by reducing $Z_L - Z_H$ while keeping $Z_M \equiv \frac{Z_L+Z_H}{2}$ fixed: this decreases the relative underpricing of L-stocks that the active fund exploits, while the overall benefits of investing in the stock market remain the same.

[13] Intuitively, condition $z_1 < \frac{Z_M}{Z_L} < z_2$ ensures that the active fund's trading gains are neither too small nor too large compared to those of the passive fund (otherwise all investor capital would be allocated to either one fund or the other); it also guarantees that the active fund does not want to deviate from its strategy of only investing in L-stocks. Condition $W < w_2$ ensures that funds do not hold the entire supply of shares. Finally, $W > w_1$ is another condition needed to ensure that both funds' AUM are positive: unless governance generates sufficient decreasing returns to scale (which requires that funds' AUM, and hence investors' total wealth W, are large enough), all investor capital will be allocated to one of the funds.

Proposition 2 and Figures 2 and 3 show that by decreasing ψ_P and $Z_L - Z_H$, our model can generate the trends observed over the last decades: increased passive fund share, growth in funds' combined AUM, and a reduction in fund fees.

Proposition 2. *(a) If access to passive funds becomes easier (ψ_P decreases), then:*

(i) fund fees, f_A and f_P, decrease; (ii) funds' combined AUM, $W_A + W_P$, increase; and

(iii) fund investors' net return, λ, increases. In particular, there exists a cutoff $\bar{\psi}_P$, such that $\lambda = 1$ for $\psi_P \geq \bar{\psi}_P$ and $\lambda > 1$ for $\psi_P < \bar{\psi}_P$.

(b) If active trading opportunities decline ($Z_L - Z_H$ decreases while Z_M stays constant) and condition (38) in the appendix is satisfied, then:

(i) fund fees, f_A and f_P, decrease; (ii) funds' combined AUM, $W_A + W_P$, increase; and

(iii) fund investors' net return, λ, increases. In particular, there exists a cutoff $\bar{\Delta}$, such that $\lambda = 1$ for $Z_L - Z_H \geq \bar{\Delta}$ and $\lambda > 1$ for $Z_L - Z_H < \bar{\Delta}$.

Figures 2 and 3 demonstrate Proposition 2 via a numerical example; we later use the same example to illustrate the implications for governance. We start by explaining the comparative statics in ψ_P in Figure 2. The x-axis in all panels of Figure 2 represents $1/\psi_P$, so access to passive funds becomes easier as we move to the right. Access to passive funds is beneficial for fund investors: it allows them to invest in the financial market at a lower cost and increases their equilibrium net return from investing with the funds (panel (a)). As a result, as panel (b) shows, investors not only allocate more capital to the passive fund but also decrease their private savings and start allocating more capital to the asset management industry as a whole, so that funds' combined AUM weakly grow, in line with the recent trends. The cutoff $\bar{\psi}_P$ separates the region $\psi_P > \bar{\psi}_P$, where investing with the passive fund is relatively costly and investors are indifferent between investing through the funds and saving privately ($\lambda = 1$), and the region $\psi_P < \bar{\psi}_P$, where investing with the passive fund is relatively cheap and investors strictly prefer to invest through the funds ($\lambda > 1$). In the first region, easier access to passive funds brings additional money into the asset management industry ($W_A + W_P$ grows in panel (b)), whereas in the second region, all investor wealth is already invested in the funds ($W_A + W_P = W$ in panel (b)), so easier access to passive funds just reallocates capital from active to passive funds.

Panels (c) and (d) show that easier access to passive funds decreases active and passive fund fees, also in line with the recent trends. The key reason is that easier access to passive funds strengthens the competition between funds, leading them to reduce fees. In particular, a decrease in ψ_P increases the investor's net (of search costs) return from investing with the passive fund and thereby increases his outside option in bargaining with the active fund, which induces the active fund to lower its fees. A reduction in active fund fees, in turn, increases the investor's net return from investing with the active fund, which increases his outside option in bargaining with the passive fund, resulting in a lower passive fund fee as well. This effect is reflected through a higher λ in the expressions for f_A and f_P in Proposition 1. It is present when $\lambda > 1$ but is absent when $\lambda = 1$, since a reduction in ψ_P improves investors' outside option in the former case but does not affect it in the latter case.[14]

Figure 3 illustrates the second part of Proposition 2. The x-axis captures $Z_H - Z_L$ (for a fixed Z_M), so that as we move to the right, the active fund has less opportunities to generate trading profits. This leads to an outflow of funds from the active fund to the passive fund, resulting in higher W_P and lower W_A. If not all capital is allocated to the funds and investors are indifferent between investing with the funds and private savings (region with $\lambda = 1$), the adjustment takes place only via fund flows and fees stay constant, as explained above. If all capital of investors is allocated to the funds, the adjustment takes place both via fund flows and fund fees. In principle, in this region, fund fees and investors' net return λ can change either way as $Z_L - Z_H$ decreases. On the one hand, lower trading opportunities make the active fund a worse product, which causes it to reduce its fees, and this can cause the passive fund to reduce its fees as well. On the other hand, the fact that the active fund is a worse product can decrease the competition faced by the passive fund, allowing it to raise fees. Under additional parameter restriction (38) in Proposition 2, fees decline, and we impose this restriction to match the empirical evidence that passive fund growth has been associated with a decline in both active and passive fund fees (French, 2008; Stambaugh, 2014).

[14] When ψ_P decreases, there is also a second reason why fees decrease (which explains why f_P decreases even in the region where $\lambda = 1$): holding investors' outside option (net return λ) constant, a reduction in ψ_P leads to a decrease in the market return $\frac{R_M}{P_M}$ earned by the passive fund. This is because as ψ_P declines, investors' net (of search costs) return from investing with the passive fund increases, and to achieve the same λ, capital must flow into the passive fund to the point until its *gross* return, $\frac{R_M}{P_M}$, decreases in a way that investors' *net* return remains the same. A decrease in the passive fund's return, in turn, results in a lower passive fund fee (as can be formally seen from (16)). This effect is reflected through a dependence of f_P on ψ_P directly (not via λ) in the expression for f_P.

4 Implications for governance

4.1 Sources of passive fund growth

We now present our main results about the implications of passive fund growth for governance. Aggregate governance in our model is determined by the extent of investor engagement in an average firm and is captured by the payoff of the market R_M.

Both easier access to passive funds and the reduction in active trading opportunities lead investors to reallocate their capital out of the active fund and into the passive fund (panel (b) in Figures 2 and 3). This has important implications for firms' ownership structures: the active fund's stake in an average firm ($\frac{1}{2}x_{AL}$) decreases, whereas the passive fund's stake (x_P) increases. This ownership dynamics can be seen in panel (f) of both figures. Since, for a given stake in the firm, the active fund's benefit from engagement is higher given its endogenously higher fees ($f_A \geq f_P$), the replacement of the active fund by the passive fund decreases the overall level of investor engagement. Moreover, both lower ψ_P and lower $Z_L - Z_H$ lead to a reduction in fund fees, which further decreases funds' combined incentives to engage.

Do these effects imply that passive fund growth is detrimental to governance? As the next result shows, this is indeed the case if the source of passive fund growth is the reduction in active trading opportunities. However, this is not always the case if the source of passive fund growth is easier access to passive funds:

Proposition 3. (*i*) *Easier access to passive funds (lower ψ_P) strictly improves aggregate governance R_M if $\psi_P > \bar{\psi}_P$. If, in addition, $e_{AL} < \frac{Z_L - Z_H}{2}$, then lower ψ_P hurts aggregate governance if $\psi_P \leq \bar{\psi}_P$.* (*ii*) *In contrast, a decrease in active trading opportunities (lower $Z_L - Z_H$ if Z_M stays fixed) hurts aggregate governance if (38) in the appendix is satisfied.*

These results are illustrated in panel (e) of Figures 2 and 3, which plot R_M as a function of $1/\psi_P$ and $Z_H - Z_L$, respectively. To understand why passive fund growth can improve governance, it is helpful to look at changes in firms' ownership structures, illustrated in panel (f). As the passive fund grows, it not only replaces the active fund, but also replaces liquidity investors: their average (across all firms) stake, $1 - x_P - \frac{x_{AL}}{2}$, declines.[15] We can think of liquidity investors as retail shareholders, who have neither ability nor incentives to engage, so all other things equal, such replacement increases investor engagement.

[15] By "replacement," we mean that at date 2, initial owners sell fewer shares to the active fund and liquidity investors, and sell more shares to the passive fund.

Why does this positive effect outweigh the negative effects (replacement of the active fund and smaller fees) only if the passive fund grows due to a reduction in ψ_P, but not in $Z_L - Z_H$? Intuitively, for the passive fund to primary replace liquidity investors, and not only the active fund, there must be sufficient flow of new capital from private savings into asset management. Easier access to passive funds (lower ψ_P) reduces the fundamental friction that prevents investors from investing through funds, so it substantially crowds out private savings and brings in new capital: $W_A + W_P$ grows significantly, even though W_A declines. In contrast, if the passive fund grows because the active fund becomes less attractive ($Z_L - Z_H$ declines), this primarily affects investors' allocations between the active and passive fund, but the overall benefits of investing through the funds do not increase much.

