DISCUSSION PAPER SERIES

No. 10438

THE QUALITY-ASSURING ROLE OF MUTUAL FUND ADVISORY FEES

Michel Antoine Habib and D. Bruce Johnsen

FINANCIAL ECONOMICS

Centre for Economic Policy Research

ISSN 0265-8003

THE QUALITY-ASSURING ROLE OF MUTUAL FUND ADVISORY FEES

Michel Antoine Habib and D. Bruce Johnsen

Discussion Paper No. 10438
February 2015
Submitted 12 February 2015

Centre for Economic Policy Research
77 Bastwick Street, London EC1V 3PZ, UK
Tel: (44 20) 7183 8801
www.cepr.org

THE QUALITY-ASSURING ROLE OF MUTUAL FUND ADVISORY FEES†

Abstract

Active fund managers implicitly promise to research profitable portfolio selection. But active management is an experience good subject to moral hazard. Investors cannot tell high from low quality up front and therefore fear manager shirking. We show how the parties mitigate the moral hazard by paying the manager a premium fee sufficiently high that the manager's one-time gain from shirking is less than the capitalized value of the premium stream he earns from maintaining his promise to provide high quality. Premium advisory fees act as a quality-assuring bond. Our model has a number of revealing extensions and comparative statics.

JEL Classification: D23, D86, G23 and L22

Keywords: advisory fees, closet indexing, excessive fees, open-access and quality-assurance

Michel Antoine Habib michel.habib@bf.uzh.ch

University of Zurich, Swiss Finance Institute and CEPR

D. Bruce Johnsen djohnsen@gmu.edu

School of Law, George Mason University

† For helpful comments we thank Laurent Barras, Jonathan Berk, Bruce Kobayashi, Dick Ippolito, Jonathan Klick, Rajnish Mehra, Olivier Scaillet, Thomas Stratmann, and seminar participants at a session honoring Yoram Barzel at the 2012 annual meetings of the International Society for New Institutional Economics and at the First Luxembourg Asset Management Summit for helpful discussions. Bruce Johnsen thanks the Law and Economics Center at George Mason School of Law for financial support.

1 Introduction

Mutual fund industry critics have long claimed the fees active managers charge fund shareholders are excessive.[1] As evidence, they point out that fees have failed to fall over time with the dramatic increase in fund assets, even though there must be scale economies in management.[2] They also note that the fee per dollar of assets retail investors pay is substantially higher than what institutional investors pay, sometimes to the same manager.[3] Despite evidence of robust industry competition—low concentration, prolific entry, and a record of substantial innovation—they argue the industry is immune to competitive forces and that every dollar fund shareholders pay in excessive fees likely comes at the expense of investment returns.

Important work by Berk and Green (2004) and others casts serious doubt on this conclusion. They show that in an efficient market with rational and fully-informed investors management fees are irrelevant because expected fund returns will be driven to the normal rate by entry and exit in the form of investment in-flows or out-flows. While it is a truism in their model that, all else being equal, higher fees reduce shareholder returns dollar-for-dollar, all else is not equal, namely total funds under management.

We go further by showing under plausible assumptions that fund shareholders actually benefit from paying premium fees. We view active management as socially productive but also as an experience good. Even if investors know their

[1] In addition to Vanguard founder John Bogle's frequent public accusations that fund fees are excessive, a number of academic commentators have weighed in on the subject. Perhaps the most critical are Freeman and Brown (2001), who argue that mutual fund advisers treat their managed funds as "cash cows." For a contrary view, see Johnsen (2010).

[2] Irwin Friend, principal investigator for the *Wharton Report*, may have been the first scholar to raise the issue of excessive fund advisory fees. His 1962 study, sponsored by the U.S. Securities and Exchange Commission, observed that industry assets under management had increased dramatically over his study period but that fees had remained steady despite what he asserted to be scale economies in fund management. He concluded that fees were immune from competitive market forces and therefore very likely excessive. His report presaged 1970 amendments to the Investment Company Act (1940) imposing on advisers a "fiduciary duty with respect to the receipt of compensation for services" and providing fund shareholders with the right to sue advisers for up to one year's worth of excessive fees.

[3] See, for example, the debate between Seventh Circuit Court of Appeals judges Frank Easterbrook and Richard Posner in *Jones v. Harris* (reversed on appeal to the U.S Supreme Court). This case centered on the fund adviser's fiduciary duty with respect to the receipt of compensation. Henderson (2009) reports that in the preceding 27 years there had been roughly 150 cases filed against fund advisers for charging excessive fees. None resulted in verdicts for the plaintiff, although some pre-filing settlements aparently involved awards for plaintiffs. He estimates the cost of this litigation to have been in excess of $1.6 billion (at 1041-42).

manager's inherent skill, it takes time for them to determine whether, and to what extent, he has spent effort researching profitable portfolio selection. An opportunistic manager might promise to do research in exchange for a fee that just covers his marginal research costs and then shirk by closet indexing and saving the cost of effort. To the extent shareholders can be fooled in this way the manager stands to earn a one-time surplus at their expense. Knowing this up front, shareholders would refuse to pay the higher fee. A low-quality equilibrium (Ippolito, 1992) would prevail in which no manager does research even though research is socially productive.