A similar logic explains why a reduction in ψ_P only improves governance if $\psi_P > \bar{\psi}_P$. Once ψ_P falls below $\bar{\psi}_P$, all capital is already invested in the funds, so any further growth in passive AUM comes entirely from investors' allocations to the active fund ($W_A + W_P$ stays constant). Thus, the first-order effect on ownership is the crowding out of the active fund, and overall investor engagement decreases. The dynamics of fund fees reinforces the different governance effects of lower ψ_P between these two regions: if $\psi_P > \bar{\psi}_P$, active fund fees do not decrease, whereas if $\psi_P < \bar{\psi}_P$, competition between the funds is strong, so both active and passive fees decrease, reducing funds' incentives to engage (panels (c) and (d)).[16]

The formal logic of Proposition 3 is related to the arguments in Berk and Green (2004): it relies on the idea that capital flows into the fund until its comparative advantage over other investment options decreases, so that in equilibrium, investors remain indifferent between investing with the fund and not. For example, consider the region in which investors are indifferent between investing with the funds and saving privately ($\lambda = 1$). As ψ_P decreases (and fee f_P decreases as well), investors' net return from investing with the passive fund, $(1 - f_P)\frac{R_M}{R_M - Z_M} - \psi_P$, increases and exceeds the return from private savings. Hence, investors start allocating more capital to the passive fund, and its AUM and holdings x_P start growing until, in equilibrium, its return on investment $\frac{R_M}{R_M - Z_M}$ declines to the point where investors again become indifferent between the passive fund and private savings. A decrease in $\frac{R_M}{R_M - Z_M}$

[16] There are two additional nuanced effects in the region $\psi_P < \bar{\psi}_P$, one negative and one positive. The negative effect is that since the passive fund invests in more expensive stocks than the active fund ($P_H > P_L$), the combined ownership of the two funds declines, while liquidity investors' ownership increases, which further reduces overall investor monitoring. The positive effect is that the reduction in R_L means that the active fund can buy L-stocks at a lower price, and hence the active fund's ownership stakes do not decrease as much. Condition $e_{AL} < \frac{Z_L - Z_H}{2}$ in Proposition 3 ensures that this positive effect is relatively small. In the proof of Proposition 3, we show that there exists a cutoff $\underline{\psi}_P$ such that this condition is satisfied for $\psi_P < \underline{\psi}_P$.

implies that R_M, and hence the aggregate level of investor engagement, must increase.

Similarly, if active trading opportunities $(Z_L - Z_H)$ decrease, while the benefits of investing in the market portfolio (Z_M) remain the same, investors' net return from investing with the active fund, $(1 - f_A)\frac{R_L}{R_L - Z_L} - \psi_A$, decreases, whereas their return from investing with the passive fund, $(1 - f_P)\frac{R_M}{R_M - Z_M} - \psi_P$, remains unchanged. Capital thus flows from the active fund into the passive fund, decreasing engagement by the active fund and increasing engagement by the passive fund. However, because investors must remain indifferent between investing with the passive fund and saving privately, $\frac{R_M}{R_M - Z_M}$ should not change, and hence the inflow of capital into the passive fund cannot be too large, so that the aggregate level of investor engagement does not increase.[17]

4.2 Fund fees and governance

It is often argued that passive fund growth is detrimental to governance due to the low fees that passive fund managers charge and, thereby, their low incentives to stay engaged. Our model highlights that such fee-related criticisms are incomplete: fees do not change exogenously and in isolation, and lower fees are likely to be accompanied by changes in funds' AUM and ownership stakes, which also affect funds' incentives to engage. In particular, the lower are the fees, the higher are investors' flows into the funds, and the resulting increase in funds' ownership stakes can more than offset the reduction in incentives from lower fees. Proposition 3 shows that this indeed occurs if $\psi_P > \bar{\psi}_P$: in this region, as access to passive funds becomes easier, fund fees decrease, but governance nevertheless improves:

Corollary 1. *If $\psi_P > \bar{\psi}_P$, then easier access to passive funds (lower ψ_P) improves aggregate governance R_M, even though it decreases fund fees.*

4.3 Trade-off between governance and fund investors' returns

Another implication of Proposition 3 is that there can be a trade-off between fund investors' returns and governance. To see this, note that in the region $\psi_P < \bar{\psi}_P$, as access to passive

[17] To be precise, Proposition 3 shows that a reduction in $Z_L - Z_H$ strictly decreases R_M if $\lambda > 1$ and does not change R_M in the region $\lambda = 1$. However, in Section 1.4.2 of the online appendix, we show that if there is heterogeneity in liquidity investors' valuations, then R_M *strictly* decreases as $Z_L - Z_H$ falls in the region $\lambda = 1$ as well. Intuitively, in this case, larger fund ownership in a firm raises the stock price by increasing the valuation of the marginal liquidity shareholder. This rise in prices limits fund returns and reduces the flow of capital into the funds, so the negative effect on governance is more pronounced.

funds becomes easier, fund investors' equilibrium rate of return increases, whereas aggregate governance worsens (panels (a) and (e) of Figure 2). The same trade-off arises if we compare the baseline case (in which both the active and passive fund are present) to a benchmark with $\psi_P = \infty$, in which there is no passive fund and investors allocate their wealth between the active fund and private savings. The red dashed line in panel (e) of Figure 2 corresponds to the market payoff R_M in this benchmark.[18] Panels (a) and (e) show that while the introduction of the passive fund always weakly increases λ compared to the benchmark (in which $\lambda = 1$), it only improves governance if it does not decrease ψ_P below $\hat{\psi}_P$ (where $1/\hat{\psi}_P$ is depicted in panel (e)) and, accordingly, does not increase λ too much (above $\hat{\lambda}$ in panel (a)). We summarize these observations as follows:

Corollary 2. *Easier access to passive funds (lower ψ_P) improves aggregate governance if and only if it does not increase fund investors' returns too much.*

Intuitively, passive fund growth is especially beneficial for fund investors (i.e., increases λ substantially) when it results in strong competition between funds and significantly decreases fund fees. However, this competition implies that the passive fund primarily replaces the active fund, rather than liquidity investors, in firms' ownership structures. Moreover, the substantial reduction in fees implies lower incentives to monitor: to have incentives to stay engaged, fund managers need to earn enough rents from managing investors' portfolios. These effects create a trade-off between governance and fund investors' net returns.

This intuition is more general and applies to changes in other parameters. To see this, recall from Proposition 1 that $R_M = (1 + \frac{1-\eta}{\psi_P + (\lambda-1)(1-\eta)})Z_M$. Thus, for any parameter that does not enter this relation (e.g., $Z_L - Z_H$ keeping Z_M fixed, as well as ψ_A, c_i, or W), a change in this parameter that increases investors' equilibrium return λ inevitably leads to worse governance R_M, and vice versa. For example, when investor wealth W is more limited, investors' return is higher because funds compete for investors' capital (see part (*iv*) of Proposition 1), but governance is worse because funds' lower AUM and ownership stakes decrease their incentives to monitor. As we show in Section 1.4 of the online appendix, the trade-off between governance and fund investors' net returns also arises for general compensation contracts and under more general assumptions about stock misvaluations and monitoring technologies.

[18] Lemma 8 in the online appendix presents sufficient conditions for such a "corner" equilibrium to exist.

4.4 Strengthening of shareholder rights

In addition to the growth of passive funds, another significant development in recent decades has been the strengthening of shareholder rights. Examples include the destaggering of corporate boards, mandatory say-on-pay votes, increased use of majority (rather than plurality) voting for directors, proxy access, and universal proxy cards, among others. In addition, asset managers have been taking steps to decrease their individual costs of monitoring, e.g., by increasing the size of their stewardship teams. Our model can be used to study the implications of these trends, as they can be interpreted as a reduction in funds' costs of monitoring, c_A and c_P. For brevity, we relegate the complete analysis to Section 1.3 of the online appendix and only present the main conclusions here.

Our analysis reveals that the effects of reducing funds' costs of monitoring are nuanced. On the one hand, lower monitoring costs induce fund managers to monitor more, which increases the value of their portfolio firms. This improvement in governance benefits fund investors on their existing investments through the funds. However, there can also be a negative effect: if traders in financial markets anticipate the benefits of increased monitoring and bid up the prices, it can hurt fund investors on their future investments.

We also show that reduced costs of monitoring have both a direct effect on fund managers' incentives to monitor, and also an indirect effect by changing fund investors' capital allocation decisions. In particular, passive funds can benefit from decreasing their costs of monitoring as it can help attract flows from active funds, whereas active funds do not benefit as much. This result is broadly consistent with the observation that the Big Three index fund families have been increasing the size of their corporate governance teams over the recent years.[19]

5 Empirical implications

Reconciling the debate in the empirical literature. The effect of passive funds on governance is a highly debated question, with several papers exploiting the index reconstitution setting and coming to conflicting conclusions: Appel, Gormley, and Keim (2016, 2019) and Filali Adib (2019) find positive effects of greater passive ownership, whereas Schmidt and Fahlenbrach (2017), Bennett, Stulz, and Wang (2020), and Heath et al. (2022) find negative effects. The literature typically alludes to differences in methodologies as a way to

[19] For example, in his 2018 letter to CEOs, BlackRock's Larry Fink committed "to double the size of the investment stewardship team over the next three years."

explain differences in results.[20] Our paper provides an alternative, unified explanation for these contradictory findings, which is complementary to the methodological explanations. Because of different methodologies, as well as slightly different samples and time periods, these papers differ in whether higher passive ownership results from lower retail or lower active fund ownership, in a manner that can explain the opposite conclusions. In particular, the papers that document a positive governance effect of higher passive ownership find no corresponding changes in active (non-index) fund ownership.[21] In contrast, both Heath et al. (2022) and Bennett, Stulz, and Wang (2020) conclude that the negative effects on governance they document are consistent with the predictions of our model because in their studies, index additions lead to a significant decrease in active fund ownership. Similarly, Schmidt and Fahlenbrach (2017) find no changes in ownership by all institutional investors, consistent with passive funds replacing actively managed institutions.[22]

Cross-sectional vs. time-series implications. Our second implication is that policymakers should exercise caution in using the existing studies to understand the governance effects of passive fund growth over the last decades. It is possible that higher passive fund ownership caused by index reconstitutions hurts governance, whereas passive fund growth over time improves governance, and vice versa. This is because to isolate the effects of passive ownership, the literature aims to identify exogenous variation in ownership structures, such as those due to index reconstitutions. In contrast, the endogenous growth in passive ownership over time has coincided with other contemporaneous changes, such as changes in active and passive fund fees, as well as active and passive funds' aggregate AUM, which all remain fixed in an index reconstitution setting. As our market equilibrium model shows, these factors have important implications for aggregate governance and their combined effects are subtle. In addition, and related to the first implication above, the types of shareholders that passive funds replace in the time-series (active funds vs. retail) could be very different from those they replace in index reconstitution studies, potentially leading to different results.