The solution for achieving a high-quality equilibrium is to pay the manager a premium fee (Klein and Leffler, 1981; Shapiro, 1983), or efficiency wage (Akerlof and Yellen, 1986), sufficiently in excess of his marginal research cost that the one-time gain from shirking is less than the capitalized value of the premium stream he stands to lose if detected cheating.[4] What has gone unrecognized in the literature on fund fees is that a manager paid a standard 'fixed' percentage fee receives a *recurring* share of total fund assets. Assuming an annual fee of 50 basis points times total portfolio assets, a manager who increases total assets through investment performance by $100 can expect to earn an extra 50 cents this year, 50 cents the next year, and so on, as long as the increase persists. The capitalized value of the manager's marginal share of returns is much higher than 50 basis points; closer to seven percent at plausible real discount rates.[5]

Most important, the manager's wealth share is paid out over time conditional on continuing satisfactory performance. If disappointed, either the fund's board can terminate the advisory contract or fund shareholders can withdraw assets, causing the manager to lose some or all of the capitalized value of the premium stream. This threat provides the manager with high-powered incentives to deliver on his quality promise. Because his compensation for performance in any period is paid out over time, possibly in perpetuity, the per period fee can be much lower than a one-time 'incentive' fee based on a published market benchmark.

We begin our analysis in Section 3 by reproducing the basic fee irrelevance

[4] Brown and Davies (2014) independently consider the same problem as we do. Our solutions differ: they consider the role of performance fees in making possible separating equilibria in which low quality managers shirk but medium and high quality managers do not; we consider the role of management fees in deterring shirking by all managers.

[5] This marginal effect assumes no further fund inflows and therefore understates the manager's full compensation.

result from Berk and Green (2004). An intuitively appealing way to understand their result is to focus on exactly what fund shareholders own. Mutual funds stand ready to issue and redeem shares daily at net asset value (total portfolio assets per share net of daily fees and other expenses). Because they share net assets in common, however, fund shareholders earn the average return on manager effort rather than the marginal return. Investor crowding dilutes returns, in essence generating a negative externality for existing shareholders.

From a property rights perspective, a mutual fund is an open-access commons subject to unrestricted entry and exit save for the small periodic management fee shareholders pay.[6] While it is true they own their proportionate share of net asset value (NAV) at any given moment, they have no exclusive claim to any unrealized excess performance their manager might generate. With investment research subject to diminishing marginal product, any expectation the manager will outperform (underperform) the market in the future will be met with fund inflows (outflows) until shareholder returns are normalized.

Given two identical funds whose managers have equal skill and exert equal effort but charge different fees, under plausible conditions the fund with the lower fee will simply have more assets under management than the fund with the higher fee. The fund manager owns his human capital, and, owing to competition between investors as suppliers of financial capital, he captures any Ricardian rents in total fees on a larger asset base.

One complication under open access is that total assets invested might exceed what the manager can profitably invest through active management. If so, some amount of indexing is efficient. We distinguish between active and closet indexing. With active indexing, the manager incurs costly research effort to determine, in part, the extent to which active stock selection is likely to generate returns in excess of the index. With closet indexing the manager simply indexes the entire portfolio, nevertheless collecting a high fee while forgoing the research effort that could generate excess returns.

We show that with active indexing the management fee is irrelevant to both value created and total manager compensation as long as the fee is low enough to ensure that the fund receives the amount of assets the manager can profitably

[6] In open-end mutual funds the paid in capital stock can expand and contract with ongoing issuance and redemption. In contrast, a closed-end fund's paid-in capital stock is fixed at issuance. Investors in closed-end funds can increase or decrease their holdings only by buying or selling shares in the market.

invest actively. Lower fees increase assets just enough to leave the manager's total compensation unchanged. Since these added assets are indexed they do not cause a reduction in the return to active assets and there is no externality from investor crowding.[7]

In Section 4 we depart from the Berk and Green assumption that investors are fully informed. We define manager skill as the contribution to fund performance investors are able to assess ex ante, possibly based on past performance, with effort being the contribution they can assess only ex post. We derive the minimum fee sufficient to assure quality, with shareholders then earning the normal return for which they bargain rather than sub-index returns (index returns minus fees). We note that a given manager might charge a higher fee as long as it is low enough to ensure the fund receives the amount of assets he can profitably invest actively. Our assumption, however, is that managers are empire builders and will therefore choose the quality-assuring fee that maximizes fund assets.[8] Ours is an equilibrium of rationally ignorant investors in which information asymmetry is endogenous and socially efficient because, implicit in our model, it allows the parties to avoid costly information duplication (Hirshleifer, 1971; Barzel, 1977).