[20] Appel, Gormley, and Keim (2020) suggest that the results in Heath et al. (2022) and Schmidt and Fahlenbrach (2017) could be biased because of these papers' failure to control for Russell's proprietary market cap (see p. 27), whereas Schmidt and Fahlenbrach (2017) hypothesize that their differences from Appel, Gormley, and Keim (2016) could be explained by the use of index-switching firms (rather than cross-sectional variation in index membership), as well as by different definitions of index funds (see p. 287).

[21] See Table 2 in Appel, Gormley, and Keim (2016); Table 2 and footnote 17 in Appel, Gormley, and Keim (2019); and p. 11 in Filali Adib (2019).

[22] See Table 3 and pp. 110 and 126 in Heath et al. (2022); Table 3, pp. 4-5, and Section 5.2 in Bennett, Stulz, and Wang (2020); and Figures 2 and 3 in Schmidt and Fahlenbrach (2017).

To shed light on which investors were replaced by passive funds over time, we present some simple aggregate statistics. We calculate the average ownership stakes of active (passive) funds by taking the combined AUM of active (passive) funds from the CRSP Mutual Fund database, and dividing them by the overall capitalization of the U.S. stock market.[23] Figure A.1 in the Appendix shows that the fraction of equity held by passive funds steadily grew over 2004-2017, from 4% to more than 15%, whereas the fraction held by active funds first grew but started declining in 2011. The combined fraction of equity held by active and passive funds grew over 2004-2011, but remained relatively stable over 2011-2017. French (2008) provides insights into ownership patterns prior to 2004: according to his Tables I and II, the fraction of U.S. equity held by all open-end funds rose from about 5% in 1980 to 28% in 2004, direct holdings decreased from 48% in 1980 to 27% in 2004, and passive fund share increased over this period. Combined, this evidence suggests that between 1984 and 2011, passive funds were primarily replacing investors other than active funds in firms' ownership structures, whereas between 2011 and 2017, passive funds were primarily replacing active funds. A more complete analysis would also involve studying the changes in fund fees, extending Lewellen and Lewellen (2022a), and is beyond the scope of this paper.

Heterogeneous effects of passive fund growth across firms. Our model implies that passive fund growth can have very different governance effects in different firms. For example, the positive aggregate effect of easier access to passive funds in the region $\psi_P > \bar{\psi}_P$ comes entirely from improvements in H-firms, in which the passive fund replaces only liquidity investors. In contrast, the value of L-firms in this region remains unaffected: in these firms, the passive fund replaces both liquidity investors and the active fund, and the combined effect is neutral (see panels (g) and (h) of Figure 2).[24] Such cross-sectional heterogeneity is also apparent in the region $\psi_P < \bar{\psi}_P$ in Figure 2, as well as in Figure 3: the governance of H-firms improves, whereas the governance of L-firms becomes worse.

Thus, a key company characteristic that affects whether greater passive fund ownership improves governance is whether passive funds replace retail shareholders or actively managed funds. In our model, this heterogeneity in ownership arises due to liquidity (retail) investors

[23] This is equivalent to calculating active and passive funds' ownership stakes within each firm and then taking the market-value-weighted average of those stakes across firms. We thank Davidson Heath, Daniele Macciocchi, Roni Michaely, and Matthew Ringgenberg for sharing the data on fund assets with us.

[24] Formally, because investors are indifferent between investing with the active fund and saving privately, the active fund's after-fee return $(1 - f_A)\,\frac{R_L}{R_L - Z_L}$ must remain the same (see (17)), which together with (15), implies that both the active fund fee f_A and the return $\frac{R_L}{R_L - Z_L}$ remain unaffected.

undervaluing some stocks more compared to others, but this property is more general and likely to apply to other characteristics, such as firm size or visibility among retail investors.

Hedge fund activism. Our model has implications for hedge fund activism if we interpret funds' monitoring efforts e_{ij} as informed voting in proxy contests run by activists: proxy contests are typically close votes, and large mutual funds are often pivotal voters (Fos and Jiang, 2015; Brav et al., 2022). The funds' costs of effort in this interpretation are the costs of acquiring information and potentially alienating management by voting for the activist. Our results suggest that if passive funds primarily crowd out private savings and replace retail investors in firms' ownership structures, activist hedge fund campaigns are more likely to succeed, whereas if passive funds primarily replace active mutual funds, such campaigns are more likely to fail. This prediction can help connect the increased flows to hedge fund activists over the last two decades[25] to the observed replacement of retail investors by large asset managers in firms' ownership structures. It is consistent with Appel, Gormley, and Keim (2019), who find that an increase in passive ownership that is not accompanied by lower active fund ownership is associated with higher activists' success rates.

6 Discussion of assumptions and extensions

In this section, we discuss the assumptions of the basic model and summarize the results of several extensions.

6.1 Active and passive funds' monitoring strategies

It is important for our results that both active and passive funds can monitor and increase firm value. While passive funds do not run activist campaigns or take board seats, they regularly use other monitoring strategies. The two most common strategies used by institutional investors are voting and engagement with management (McCahery, Sautner, and Starks, 2016). Accordingly, Fisch et al. (2019) note that passive funds have become increasingly engaged through both voting and engagement. Large passive fund families have governance committees that analyze how votes should be cast, and their votes are often pivotal for im-

[25] See, e.g., "Outlook Remains Bright for Activist Investing," at https://sophisticatedinvestor.com/outlook-remains-bright-for-activist-investing (February 1, 2016).

portant issues, such as proxy fights or contentious M&As (Brav et al., 2022).[26] Passive funds also regularly meet with and communicate their views to management.[27] The evidence in Gormley et al. (2023) suggests that governance campaigns by the Big Three passive families have a material impact on board composition of their portfolio firms.

While both passive and active funds engage in governance, their costs of making effective changes (c_P and c_A in the model) may differ. Our assumption $c_P \geq c_A$ is consistent with the common view that "governance interventions are especially costly for passive funds, which do not generate firm-specific information as a byproduct of investing" (Lund, 2018), as well as with Brav et al. (2022) and Heath et al. (2022), who find that passive funds are less likely to vote against management than active funds.

However, this view is not universally held, and some argue that passive funds could be more effective at monitoring (see Kahan and Rock (2020) and Brav, Malenko, and Malenko (2023) for detailed discussions). For example, passive funds' long-term horizon could give credibility to their demands and make it easier for them to influence management compared to active funds with high turnover. Kahan and Rock (2020) also note that the market-wide expertise and holdings of index funds can be particularly valuable for broad governance issues affecting multiple firms. In the context of our model, if passive funds have lower monitoring costs, $c_P < c_A$, then passive funds replacing active funds in firms' ownership structures would have an ambiguous effect: passive funds would have lower incentives to monitor due to lower fees, but a greater ability to do so. However, all the other effects would remain the same, and hence the trade-offs described in Section 4.1 would arise in this setting as well. In particular, since the numerical example in Figures 2 and 3 features $c_P = c_A$, the results would remain qualitatively unchanged if c_P were slightly lower than c_A.

6.2 Bargaining over fees

Assuming that fees are set via bargaining makes the model very tractable. This assumption is natural if we think of fund investors as institutional investors, but may be less natural

[26]Kahan and Rock (2020) discuss that on such consequential issues, passive funds tend to invest significant resources in acquiring firm-specific information and deciding the outcome. Indeed, BlackRock writes: "In some cases, we have multiple meetings with both the company and the activist over many months as the situation evolves" (https://www.blackrock.com/corporate/literature/publication/blk-profile-of-blackrock-investment-stewardship-team-work.pdf).

[27]For example, in 2017, BlackRock, Vanguard, and State Street had, respectively, over 1600, 950, and 650 conversations with management teams, and also sent hundreds of letters to them ("At BlackRock, Vanguard and State Street, 'Engagement' Has Different Meanings," *The Wall Street Journal*, January 20, 2018).

in the context of individual investors. However, the qualitative effects that arise in our model are likely robust to other models of imperfect competition among funds. Consider, for example, the implications of easier access to passive funds. The property of fees that is needed for our effects is that easier access to passive funds, by improving fund investors' outside options, decreases the fees of the active fund, and the extent of this effect depends on whether the active fund primarily competes with the passive fund or with investors' private savings. This property is likely to hold in other models of imperfect competition, e.g., in a model where fund managers set their fees in advance and investors need to incur heterogeneous "transportation" costs to invest with the funds, as in Hotelling (1929) and Salop (1979). The complication that would arise in this alternative setting is that when setting the fees, fund managers would take into account the effect of fees on their future monitoring efforts. This "governance effect" on fees is likely to be second-order in practice. Modeling fee setting via Nash bargaining allows us to abstract from the "governance effect" (see Section 3.3 and footnote 12), while capturing the more first-order effects stemming from competition between funds and fund investors' outside options.

6.3 After-fee performance of active and passive funds

In our model, the after-fee return of the active fund is higher than that of the passive fund; otherwise, rational investors would not be willing to incur a higher search cost to invest with the active fund. This is similar to Stambaugh (2014), where rational allocation decisions by investors imply a positive net alpha in equilibrium (see Section III.D). However, the model can be easily modified to capture the empirically observed after-fee underperformance of active funds (Fama and French, 2010). For example, one reason proposed for why investors allocate capital to active funds despite their negative after-fee alphas is that investors overvalue managerial skill, e.g., because they cannot distinguish performance due to skill from performance due to exposures to systematic factors (Song, 2020).[28] In Section 1.4.6 of the online appendix, we capture the overvaluation of skill by assuming that if the equilibrium return of an active fund is r_A, fund investors perceive it to be $r_A + \rho$ for some $\rho > 0$. We show that this model features after-fee underperformance of the active fund relative to the passive fund, but the results about governance remain qualitatively unchanged.

[28] Another reason is that fund investors demand a non-market portfolio due to their unique investment needs (e.g., hedging labor income or real estate) and are willing to pay for it via higher fees. Finally, as Pastor and Stambaugh (2012) show, if investors have uncertainty about the extent of decreasing returns to scale, then the allocations to active funds could be high despite the historical evidence on their underperformance.

6.4 Summary of extensions

In Section 1.4 of the online appendix, we analyze several extensions of the basic model. Here, we briefly summarize these extensions and discuss the robustness of our results.

General compensation contracts. Our model is tractable for more general compensation contracts. For example, a hedge fund manager's fee structure typically includes a management fee, a performance fee, and high water marks. In Section 1.4.1 of the online appendix, we allow for contracts of general shape. While the shape of the contract affects the equilibrium effort of fund managers and changes governance, our conclusions continue to hold: the governance effects of passive fund growth crucially depend on whether passive funds grow due to their easier availability or a decline in active fund trading opportunities, and there is often a trade-off between governance and fund investors' net returns.

Heterogeneous valuations of liquidity investors. In our basic model, all liquidity investors have the same valuation of a given stock. In Section 1.4.2 of the online appendix, we consider an extension in which liquidity investors have heterogeneous valuations. Then, funds' trades have price impact both because of the anticipated changes in governance and because higher fund ownership increases the valuation of the marginal liquidity investor. We show that our key results continue to hold: the growth in passive funds due to their easier availability (lower ψ_P) improves governance in the region $\lambda = 1$, whereas if passive funds grow due to lower active trading opportunities, governance strictly worsens.

Generalization of mispricing. The basic model assumes that the misvaluation of the stock does not depend on investors' trading and monitoring decisions. In Section 1.4.3 of the online appendix, we allow the degree of misvaluation to increase or decrease as funds increase their ownership stakes and monitor. For example, greater institutional ownership and monitoring could be associated with better disclosure (e.g., Boone and White, 2015) and thereby lower misvaluation. Our main results remain robust in this extension. Among other things, we show that as access to passive funds becomes easier, governance can still improve, but the sensitivity of governance to passive fund growth now depends on the extent to which governance affects misvaluation. We also show in that section that our results continue to hold if the proportions of L- and H-firms are different from $\frac{1}{2}$.

Multiple active and passive funds. In Section 1.4.4 of the online appendix, we show that our results are robust if we extend the model to multiple funds of each type.

Generalization of the monitoring technology. In Section 1.4.5 of the online appendix, we consider two extensions of the baseline monitoring technology. First, large shareholders may be more effective at promoting value-increasing changes: their larger ownership stakes give them more leverage in their engagements with management, and they also have more influence on voting outcomes. We thus analyze an extension in which the fund manager is more effective at monitoring if he owns a larger stake in the firm. While this assumption changes how firm value depends on the fund's ownership stake, our key results about the impact of passive fund growth continue to hold. Second, we allow for general cost functions $c_i(e)$ and also show the robustness of the key results.

7 Conclusion

The effect of passive fund growth on governance is the subject of an ongoing debate among academics and policymakers. In this paper, we develop a tractable theoretical framework to study the governance effects of active and passive funds in a general equilibrium setting. Analyzing market equilibrium is critical for understanding the governance implications of passive fund growth because their greater availability changes not only firms' ownership structures, but also the fees and AUM of both active and passive funds, which all affect fund managers' combined incentives to be engaged shareholders.

We highlight that passive fund growth can improve aggregate governance even though passive funds charge low fees and even if their growth is accompanied by a reduction in active funds' ownership stakes. However, improvements in governance are not guaranteed and depend on what the reasons for passive fund growth are, and on whether passive funds primarily compete with investors' private savings or with active funds. Moreover, the effects of higher passive ownership are likely to be heterogeneous across firms. Our analysis has important implications for the interpretation of empirical studies of passive funds and helps reconcile the conflicting evidence on their governance role.

To focus on the interplay between fund managers' AUM, fees, investment strategies, and monitoring incentives, we abstract from several important features of the monitoring process, such as investors' private information about firms, dynamic considerations due to differences in investors' horizons, and potential coordination between shareholders. An in-depth look at these questions and their interaction with the mechanisms we study in the paper provides interesting avenues for future research.

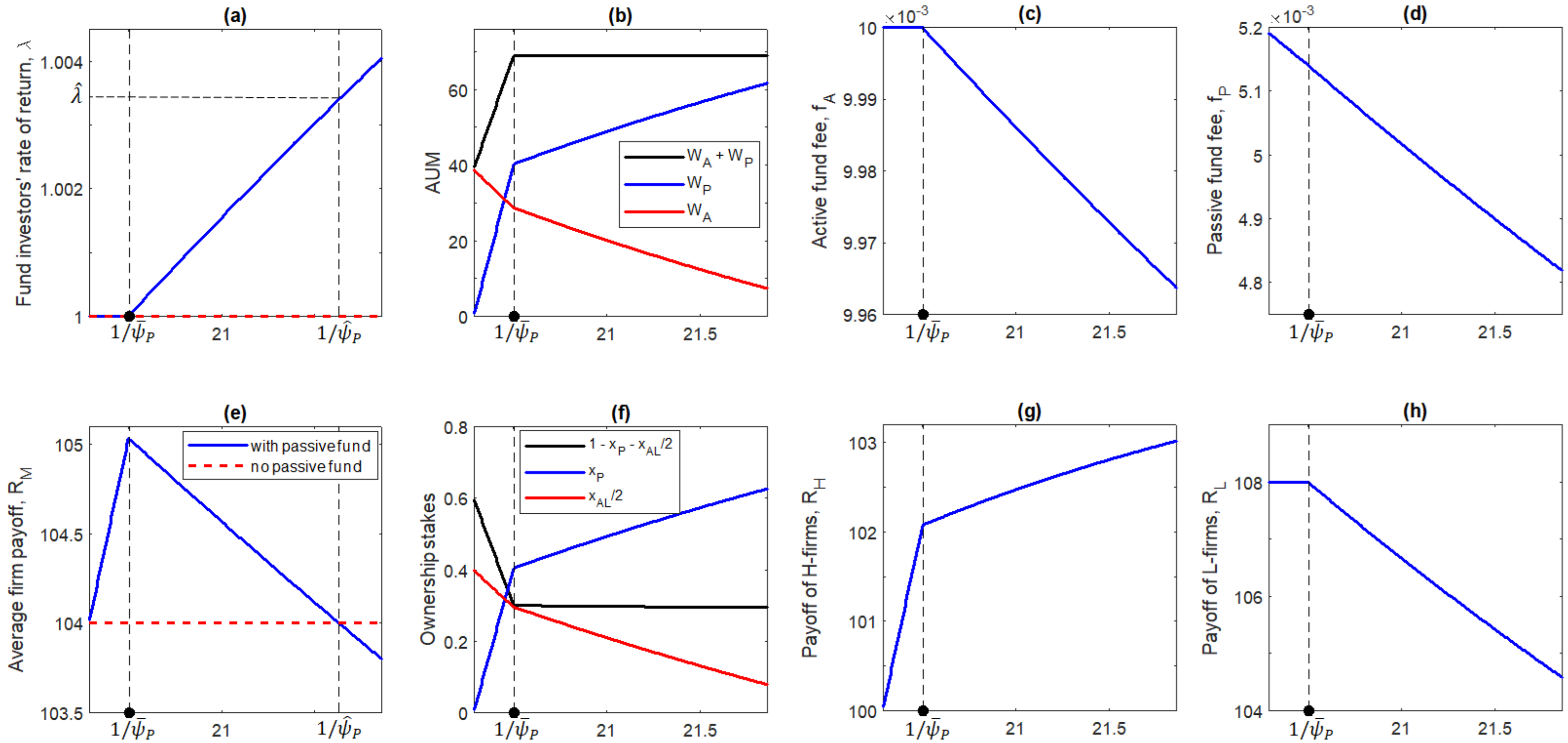

Figure 2. The x-axis in all panels captures $1/\psi_p$, so moving to the right corresponds to easier access to passive funds. The y-axes are: (a) fund investors' rate of return λ; (b) AUM of the active fund (W_A), passive fund (W_P), and of funds combined ($W_A + W_P$); (c) active fund fee f_A; (d) passive fund fee f_P; (e) market payoff R_M in the baseline parameter specification (solid blue line) and in the benchmark case without a passive fund (dashed red line); (f) average (across all firms) ownership stakes of the passive fund (x_P), active fund ($x_{AL}/2$), and liquidity investors ($1 - x_P - x_{AL}/2$); (g) payoff R_H of H-firms; (h) payoff R_L of L-firms. The parameters are $\eta = 0.1$, $c_A = c_P = 0.001$, $\psi_A = 0.1$, $Z_L = 10.8$, $Z_H = 0$, $R_0 = 100$, and $W = 69$.