In Section 5 we generate comparative statics to show that the level of actively managed assets falls as the cost of research effort per actively-managed dollar rises, but that the net effect of research costs on the management fee is ambiguous. The effect of research costs on total assets and active share (defined as the ratio of actively managed assets to total assets (Cremers and Petajisto, 2009)) is also ambiguous. In accord with the empirical evidence, funds charging a higher fee should have higher expected pre-fee returns (Elton and Gruber, 2011; Malkiel, 1995; Carhart, 1997; Wermers, 2000), all else equal. Actively managed assets increase in manager skill, while the effect of skill on the fee, to-

[7] If the manager were required to actively invest all assets, the optimal fee – and the fee that maximizes the manager's profit – would be the one that internalizes the externality from entry. This is exactly the result Frank Knight (1924) identified in his response to A.C. Pigou's analysis of overcrowding by travelers on two roads.

[8] Various institutional constraints suggest managers will prefer lower fees and a larger asset base. One is that the Investment Company Act (1940) imposes diversification and fragmentation rules on 75 percent of the portfolio that limit managers' ability to actively manage that portion. All else being equal, this will lead managers who want to exhaust their profit opportunities to prefer a larger asset base. Another is that if managers execute securities trades on behalf of the fund only when they are informed by active research the trades will suffer from adverse price impact. Holding additional assets that are indexed but need occasional trading to rebalance or fund redemptions allows the manager to obscure his informed trades and limit price impact.

tal assets, and active share is ambiguous. In accord with Petajisto (2013), our model predicts that active share and the fee per dollar of assets are positively related.

In Section 6 we extend the model to identify the circumstances under which investors find it in their interest to subsidize the manager's costly research effort. The often maligned practice of soft dollar brokerage, in which brokers who execute portfolio trades for the fund provide the manager with research bundled into brokerage commissions (paid by the fund), appears to be an ideal subsidy as long as research use is verifiable ex post. We identify several legal and regulatory constraints that seem to ensure this condition.

We also introduce monitoring costs and show that the minimum fee increases and total assets decrease as shareholders' difficulty detecting shirking increases. This explains why institutional investors pay a lower fee than retail investors, even to the same manager. Being better able and better motivated to detect shirking, institutional investors have no need to pay a premium fee for quality assurance.[9] Among other things, our results are consistent with the observation that fees on bond funds are lower than fees on equity funds owing to the lower noise in bond fund returns and the greater ease investors have detecting manager shirking. We note that investors in closed-end funds, who are unable to withdraw their capital if dissatisfied, have greater difficulty punishing a shirking manager than mutual fund investors. Our analysis predicts that to deter shirking closed end fund managers must charge higher fees, as (Deli, 2002) and others have shown.

The picture that emerges is one in which the mutual fund form of organization provides managers with high-powered incentives to perform research and retail investors with state-of-the art returns given the informational problems they face. Closed-end funds, an historically close substitute for mutual funds, stand as a closed-access form of managed portfolio, and yet closed-end funds routinely exhibit their own drawback in the form of large share price discounts from NAV. Neither form of organization can be expected to achieve first-best in a world subject to frictions.

Aside from explaining why active fees might appear to be excessive when in fact they are not, our analysis provides powerful insight into the legal and

[9] In our model, of course, those who manage index funds have little need to bond their performance.

regulatory policy governing mutual funds. This is especially timely with total U.S. mutual fund assets exceeding $13 trillion dollars as of this writing (ICI Factbook, 2013)) and Dodd-Frank (2010) regulatory reforms in the works.

2 Literature review

Our analysis implicates various economic subfields, including the economics of property rights, efficient markets, principal-agent relations, and share contracting. The early property rights literature viewed open access as an inefficient form of organization akin to the complete absence of ownership (Demsetz, 1967). Compared to the viable alternatives, however, Lueck (1995) shows that in a world subject to frictions open access can be efficient. Open access does not describe the complete absence of ownership, it simply describes the moment at which ownership vests and to what. Those who race to catch salmon on the open sea own their catch, but they have no exclusive claim to the underlying capital stock that generates successive runs. Similarly, mutual fund investors own their share of the portfolio value at any given moment, but they have no exclusive claim to the underlying capital stock—the manager's skill—that generates yet-to-be realized excess returns. In both cases crowding occurs.

There is a large and fast-growing literature on actively managed funds. Elton and Gruber (2011) provide an excellent review. One of the most longstanding controversies in the literature is whether active fund managers have skill that allows them to outperform a market portfolio net of fees. Empirical work starting with Jensen (1968) suggests they cannot, and that on average active funds actually underperform the market. Jensen concluded that active managers lack skill and that the higher fees investors pay them very likely lead to below-market NAV returns.[10]

Wermers (2000) shows that fund returns based on NAV must be distinguished from the returns the fund manager earns on his actual stock picks before subtracting fees and other expenses. He showed that a large subset of active managers is able to outperform a popular S&P 500 index fund. Only after deducting fees, expenses, and certain transaction costs do their holdings-based returns fall short of the market. He nevertheless finds that a small fraction of

[10] For evidence of persistent net-of-fee underperformance, see for example Malkiel (1995), Carhart (1997), Wermers (2000), Pástor and Stambaugh (2002), Fama and French (2010), and Del Guercio and Reuter (2014).

the managers of the most actively traded large-cap funds is able to persistently outperform a popular index fund on a net basis.