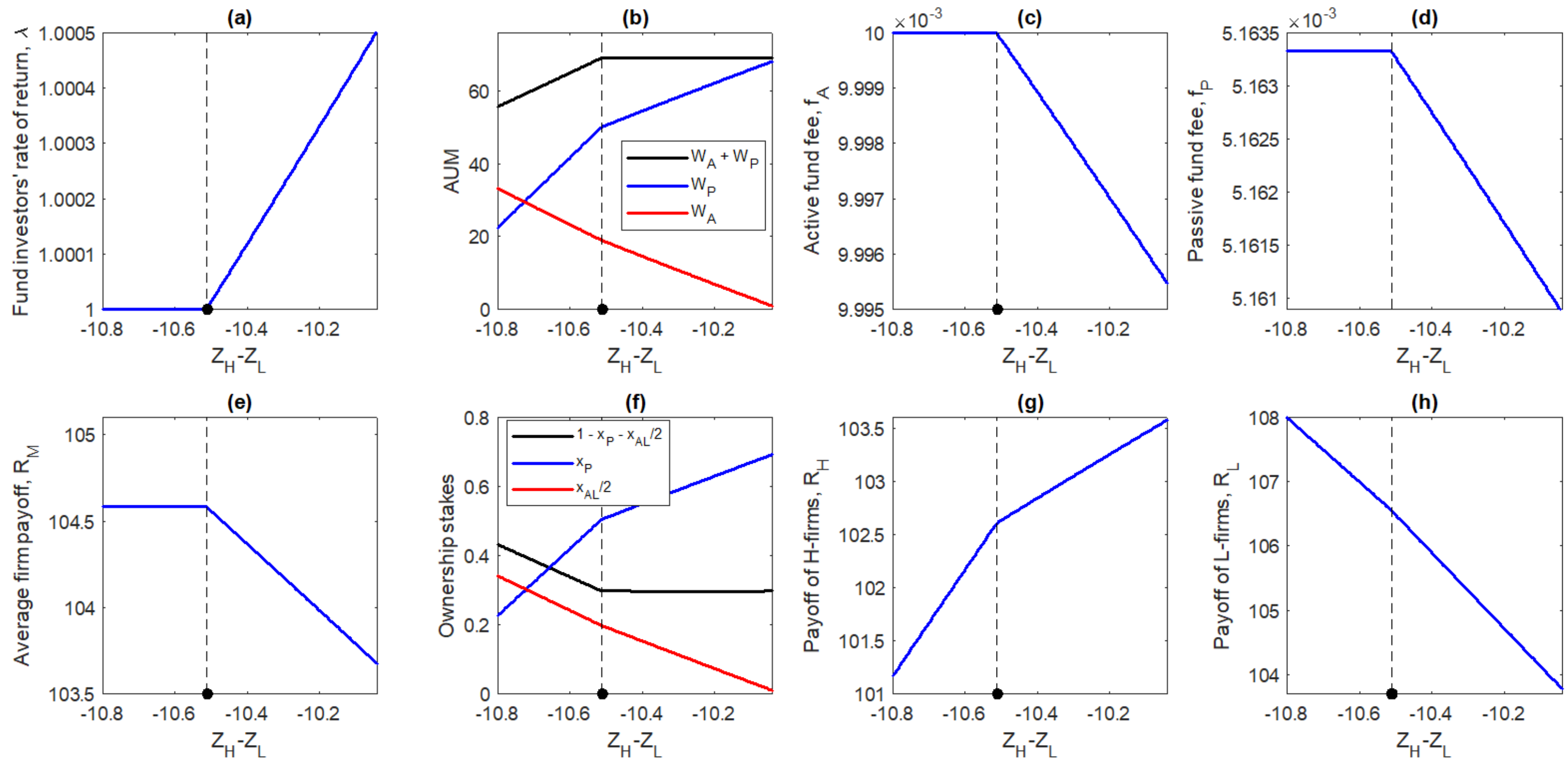

Figure 3. The x-axis in all panels captures $Z_H - Z_L$, so moving to the right corresponds to a reduction in active trading opportunities (lower $Z_L - Z_H$ keeping Z_M fixed). The y-axes are: (a) fund investors' rate of return λ; (b) AUM of the active fund (W_A), passive fund (W_P), and of funds combined ($W_A + W_P$); (c) active fund fee f_A; (d) passive fund fee f_P; (e) market payoff R_M; (f) average (across all firms) ownership stakes of the passive fund (x_P), active fund ($x_{AL}/2$), and liquidity investors ($1 - x_P - x_{AL}/2$); (g) payoff R_H of H-firms; (h) payoff R_L of L-firms. The parameters are $\eta = 0.1$, $c_A = c_P = 0.001$, $\psi_A = 0.1$, $\psi_P = 0.049$, $Z_M = \frac{Z_L+Z_H}{2} = 5.4$, $R_0 = 100$, and $W = 69$.

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Appendix

Ownership by active and passive funds over time

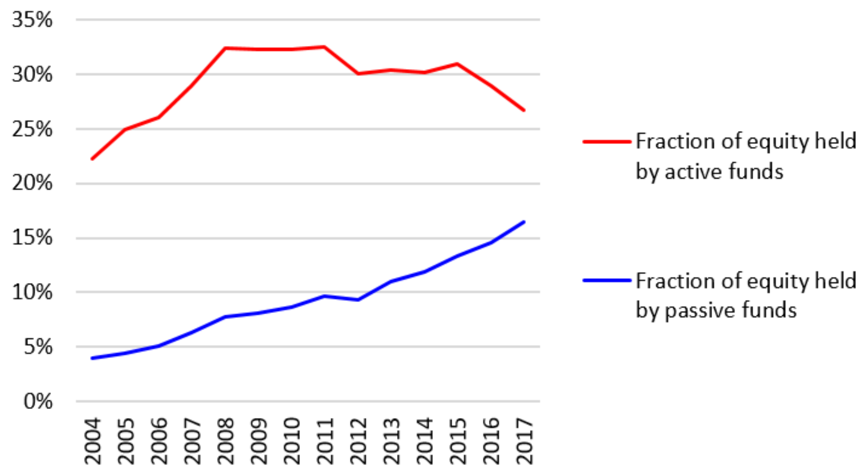

Figure A.1. The fraction of equity held by active (passive) funds is calculated by dividing the combined AUM of active (passive) funds from the CRSP Mutual Fund database by the total market capitalization of U.S. public firms. This is equivalent to calculating the ownership stakes of active and passive funds within each firm and then taking the market-value-weighted average of those stakes across firms.

Proofs

The proofs of several auxiliary results have been relegated to the online appendix. We refer to these results in some places of the main appendix.

Proof of Proposition 1. There are two possible cases: 1) $\lambda = 1$, and 2) $\lambda > 1$. We consider each case separately.

(1) Equilibrium when $\lambda = 1$.

Consider the three equations for the active fund manager and L-stocks, i.e., (8), (15), and (17), which we can rewrite as:

$$f_A = \eta \frac{Z_L}{R_L} \quad \text{(fee bargaining)} \tag{22}$$

$$(1 - f_A)\frac{R_L}{P_L} = 1 + \psi_A \quad \text{(investor indifference)} \tag{23}$$

$$R_L - P_L = Z_L \quad \text{(market clearing)} \tag{24}$$

Plugging f_A from (22) and P_L from (24) into (23) gives:

$$\left(1 - \frac{\eta Z_L}{R_L}\right) \frac{R_L}{R_L - Z_L} = 1 + \psi_A \Leftrightarrow (1 + \psi_A - \eta) Z_L = \psi_A R_L.$$

Hence, $R_L = \left(1 + \frac{1-\eta}{\psi_A}\right) Z_L$. Then, (24) implies $P_L = R_L - Z_L = \frac{1-\eta}{\psi_A} Z_L$, and (22) implies

$$f_A = \eta \frac{Z_L}{\frac{1+\psi_A-\eta}{\psi_A} Z_L} = \frac{\eta\psi_A}{1+\psi_A-\eta}.$$

Similarly, we can rewrite the three equations for the passive fund manager and the market portfolio, i.e., (9), (16), and (18), as

$$\begin{aligned} f_P &= \eta \frac{Z_M}{R_M} && \text{(fee bargaining)} \\ (1 - f_P) \frac{R_M}{P_M} &= 1 + \psi_P && \text{(investor indifference)} \\ R_M - P_M &= Z_M && \text{(market clearing)} \end{aligned}$$

Since this system looks similar to the corresponding system for the active fund and the L-stocks, the solution is: $R_M = \left(1 + \frac{1-\eta}{\psi_P}\right) Z_M$, $P_M = \frac{1-\eta}{\psi_P} Z_M$, and $f_P = \frac{\eta\psi_P}{1+\psi_P-\eta}$.

(2) Equilibrium when $\lambda > 1$.

We start by deriving (21). Using (6) and (7) and plugging them into (20), we get

$$W = \frac{1}{2} x_{AL} P_L + x_P P_M. \tag{25}$$

Next, using (10) and (11),

$$R_L - R_M = \frac{1}{2}\frac{f_A x_{AL}}{c_A} \Leftrightarrow c_A(2(R_L - R_M)) = f_A x_{AL}, \tag{26}$$

$$2R_M - R_L = R_0 + \frac{f_P x_P}{c_P} \Leftrightarrow c_P(2R_M - R_L - R_0) = f_P x_P. \tag{27}$$

Plugging these into (25) gives (21). We next characterize the equilibrium as a function of λ, using (8)-(11); (15), (16); and (19), (21).

First, consider L-stocks and the active fund and use (15), (19), and (8):

$$f_A \frac{R_L}{P_L} = \eta \left(\frac{R_L}{P_L} - \lambda\right) \qquad \text{(fee bargaining)} \tag{28}$$

$$(1 - f_A) \frac{R_L}{P_L} = \psi_A + \lambda \qquad \text{(investor indifference)} \tag{29}$$

$$P_L = R_L - Z_L \qquad \text{(market clearing)} \tag{30}$$

From (28), $\frac{R_L}{P_L} = \frac{\eta\lambda}{\eta - f_A}$, and plugging this into (29) gives

$$(1 - f_A) \frac{\eta\lambda}{\eta - f_A} = \psi_A + \lambda \Leftrightarrow f_A = \frac{\eta\psi_A}{\psi_A + \lambda (1 - \eta)}.$$

Plugging this into (28) gives

$$\frac{R_L}{P_L}\eta \left(1 - \frac{\psi_A}{\psi_A + \lambda (1 - \eta)}\right) = \eta\lambda \Leftrightarrow (\psi_A + \lambda (1 - \eta)) P_L = (1 - \eta) R_L,$$

and using (30) gives

$$R_L = \left(1 + \frac{1 - \eta}{\psi_A + (\lambda - 1)(1 - \eta)}\right) Z_L. \tag{31}$$

Finally, using (30) and (31), $P_L = R_L - Z_L = \frac{1-\eta}{\psi_A + (\lambda-1)(1-\eta)} Z_L$.

Second, consider asset M (the market portfolio) and the passive fund manager. Since the system of equations (9), (16), and (19) looks exactly the same as the corresponding system for active fund managers and the L-asset (28)-(30), the solution looks the same as well, which gives the expressions for f_P, R_M, and P_M in the statement of the proposition.

Thus, all equilibrium outcomes – f_A, f_P, R_L, R_M, P_L, P_M – are expressed as a function of λ and the exogenous parameters of the model. The equilibrium λ is then determined from the equilibrium condition that investors invest all of their capital either with the active or with the passive fund manager, i.e., the fixed point solution to (21).

(3) Combining the two cases together.

By Lemma 1 in the online appendix, if $c_P \geq \frac{\psi_P}{\psi_A} c_A$ (which follows from our assumption $c_P \geq c_A$ since $\psi_P \leq \psi_A$), then λ is decreasing in W. Hence, there exists $\bar{W}$ such that $\lambda > 1$ for $W < \bar{W}$ and $\lambda = 1$ for $W \geq \bar{W}$. As also shown in Lemma 1, λ strictly decreases in W if $W < \bar{W}$ and $c_P \geq \frac{\psi_P}{\psi_A} c_A$. It remains to ensure that in the conjectured equilibrium: (1) the active fund indeed finds it optimal to only invest in L-stocks and to diversify across all L-stocks; (2) both the active and passive fund raise positive AUM; and (3) the active and passive fund combined do not hold all the shares, so that liquidity investors hold at least some shares in each firm. Lemma 2 in the online appendix proves that the active fund will indeed diversify equally across L-stocks. Part (*ii*) of Lemma 3 in the online appendix imposes conditions that are sufficient for the active fund to not deviate to investing in H-stocks. Lemma 4 in the online appendix imposes sufficient conditions for both funds' AUM to be positive, and Lemma 5 in the online appendix imposes sufficient conditions for the active and passive fund combined to not hold all the shares. Combining these conditions together yields the following two conditions:

$$\max \left\{ \frac{\frac{R_0}{Z_L} + \left[1 + \frac{1-\eta}{\psi_A}\right]}{2\left[1 + \frac{1-\eta}{\psi_P}\right]}, \frac{\xi_A \xi_P + \xi_A - \xi_P}{\xi_P^2} \right\} \;<\; \frac{Z_M}{Z_L} < \frac{1 + \frac{1-\eta}{\psi_A}}{1 + \frac{1-\eta}{\psi_P}}, \tag{32}$$

$$\hat{W} \;\leq\; W < \frac{R_0 - Z_L}{2}, \tag{33}$$

where ξ_A and ξ_P are given by (74)-(75) and $\hat{W} < \bar{W}$ is given by (83) in the online appendix. Finally, we point out that the conditions of the proposition describe a non-empty set of parameters. For example, $\eta = 0.01$, $c_A = 0.001$, $c_P = 0.002$, $\psi_A = 0.1$, $Z_L = 1$, $Z_H = 0.81$, $R_0 = 10.75$, $W = 1.5$, and $\psi_p \in [0.0897; 0.08974]$ satisfy these conditions. ■

Proof of Proposition 2. We start by deriving the expressions for active and passive funds' AUM. Using Proposition 1 and (49),

$$\begin{aligned} W_P = x_P P_M = \tfrac{c_P e_P}{f_P} \tfrac{R_M}{\frac{\psi_P}{1-\eta}+\lambda} &= c_P \left(2R_M - R_L - R_0\right) \tfrac{\psi_P+\lambda(1-\eta)}{\eta\psi_P} \tfrac{R_M(1-\eta)}{\psi_P+\lambda(1-\eta)} \\ &= \tfrac{1-\eta}{\eta} \tfrac{c_P}{\psi_P} R_M \left(2R_M - R_L - R_0\right). \end{aligned} \tag{34}$$

Similarly, using Proposition 1 and (48),

$$\begin{aligned} W_A = \tfrac{1}{2} x_{AL} P_L = \tfrac{1}{2} \tfrac{c_A e_{AL}}{f_A} \tfrac{R_L}{\frac{\psi_A}{1-\eta}+\lambda} &= \tfrac{1}{2} 2c_A \left(R_L - R_M\right) \tfrac{\psi_A+\lambda(1-\eta)}{\eta\psi_A} \tfrac{R_L(1-\eta)}{\psi_A+\lambda(1-\eta)} \\ &= \tfrac{1-\eta}{\eta} \tfrac{c_A}{\psi_A} R_L \left(R_L - R_M\right). \end{aligned} \tag{35}$$

Note, as an auxiliary result, that these expressions imply that when $\lambda = 1$, AUM of fund i are decreasing in ψ_i. Indeed, if $\lambda = 1$, then R_L does not depend on ψ_P, and W_P strictly decreases in ψ_P if and only if

$$-\frac{c_P}{\psi_P^2} R_M \left(2R_M - R_L - R_0\right) + \frac{c_P}{\psi_P} \left(4R_M - R_L - R_0\right) \frac{dR_M}{d\psi_P} < 0,$$

which holds since $2R_M - R_L - R_0 > 0$ and $\frac{dR_M}{d\psi_P} < 0$. Similarly, if $\lambda = 1$, then R_M does not depend on ψ_A, and W_A strictly decreases in ψ_A if and only if

$$-\frac{c_A}{\psi_A^2} R_L \left(R_L - R_M\right) + \frac{c_A}{\psi_A} \left(2R_L - R_M\right) \frac{dR_L}{d\psi_A} < 0,$$

which holds since $R_L - R_M > 0$ and $\frac{dR_L}{d\psi_A} < 0$. Note also that the same arguments hold for the equilibria of Lemma 8 in the online appendix, in which only one fund raises AUM – this is because the above expressions for W_A (W_P) are still valid in the equilibrium where only the active (passive) fund raises AUM.

(i) We first prove the comparative statics results in parameter ψ_P.

We start by showing that the combined AUM of active and passive fund managers, $W_A + W_P$, strictly decrease in ψ_P if λ is kept fixed (and in particular, in the region where $\lambda = 1$). This automatically implies that $W_A + W_P$ always weakly decrease in ψ_P (because when $\lambda > 1$, $W_A + W_P = W$). To show that total AUM decrease in ψ_P for a fixed λ, note, using (35)-(34), that

$$W_A + W_P = \frac{1-\eta}{\eta} \left(\frac{c_A}{\psi_A} R_L \left(R_L - R_M\right) + \frac{c_P}{\psi_P} R_M \left(2R_M - R_L - R_0\right) \right). \tag{36}$$

Since R_L does not depend on ψ_P for a fixed λ, $W_A + W_P$ decreases in ψ_P if and only if

$$\begin{aligned}
-\frac{c_A}{\psi_A} R_L \frac{dR_M}{d\psi_P} - \frac{c_P}{\psi_P^2} R_M \left(2R_M - R_L - R_0\right) + \frac{c_P}{\psi_P} \left(4R_M - R_L - R_0\right) \frac{dR_M}{d\psi_P} &< 0 \Leftrightarrow \\
\left[-\frac{c_A}{\psi_A} R_L + \frac{c_P}{\psi_P} \left(4R_M - R_L - R_0\right)\right] \frac{dR_M}{d\psi_P} - \frac{c_P}{\psi_P^2} R_M \left(2R_M - R_L - R_0\right) &< 0.
\end{aligned}$$

Since $2R_M - R_L - R_0 > 0$ and $\frac{\partial R_M}{\partial \psi_P} < 0$, it is sufficient to show that

$$-\frac{c_A}{\psi_A} R_L + \frac{c_P}{\psi_P} \left(4R_M - R_L - R_0\right) \geq 0. \tag{37}$$

Note that $e_P = 2R_M - R_L - R_0 \geq 0$ and hence $2R_M - R_L > 0$, and summing up these two inequalities gives $4R_M - R_L - R_0 > R_L$. This, together with the assumption of Proposition 1 that $\frac{c_P}{\psi_P} \geq \frac{c_A}{\psi_A}$, implies (37), as required. The same result with respect to ψ_P also applies in the equilibrium of Lemma 8 in the online appendix in which only the passive fund raises positive AUM.