Barras, Scaillet, and Wermers (2010) introduce a new method of accounting for false discoveries in mutual fund NAV returns, and they find evidence of persistent manager skill. They estimate that about 10% of managers add value in the sense of delivering positive pre-expense NAV alphas, but of course the bulk of such value accrues to managers, with only 0.6% of managers delivering positive after-expense alphas over the recent past; 75.4% of fund managers deliver zero after-expense alphas and 24% negative alphas.

More recently, Berk and Van Binsbergen (2012) find that the average mutual fund manager adds about $2 million per year to portfolio value, and that the skill that makes such value-creation possible persists over time. Kacperczyk, Van Nieuwerburgh, and Veldkamp (2014) also provide convincing empirical evidence of active manager skill. They find that during economy-wide booms a subset of all active managers tend to add value by stock picking, while during downturns the same managers add value by general market timing.

Based on a sample of over 4,800 advisory contracts, Deli (2002) found that managers' marginal compensation is driven by hypothesized differences in adviser marginal product (skill plus effort) and the difficulty investors have monitoring performance across funds with different characteristics. For example, high turnover funds and funds with high underlying volatility owing to investment style—both of which impose greater monitoring costs on investors—had higher marginal adviser compensation. These results are consistent with manager skill and our hypothesis that fund fees mitigate agency conflicts with fund shareholders.

Following empirical work showing that top performing active funds experience substantial fund inflows (Ippolito 1992; Gruber 1996; Chevalier and Ellison 1997; Sirri and Tufano 1998), Berk and Green (2004) explain why, even if active managers have stock picking skill, fund returns will nevertheless be driven to the normal rate by entry.[11] They fail to explain continued findings, however,

[11] Fund shareholders likewise react to signals of poor quality, sometimes dramatically. For example, Choi and Kahan (2007) looked at fund shareholders' response to 2003 public allegations by New York Attorney General Eliot Spitzer that their managers had engaged in civil and criminal wrongdoing by allowing stale-price arbitrage. They found that in response to these allegations, investment outflows were economically large and statistically significant. What is more, the more serious the allegations (criminal as opposed to merely civil), the greater the percentage outflow.

that active manager performance, net of fees, falls short of the market and even short of actual index funds that pay management fees and incur trading costs. With total fund fees endogenous to investor expectations, the question is why the shareholders of many funds are willing to accept returns that fall short of what appears to be their next best alternative investment.

Glode (2011) shows that if the pricing kernel is subject to measurement error that correlates positively with the returns to active management, alphas will be negatively biased: underperformance will appear where there is in fact none.[12] Citing evidence that active funds tend to underperform the market during economy-wide booms but outperform during recessions, he shows that the error in the pricing kernel leads to an underestimation of the value of the insurance provided by active management in recessions. This underestimation creates the appearance of underperformance.

Pástor and Stambaugh (2012) show that active managers' persistent observed underperformance is not necessarily inconsistent with investor rationality. In their model, investors' ability to shift assets between active and passive funds dramatically increases the noise in NAV returns. As a greater share of fund assets moves to index funds, fewer active assets share the finite number of profitable stock picks, causing active returns to increase, all else being equal. If investors update their priors regarding the returns to active management slowly, given their priors consistent with past active holdings their posteriors on active management can correctly remain (weakly) positive despite the years of underperformance.

We are agnostic on what inferences can be drawn from persistent negative alphas relative to index funds.[13] Absent certainty that every possible influence on investor choice has been identified, it is impossible to conclude unequivocally that active and index funds should be subject to the law of one price. The point of our analysis is that, absent advisory contracts that reward active managers for current effort by paying back-end-loaded fees conditional on good performance, NAV returns would be even more negative than they appear to be.

[12] The pricing kernel specifies the value investors attach to returns in each possible state of the world; that value is higher, the more recessionary is the state.

[13] Stambaugh (2014) shows that the scope for active management to create value depends on individual investors' stock market participation: the lower is that participation, the lower is the value of active management.

3 The irrelevance of fees

This section sets the stage for our analysis by rederiving the Berk and Green (2004) irrelevance results in the context of our simplified model. To focus on the manager's moral hazard, we diverge from Berk and Green in assuming neither stochastic returns nor asymmetric information.