The fact that $W_A + W_P$ decreases in ψ_P implies the last statement of part (i), i.e., that $\lambda = 1$ only when ψ_P is large enough. Indeed, if $\lambda = 1$, fund investors invest their funds both with the fund managers and in private savings, and hence $W_A + W_P < W$, while if $\lambda > 1$, all investor funds are allocated to the fund managers, i.e., $W_A + W_P = W$. Hence, $\lambda = 1$ if and only if $W_A + W_P < W$, or if and only if ψ_P is large enough.

Next, we prove that λ decreases in ψ_P under the conditions of Proposition 1. This is weakly satisfied in the region where $\lambda = 1$. To see this for the region where $\lambda > 1$, note that in this region, $W_A + W_P = W$. If we write W_A and W_P as functions of λ and ψ_P, we get

$$W_A\left(\lambda, \psi_P\right) + W_P\left(\lambda, \psi_P\right) = W,$$

and hence,

$$\frac{\partial\left(W_A + W_P\right)}{\partial \lambda} \frac{d\lambda}{d\psi_P} + \frac{\partial\left(W_A + W_P\right)}{\partial \psi_P} = 0,$$

where $\frac{\partial(W_A+W_P)}{\partial \lambda} < 0$ (as follows from the proof of Lemma 1 in the online appendix) and $\frac{\partial(W_A+W_P)}{\partial \psi_P} < 0$, as shown above. Together, this implies $\frac{d\lambda}{d\psi_P} < 0$, as required.

Finally, we prove the result for fees. Since $f_A = \frac{\eta\psi_A}{\psi_A+\lambda(1-\eta)}$, it weakly increases in ψ_P (it does not depend on ψ_P if $\lambda = 1$ and strictly increases if $\lambda > 1$ given $\frac{d\lambda}{d\psi_P} < 0$). And, since $f_P = \frac{\eta\psi_P}{\psi_P+\lambda(1-\eta)}$, it always strictly increases in ψ_P: if $\lambda = 1$, this is because $f_P = \frac{\eta\psi_P}{\psi_P+1-\eta}$, while if $\lambda > 1$, this is because $\frac{df_P}{d\psi_P} = \frac{\partial f_P}{\partial \lambda}\frac{d\lambda}{d\psi_P} + \frac{\partial f_P}{\partial \psi_P} > 0$, which follows from $\frac{\partial f_P}{\partial \lambda} < 0$, $\frac{d\lambda}{d\psi_P} < 0$, and $\frac{\partial f_P}{\partial \psi_P} > 0$.

(ii) We next prove the comparative statics results in $Z_L - Z_H$ while keeping $\frac{Z_L+Z_H}{2}$ fixed and assuming that the following condition holds:

$$\frac{\psi_A}{\psi_P} c_P - c_A > \min\left\{2c_A, \frac{1}{R_0} \frac{\eta\psi_A}{\psi_A + 1 - \eta} \frac{\psi_A}{\psi_P}\right\}. \tag{38}$$

The proof follows the same logic as the proof of part (i). Note that

$$\frac{\partial\left(W_A+W_P\right)}{\partial R_L}<0 \Leftrightarrow \frac{c_A}{\psi_A}(2R_L-R_M)-\frac{c_P}{\psi_P}R_M<0. \tag{39}$$

As we show in Lemma 7 of the online appendix, this inequality is guaranteed by (38) assumed in the proposition, and hence W_A+W_P decreases in R_L. Consider an increase in Z_L-Z_H keeping Z_M fixed. If we are in the region where $\lambda=1$, Proposition 1 implies that R_M remains constant and R_L increases. Since W_A+W_P decreases in R_L, W_A+W_P decreases when Z_L-Z_H increases. If we are in the region where $\lambda>1$, we have $W_A+W_P=W$, so it stays constant if Z_L-Z_H increases. Hence, W_A+W_P always weakly decreases in Z_L-Z_H. Since $\lambda=1$ if and only if $W_A+W_P<W$, this also implies the last statement of part (ii), i.e., that $\lambda=1$ only if Z_L-Z_H is large enough.

Next, we prove that λ weakly decreases in Z_L-Z_H. In the region where $\lambda=1$, this is satisfied. In the region where $\lambda>1$, we have $W_A+W_P=W$. If we write W_A and W_P as functions of λ and (Z_L-Z_H), we get

$$W_A\left(\lambda,Z_L-Z_H\right)+W_P\left(\lambda,Z_L-Z_H\right)=W,$$

and hence,

$$\frac{\partial\left(W_A+W_P\right)}{\partial\lambda}\frac{d\lambda}{d\left(Z_L-Z_H\right)}+\frac{\partial\left(W_A+W_P\right)}{\partial\left(Z_L-Z_H\right)}=0,$$

where $\frac{\partial(W_A+W_P)}{\partial\lambda}<0$ (as follows from the proof of Lemma 1 in the online appendix) and $\frac{\partial(W_A+W_P)}{\partial(Z_L-Z_H)}<0$, as shown above. Together, this implies $\frac{d\lambda}{d(Z_L-Z_H)}<0$, as required.

Finally, we prove the comparative statics for fees. Since $f_A=\frac{\eta\psi_A}{\psi_A+\lambda(1-\eta)}$ and $f_P=\frac{\eta\psi_P}{\psi_P+\lambda(1-\eta)}$, f_A and f_P do not change with Z_L-Z_H in the region $\lambda=1$ and increase in Z_L-Z_H in the region $\lambda>1$ (since, as shown above, λ decreases in Z_L-Z_H in this region).

We complete the proof of the proposition by noting that the conditions of Proposition 1 together with (38) describe a non-empty set of parameters. For example, the same parameters that are provided at the end of the proof of Proposition 1 also satisfy condition (38). ■

Proof of Proposition 3. *(i)* We first prove the comparative statics in ψ_P. Note that $c_P\geq c_A$ and $\psi_P\leq\psi_A$ together imply that $c_P\geq\frac{\psi_P}{\psi_A}c_A$. Recall that by Proposition 2, $\lambda=1$ if $\psi_P\geq\bar{\psi}_P$ and $\lambda>1$ if $\psi_P<\bar{\psi}_P$. Therefore, if $\psi_P>\bar{\psi}_P$, Proposition 1 implies that R_M strictly increases as ψ_P decreases.

Second, to establish that the continuity of equilibrium also applies at $\psi_P=\bar{\psi}_P$, we prove that $\lim_{\psi_P\uparrow\bar{\psi}_P}\lambda=1$, and that $\psi_P=\bar{\psi}_P$ satisfies the fixed point equation (21) with $\lambda=1$. To see this, note that Propositions 1 and 2 imply that for all $\psi_P<\bar{\psi}_P$, (21) is satisfied for the equilibrium λ. Denote the right hand side of (21) by $RHS(\lambda,\psi_P)$, and recall that by the proof of Proposition 1, $RHS(\lambda,\psi_P)$ represents the total AUM of active and passive funds (that is, W_A+W_P). Also note that $RHS(\lambda,\psi_P)$ is continuous w.r.t. λ and ψ_P, is strictly decreasing with ψ_P (by step (3) of the proof of Proposition 2), and is strictly decreasing in λ (by Proposition 1). Therefore, it is sufficient to show that $\psi_P=\bar{\psi}_P$ satisfies (21) with $\lambda = 1$ (since it would also imply that $\lim_{\psi_P \uparrow \bar{\psi}_P} \lambda = 1$). Suppose this is not the case. Then, since $\lambda = 1$ has to hold by Proposition 2, it must be that $W \neq RHS(1, \bar{\psi}_P)$. Since $RHS(\lambda, \psi_P)$ represents the total AUM, it cannot be $W < RHS(1, \bar{\psi}_P)$, and hence it must be $W > RHS(1, \bar{\psi}_P)$. However, then by continuity of $RHS(\lambda, \psi_P)$ in ψ_P, there exists $\varepsilon > 0$ such that $W > RHS(1, \psi'_P)$ for any $\psi'_P \in (\bar{\psi}_P - \varepsilon, \bar{\psi}_P)$. Therefore, for any such $\psi_P = \psi'_P$, $\lambda = 1$ should be an equilibrium according to step (1) in the proof of Proposition 1, which yields a contradiction with Proposition 2 since $\psi'_P < \psi_P$.

Third, we prove that if W_A weakly increases as ψ_P decreases and $\psi_P \leq \bar{\psi}_P$, then R_M strictly decreases as ψ_P decreases. Note that as ψ_P decreases, Proposition 2 implies that λ strictly increases, where "strictly" follows step (3) in the proof of Proposition 2. Therefore, Proposition 1 implies that R_L strictly decreases as ψ_P decreases. Therefore, since W_A is given by (35), for W_A to weakly increase it must be that R_M strictly decreases.

Fourth, we re-formulate R_H and R_L. Denote the total capital invested by the passive fund in L-firms and H-firms by W_{PL} and W_{PH}, respectively. Then, using this notation, we can re-formulate R_H and R_L as follows.

(a) Re-formulation of R_H: By (3) and $x_{AH} = 0$, we have $R_H = R_0 + \frac{f_P x_P}{c_P}$. Plugging in $x_P = \frac{W_{PH}}{\frac{1}{2} P_H}$ (since there is $\frac{1}{2}$ measure of H-firms) and $P_H = R_H - Z_H$,

$$\begin{aligned} R_H &= R_0 + \frac{f_P}{c_P} \frac{2W_{PH}}{R_H - Z_H} \Leftrightarrow R_H (R_H - Z_H) = R_0 (R_H - Z_H) + \frac{f_P}{c_P} 2W_{PH} \\ &\Leftrightarrow R_H^2 - (R_0 + Z_H) R_H - \left(\frac{f_P}{c_P} 2W_{PH} - R_0 Z_H \right) = 0. \end{aligned}$$

The discriminant of this quadratic equation is given by $D = (R_0 - Z_H)^2 + 8 \frac{f_P}{c_P} W_{PH}$. Since $\sqrt{D} > R_0 - Z_H$, the smaller root for R_H is smaller then Z_H, contradicting with $P_H = R_H - Z_H > 0$. Therefore, R_H is given by the larger root:

$$R_H = \frac{1}{2} (R_0 + Z_H) + \sqrt{\frac{1}{4} (R_0 - Z_H)^2 + 2 \frac{f_P}{c_P} W_{PH}}. \tag{40}$$

Hence,

$$\frac{dR_H}{d\psi_P} = \frac{2}{2R_H - Z_H - R_0} \left(\frac{f_P}{c_P} \frac{dW_{PH}}{d\psi_P} + \frac{1}{c_P} W_{PH} \frac{df_P}{d\psi_P} \right). \tag{41}$$

(b) Re-formulation of R_L: By (3), we have $R_L = R_0 + \frac{f_P x_P}{c_P} + \frac{f_P x_{AL}}{c_A}$. Plugging in $x_P = \frac{W_{PL}}{\frac{1}{2} P_L}$ and $x_{AL} = \frac{W_A}{\frac{1}{2} P_L}$ (since $x_{AH} = 0$ and there is $\frac{1}{2}$ measure of H-firms) and using derivations analogous to part (a) yields

$$R_L = \frac{1}{2} (R_0 + Z_L) + \sqrt{\frac{1}{4} (R_0 - Z_L)^2 + \frac{f_P}{c_P} 2W_{PL} + \frac{f_A}{c_A} 2W_A}. \tag{42}$$

Hence,

$$\frac{dR_L}{d\psi_P} = \frac{2}{2R_L - Z_L - R_0}\left(\frac{f_P}{c_P}\frac{dW_{PL}}{d\psi_P} + \frac{f_A}{c_A}\frac{dW_A}{d\psi_P} + \frac{1}{c_P}W_{PL}\frac{df_P}{d\psi_P} + \frac{1}{c_A}W_A\frac{df_A}{d\psi_P}\right). \tag{43}$$

Fifth, we prove that if W_A strictly decreases as ψ_P decreases, $\psi_P \leq \bar{\psi}_P$, and $Z_L - Z_H > 2e_{AL}$, then $\frac{dR_M}{d\psi_P} > 0$. Note that as noted in the third step above, as ψ_P decreases, λ strictly increases and R_L strictly decreases. Denote the total capital invested by the passive fund in L-firms and H-firms by W_{PL} and W_{PH}, respectively. Then, combining $W_A + W_P = W_A + W_{PL} + W_{PH}$ with $W = W_A + W_P$ (where the latter follows by the arguments in the second step above) yields

$$\frac{dW_A}{d\psi_P} + \frac{dW_{PL}}{d\psi_P} = -\frac{dW_{PH}}{d\psi_P}. \tag{44}$$

(When $\psi_P = \bar{\psi}_P$, we replace all derivatives with left-hand derivatives, i.e., derivatives as $\psi_P \uparrow \bar{\psi}_P$.) Note that $\frac{dW_A}{d\psi_P} > 0$ since we are focusing on the case where W_A strictly decreases as ψ_P decreases. Also note that $\frac{d\lambda}{d\psi_P} < 0$ together with Propositions 1 and 2 imply that $\frac{df_P}{d\psi_P} > 0$ and $\frac{df_A}{d\psi_P} > 0$. There are two scenarios to consider:

(1) Suppose that $\frac{dW_A}{d\psi_P} + \frac{dW_{PL}}{d\psi_P} \leq 0$. Then, (44) implies that $\frac{dW_{PH}}{d\psi_P} \geq 0$. Therefore, $\frac{df_P}{d\psi_P} > 0$ and (41) imply that $\frac{dR_H}{d\psi_P} > 0$, i.e., R_H strictly decreases as ψ_P decreases. Since we have previously established that $\frac{dR_L}{d\psi_P} > 0$, this implies that $\frac{dR_M}{d\psi_P} = \frac{1}{2}\left(\frac{dR_L}{d\psi_P} + \frac{dR_H}{d\psi_P}\right) > 0$.

(2) Suppose that $\frac{dW_A}{d\psi_P} + \frac{dW_{PL}}{d\psi_P} > 0$. Due to (44), this implies that $\frac{dW_{PH}}{d\psi_P} < 0$. Since $\frac{df_P}{d\psi_P} > 0$ and $\frac{df_A}{d\psi_P} > 0$, (41) and (43) imply that to show $\frac{dR_M}{d\psi_P} = \frac{1}{2}\left(\frac{dR_L}{d\psi_P} + \frac{dR_H}{d\psi_P}\right) > 0$, it is sufficient to prove that

$$0 < \frac{1}{2R_H - Z_H - R_0}\frac{f_P}{c_P}\frac{dW_{PH}}{d\psi_P} + \frac{1}{2R_L - Z_L - R_0}\left(\frac{f_P}{c_P}\frac{dW_{PL}}{d\psi_P} + \frac{f_A}{c_A}\frac{dW_A}{d\psi_P}\right). \tag{45}$$

Recall that $\frac{dW_A}{d\psi_P} > 0$. Combining with $c_P \geq c_A$ and $f_P \leq f_A$ (where the latter is by Proposition 1), this implies that to show (45), it is sufficient to show

$$0 < \frac{1}{2R_H - Z_H - R_0}\frac{dW_{PH}}{d\psi_P} + \frac{1}{2R_L - Z_L - R_0}\left(\frac{dW_{PL}}{d\psi_P} + \frac{dW_A}{d\psi_P}\right). \tag{46}$$

In turn, (44) and $\frac{dW_{PH}}{d\psi_P} < 0$ imply that (46) is equivalent to

$$0 < -\frac{1}{2R_H - Z_H - R_0} + \frac{1}{2R_L - Z_L - R_0} \Leftrightarrow 2R_L - Z_L < 2R_H - Z_H \Leftrightarrow 2e_{AL} < Z_L - Z_H,$$

where the equivalence follows from $R_H = R_0 + e_P$ (since $x_{AH} = 0$) and $R_L = R_0 + e_P + e_{AL}$. Since $Z_L - Z_H > 2e_{AL}$ holds by assumption, this concludes the proof of the proposition.

We now show that there exists a cutoff $\underline{\psi}_P$ such that condition $e_{AL} < \frac{1}{2}(Z_L - Z_H)$ is satisfied if $\psi_P < \underline{\psi}_P$. Since $e_{AL} = 2(R_L - R_M)$, this reduces to $\frac{1}{2}(Z_L - Z_H) > 2(R_L - R_M)$.

Plugging in $Z_H = 2Z_M - Z_L$ and R_L and R_M from Proposition 1, this inequality becomes

$$\begin{aligned} Z_L - Z_M &> 2\left(1 + \frac{1-\eta}{\psi_A + (\lambda-1)(1-\eta)}\right) Z_L - 2\left(1 + \frac{1-\eta}{\psi_P + (\lambda-1)(1-\eta)}\right) Z_M \\ &\Leftrightarrow \frac{1 + 2\frac{1-\eta}{\psi_P + (\lambda-1)(1-\eta)}}{1 + 2\frac{1-\eta}{\psi_A + (\lambda-1)(1-\eta)}} > \frac{Z_L}{Z_M}. \end{aligned} \tag{47}$$

Since $\psi_P \leq \psi_A$, the left-hand side decreases in λ. Since $\lambda \leq \lambda_{\max} = \frac{R_0}{R_0 - Z_L} - \psi_A$ by Lemma 6 in the online appendix, it is sufficient to show that (47) holds for $\lambda = \lambda_{\max}$, i.e.,

$$\psi_P < 2\frac{1-\eta}{\frac{Z_L}{Z_M}\left(1 + 2\frac{1-\eta}{\psi_A + (\lambda_{\max}-1)(1-\eta)}\right) - 1} - (\lambda_{\max} - 1)(1-\eta) \Leftrightarrow$$

$$\psi_P < \underline{\psi}_P \equiv 2\frac{1-\eta}{\frac{Z_L}{Z_M}\left(1 + 2\frac{1-\eta}{\psi_A + \left(\frac{R_0}{R_0 - Z_L} - \psi_A - 1\right)(1-\eta)}\right) - 1} - \left(\frac{R_0}{R_0 - Z_L} - \psi_A - 1\right)(1-\eta).$$

(ii) We next prove the comparative statics in $Z_L - Z_H$ keeping Z_M fixed. By Proposition 1, $R_M = (1 + \frac{1-\eta}{\psi_P + (\lambda-1)(1-\eta)}) Z_M$. Recall that by Proposition 2, if (38) is satisfied, then $\lambda = 1$ if $Z_L - Z_H \geq \bar{\Delta}$ and λ strictly decreases in $Z_L - Z_H$ if $Z_L - Z_H < \bar{\Delta}$. Hence, R_M does not depend on $Z_L - Z_H$ in the region $Z_L - Z_H \geq \bar{\Delta}$ (where $\lambda = 1$) and strictly increases in $Z_L - Z_H$ in the region $Z_L - Z_H < \bar{\Delta}$ (where $\lambda > 1$). ■

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