3.1 The basic model

Let the normal rate of return available to all investors through the market index be r, with \$1 invested in the index growing to $\$\,(1+r)$ after one period. Consider a skilled manager who can beat the index through active management. Shares in the fund are priced at one dollar per share, so that total invested assets, T, also equal the number of outstanding shares, as in a money market fund. Let the manager actively manage A assets at an end-of-period cost, C, per share and index what remains, $T-A$.[14] Curve R in Figure 1 shows the gross return to active management, essentially the manager's production function under the assumption that he must actively manage all assets. It assumes $R(0)-C>r$, $R'(.)<0$, $R''(.)>0$, and $lim_{A\to\infty}R(A)=0$. Returns per actively managed dollar decrease in actively managed assets ($R'(.)<0$), but the decrease is attenuated as more assets are actively managed ($R''(.)>0$).[15]

With the manager able to generate returns that beat the index, rational investors recognize that assets invested will grow to $(1+R(A))\,A+(1+r)\,(T-A))$ by the end of the period. The manager charges a fee as a share of total assets equal to f per year, and his net payoff is $f\left[(1+R(A))\,A+(1+r)\,(T-A)\right]-CA$. Shareholders receive a net payout of

$$(1-f)\left[(1+R(A))\,A+(1+r)\,(T-A)\right].$$

Assets invested with the manager grow to equalize net-of-fee returns in the fund with returns on the index

$$(1-f)\left[(1+R(A))\,A+(1+r)\,(T-A)\right]=(1+r)\,T. \tag{1}$$

The fee investors pay clearly does not matter for NAV returns. A lower or higher fee combines with lower or higher gross returns, respectively, to equate

[14] We assume for the time being that the manager can if necessary borrow to invest by selling short the index, so that $T-A\lesseqgtr 0$.

[15] Note that the contrary assumption, $R''(.)<0$, would conflict with $lim_{A\to\infty}R(A)=0$.

the NAV return with $1 + r$. The open-access nature of mutual funds ensures returns are driven down to the normal rate in any event.

The level of actively managed assets that maximizes the combined payoff to shareholders and the manager is A^{opt} in Figure 1, where the marginal benefit of active management, $R\left(A^{opt}\right) + A^{opt}R'\left(A^{opt}\right)$, equals the marginal cost, $r + C$. Formally,[16]

$$R(A^{opt}) + A^{opt}R'(A^{opt}) = r + C. \tag{2}$$

The term $A^{opt}R'(A^{opt}) < 0$ represents the negative externality shareholders entering at A^{opt} impose on existing shareholders, diluting NAV returns in the process. It is this dilution that drives shareholder after-fee returns to the normal rate, r, regardless of the level of the fee.[17] With the manager indexing the funds $T - A^{opt}$ in excess of A^{opt}, the marginal before-fee return on assets is the discontinuous bold line $R + AR'$ up to A^{opt} in Figure 1 and r thereafter. Owing to open access, investors will drive the corresponding average net-of-fee return, $\left[A^{opt}R\left(A^{opt}\right)(1-f) + (T - A^{opt})r(1-f)\right]/T$, down to its equlibrium value of $r + f$.[18] We show in Section 3.2 below that the manager will invariably choose A^{opt} actively managed assets for any strictly positive fee $0 < f \leqslant 1$.

3.2 Fee irrelevance

Consider the manager's problem, which is to maximize his own net-of-cost compensation conditional on investors earning only a normal return:

$$\max_{f,A,T} f\left[(1 + R(A))A + (1+r)(T - A)\right] - CA \tag{3}$$

[16] Equation (2) is obtained by noting that

$$\begin{aligned} A^{opt} &\equiv \arg\max_{A} \begin{array}{l} (1-f)\left[(1+R(A))A + (1+r)(T-A)\right] \\ +f\left[(1+R(A))A + (1+r)(T-A)\right] - CA \end{array} \\ &= \arg\max_{A}\left(R(A) - r\right)A + (1+r)T - CA \\ &= \arg\max_{A}\left(R(A) - r - C\right)A. \end{aligned}$$

[17] In the admittedly unrealistic case in which the manager actively manages all assets but charges a zero fee, shareholders will invest A^{nf} in Figure 1.

[18] The condition

$$\frac{A^{opt}R\left(A^{opt}\right)(1-f) + (T - A^{opt})r(1-f)}{T} = r + f$$

is identical to Condition (1) with $A = A^{opt}$; no funds beyond T in the preceding condition will be invested with the manager in equlibrium.

subject to

$$(1-f)\left[(1+R(A))\,A+(1+r)\,(T-A)\right]=(1+r)\,T. \tag{4}$$

We show

Proposition 1 *(Berk and Green, 2004) The fee the manager sets affects neither his compensation nor the level of actively managed assets, which equal A^{opt}.*

The intuition is straightforward. Because investors drive their return down to the normal rate available through the index, the manager receives the entire value he creates by beating the index. It is therefore in his own interest to maximize that value. He does so by choosing the optimal level of actively managed assets A^{opt}. By way of example, consider the admittedly extreme case where $f=1$. Clearly, no assets will be invested with the manager. Yet, he can reap profit $(R(A)-r-C)\,A$ by shorting the index at a cost, r per dollar, in the amount A. He can maximize that value only by choosing $A=A^{opt}$.

Proposition 1 begs the obvious question of what determines the optimal fee. We answer and elaborate on this question in the remainder of the paper. Before doing so, we establish three brief corollaries of Proposition 1.

Corollary 1 *The option for the manager to invest in the index is essential to Proposition 1.*

When the manager is denied the option to invest in the index and must actively manage all assets, that is $T=A$, investors equating average net-of-fee returns from the fund, $(1-f)\,(1+R(A))$, with the return on the index, $1+r$, implies that for a sufficiently low fee the level of assets A exceeds A^{opt}, the level at which the marginal return on the fund, $1+R(A)+AR'(A)-C$, equals the return on the index. There is therefore the need for an optimal level of fees, that at which the average net-of-fee returns which investors equate with the return in the index is also equated to the marginal return.[19] Put slightly differently, when the manager cannot undo the negative externality generated by investor inflows beyond the optimal level A^{opt} by investing in the index, there is the need for an optimal level of fees that makes investors internalize this externality.

[19] Formally, f must be such that

$$(1-f)\left(1+R(A^{opt})\right)=1+r=1+R(A^{opt})+A^{opt}R'(A^{opt})-C.$$

Corollary 2 *A limit to fund inflows increases investor returns above the return on the index and decreases manager returns.*

A limit to inflows prevent investors from driving returns down to the normal rate available through the index. They therefore receive part of the value created by the manager, whose profit is correspondingly reduced.

Corollary 3 *The joint requirement that fees be set at their break-even level and that the manager actively manage all assets decreases manager returns and leaves investor returns unchanged.*

A break-even fee compensates the manager for the costs he incurs but does not account for the negative externality associated with an increase in actively managed assets. Shareholders consequently overinvest in the fund, thereby decreasing the value created by the manager and denying him the option to undo the negative externality by investing in the index.

4 Moral hazard and quality-assuring fees

The preceding analysis fails to consider manager shirking in the form of closet indexing, in which the manager charges a fee for active management but invests the entire amount, T, in the index. Absent reputational concerns, this allows him to avoid the cost of active management, CA^{opt}. He might be tempted to shirk where the fee he earns on excess returns is less than the per dollar cost of active management:

$$f\,(1+r)\,T > f\left[\left(1+R(A^{opt})\right)A^{opt} + (1+r)\left(T - A^{opt}\right)\right] - CA^{opt}$$

$$\Leftrightarrow f\left(R(A^{opt}) - r\right) < C.$$

Shirking can be precluded if $f \geqslant C/\left(R(A^{opt}) - r\right)$. That the minimum fee, $C/\left(R(A^{opt}) - r\right)$, may generate sub-optimal inflows into the fund ($T < A^{opt}$) need not be a problem where the manager can short the index by the missing amount, $A^{opt} - T$. In the presence of short-selling constraints, however, it is no longer true that total invested assets, T, can be supplemented by shorting the index. In what follows we assume the manager cannot short sell the index. Lowering fees to at least the level that induces investment of A^{opt} becomes essential for him to reap the full value of his human capital.

4.1 Reputation and 'back-end loading'

Managerial reputation provides one mechanism to ensure the manager makes the optimal investment in research. Following the literature on quality assurance (Klein and Leffler, 1981; Shapiro, 1983) and on-the-job performance (Akerlof and Yellen, 1986), we define one period as the time it takes shareholders to observe manager performance. A manager who shirks by closet indexing would be denied all funding after the period ends. Because of the manager's poor reputation, investors will refuse to pay him anything for indexing because they can index on their own. A shirking manager would therefore be unable to capture the value of his human capital. The 'no shirking' condition in the presence of reputational concerns becomes

$$\frac{f\left[\left(1+R(A^{opt})\right)A^{opt}+(1+r)\left(T-A^{opt}\right)\right]-CA^{opt}}{r} \geqslant \frac{f\,(1+r)\,T}{1+r}, \tag{5}$$

where total assets invested with the manager, T, are the solution to

$$(1-f)\left[\left(1+R(A^{opt})\right)A^{opt}+(1+r)\left(T-A^{opt}\right)\right]=(1+r)\,T.$$

Assume for the time being the fee is such that $T \geqslant A^{opt}$. Condition (5) can be rewritten as

$$\begin{aligned} & f\,(1+r)\,T - f\left[\left(1+R(A^{opt})\right)A^{opt}+(1+r)\left(T-A^{opt}\right)\right]+CA^{opt} \\ & \leqslant \frac{f\left[\left(1+R(A^{opt})\right)A^{opt}+(1+r)\left(T-A^{opt}\right)\right]-CA^{opt}}{r} \end{aligned} \tag{6}$$

This inequality states that the one-period gain from shirking is lower than the capitalized value of future compensation from active management. We now have

Proposition 2 *The minimum fee necessary to preclude shirking in the presence of reputational concerns is*

$$f^r \equiv \frac{1}{r}\left[C\left(\frac{1+r}{R(A^{opt})-r}\right)-1\right]. \tag{7}$$

Expanding f^r into $C/\left(R(A^{opt})-r\right)-\left[1-C/\left(R(A^{opt})-r\right)\right]/r$, we observe that managerial reputation decreases the minimum level of fees by $\left[1-C/\left(R(A^{opt})-r\right)\right]/r$, from the level $C/\left(R(A^{opt})-r\right)$ necessary if there were no reputational constraints. To interpret f^r, it is helpful to rewrite (7) as

$$f^r\left(R(A^{opt})-r\right)A^{opt}=CA^{opt}-\frac{\left(R(A^{opt})-r-C\right)A^{opt}}{r}. \tag{8}$$

The term $(R(A^{opt}) - r - C)\, A^{opt}$ is the per period value of the manager's research effort. The capitalized value to the manager of remaining in the relationship is therefore $(R(A^{opt}) - r - C)\, A^{opt}/r$. He forgoes this capitalized value if he shirks because it is promised as a stream of back-end loaded compensation conditional on no shirking.[20]

5 Comparative statics

We now derive the comparative statics of the costs of active management, C, on total assets actively managed, A, total assets under management, T, the fee, f, and active share, A/T. We also extend the model to account for differences in manager skill. We assume throughout that managers are 'empire builders.' All else being equal, they prefer more assets under management to less. They therefore choose the lowest fees consistent with no shirking, that is, $f = f^r$.

5.1 Costs of active management

As before the manager solves

$$\max_{f,A,T} f\left[(1 + R(A))\, A + (1 + r)\,(T - A)\right] - CA$$

subject to

$$(1 - f)\left[(1 + R(A))\, A + (1 + r)\,(T - A)\right] = (1 + r)\, T$$

and

$$(1 + rf)\,(R(A) - r) - (1 + r)\, C = 0.$$

The equilibrium is defined by[21]

$$(1 + rf)\,(R(A) - r) - (1 + r)\, C = 0, \tag{9}$$

$$R(A) - r + AR'(A) - C = 0, \tag{10}$$

[20] In Klein and Leffler (1981), premium product prices are all it takes to assure quality. To achieve a zero-profit equilibrium, they assume the seller posts an up front bond in the form of nonsalvageable capital equal to the present value of premium prices. In our model, the manager devotes his human capital to the fund, and it is the opportunity cost of this capital that zeroes out profits. Note that a manager who outperform in early periods is locked in to trailing fees absent the ability to sell the right to manage the fund for a lump sum.

[21] Denoting λ and μ the Lagrange multipliers associated with the two constraints, respectively, we have $\lambda = 1$ and $\mu = 0$.

and

$$(1-f)\,(R(A)-r)\,A - f\,(1+r)\,T = 0, \tag{11}$$

with f, A, and T the endogenous variables.[22] We wish to examine how these vary in costs, C. We have

Proposition 3 *Assets under active management decrease in costs ($\partial A/\partial C < 0$). A necessary and sufficient condition for fees to increase in costs ($df/dC > 0$) is*

$$-\,(1+rf)\,R'(A) + (1+r)\,(2R'(A) + AR''(A)) < 0. \tag{12}$$

The condition is also sufficient for total assets under management and for active share to decrease in costs ($\partial T/\partial C$ and $\partial\,[A/T]\,/\partial C$).

That assets under active management decrease in the costs of active management is to be expected. That the fee does not necessarily increase in costs is perhaps unexpected. There is both a direct effect and, by way of assets under management, an indirect effect of costs on the fee. The direct effect increases the fee, while the indirect effect decreases the fee by decreasing actively managed assets and thereby increasing the per dollar return. The larger the per dollar return, the more the manager stands to lose from shirking and therefore the less he needs to bond his performance through a premium fee. Intuitively, Condition (12) states that the marginal return, $R'\,(.)$, on actively managed assets must not be so large in magnitude as to make the indirect, negative effect of an increase in C on A offset the direct, positive effect in the expression for f.[23]

Unlike the case for fees, Condition (12) is sufficient but not necessary for total assets under management. It is possible for total assets to decrease ($\partial T/\partial C < 0$) even as the fees declines ($\partial f/\partial C < 0$).[24] This occurs where the decrease in actively managed assets, A, due to the increase in costs, C, dominates any increase in passively managed assets, $T - A$, possibly due to the fee reduction.

[22] The solutions for A and f are A^{opt} and f^r in (2) and (7), respectively. We drop the superscripts to simplify the notation.

[23] Formally, Condition (12) can be shown to be necessary and sufficient for $\partial f/\partial C + \partial f/\partial A \times \partial A/\partial C > 0$.

[24] To see this, totally differentiate (11) with respect to C to obtain

$$f\,(1+r)\,\frac{\partial T}{\partial C} = -\left[(R(A)-r)\,A + (1+r)\,T\right]\frac{\partial f}{\partial C} + (1-f)\left[AR'(A) + R(A) - r\right]\frac{\partial A}{\partial C}. \tag{13}$$

The intuition for the result on active share, A/T, can best be understood by using (11) to write

$$\frac{A}{T} = \left[\frac{1-f}{f}\left(R(A)-r\right)\right]^{-1}(1+r)\,. \tag{14}$$

Active management generates the abnormal return that compensates investors for paying the fee. Where the fee decreases in costs there is less need for active management and A/T declines. This is all the more so because the per-dollar return, $R\,(A)$, increases owing to the reduction in actively managed assets. Where, in contrast, the fee increases in costs it may be that the increase in active per-dollar return, $R\,(A)$, fails to cover the increased fee. A higher fraction of assets must be managed actively in such a case and active share must rise.

We now consider gross returns on total assets under management and on assets under active management. The former are[25]

$$\begin{aligned} 1 + R_{G,T} &\equiv \frac{\left(R(A)-r\right)A + (1+r)\,T}{T} \\ &= \left(\frac{f}{1-f}+1\right)(1+r)\,. \end{aligned} \tag{15}$$

Note that $sgn\left\{\partial R_{G,T}/\partial C\right\} = sgn\left\{\partial f/\partial C\right\}$. Owing to open access, net returns on total assets under management equal r, and investors therefore must be compensated for the payment of a higher fee through higher gross returns. Alternatively, as abnormal returns accrue to the manager, his compensation rises through higher fees. This is simply the well-established result that high-fee funds generally deliver higher gross returns. In our model, of course, net returns equal index returns by construction.

The gross returns on assets under active management are

$$1 + R_{G,A} \equiv \frac{\left(1+R(A)\right)A}{A} = 1 + R(A). \tag{16}$$

Differentiating with respect to C, we obtain

$$\frac{\partial R_{G,A}}{\partial C} = R'(A)\frac{\partial A}{\partial C} > 0.$$

Where the costs of active management are higher and fewer assets are managed actively the assumption of decreasing marginal returns on actively managed assets implies that the per-actively-managed-dollar gross return increases.

[25] The equality is obtained by using (11) to replace T by $(1-f)\left(R(A)-r\right)A/\left[f\,(1+r)\right]$.

5.2 Manager skill

We have thus far assumed that all fund managers are identical. Yet, as Chevalier and Ellison (1999), Berk and Green (2004), and others have noted, there is likely a wide distribution of manager skill. Some managers are able to generate a higher return than others for given C. In this section we analyze how actively managed assets, A, total assets under management, T, fees, f, and active share, A/T, vary with manager skill.

Let θ index managerial skill and write per dollar return on active management as $R(A, \theta)$. We assume $\partial R(., \theta)/\partial\theta > 0$, $\partial R'(., \theta)/\partial\theta > 0$, and $\partial R''(., \theta)/\partial\theta > 0$. The first inequality indicates that higher skill managers generate a higher return, while the second indicates that higher skill managers attenuate more the decrease in return that results from an increase in invested assets, $(R'(., \theta) < 0)$. The third indicates that the attenuation of the decrease in return due the increase in assets $(R''(., \theta) > 0)$ is faster for higher skill managers.

The System of Equations (9)-(11) that defines equilibrium remains valid, with return on active management now including the additional argument θ. We have

Proposition 4 *Assets under active management increase in manager skill ($\partial A/\partial\theta > 0$). A necessary and sufficient condition for the fee and active share to decrease in skill ($\partial f/\partial\theta < 0$ and $\partial[A/T]/\partial\theta < 0$) is*

$$R'(A, \theta)\left(\frac{\partial R(A, \theta)}{\partial\theta} + A\frac{\partial R'(A, \theta)}{\partial\theta}\right) - (2R'(A, \theta) + AR''(A, \theta))\frac{\partial R(A, \theta)}{\partial\theta} > 0. \tag{17}$$

The condition is also sufficient for total assets under management to increase in manager skill ($\partial T/\partial\theta > 0$).

That higher skill managers should actively manage more assets is to be expected. The intuition for the other results is as follows. Condition (17) is equivalent to[26]

$$\frac{dR(A, \theta)}{d\theta} = \frac{\partial R(A, \theta)}{\partial\theta} + R'(A, \theta)\frac{\partial A}{\partial\theta} > 0.$$

For a given level of costs, $R(A, \theta)$ determines the manager's active per-dollar return. The higher that return, the more the manager stands to lose from

[26] Similarly to Condition (12), Condition (17) is equivalent to $\partial f^b/\partial\theta + \partial f^b/\partial A \times \partial A/\partial\theta < 0$.

shirking and the lower the fee necessary to deter him from shirking. The manager's active per-share return naturally increases in skill, θ ($\partial R(A,\theta)/\partial\theta > 0$). There is, however, an offsetting effect because actively managed assets also increase in skill ($\partial A/\partial\theta > 0$). This decreases active per-dollar return ($R'(.,\theta) < 0$), all else being equal. The former effect is direct, the latter indirect through actively managed assets. Whether active per-dollar return increases or decreases in skill and therefore whether the fee decreases or increases in skill, respectively, depends on which effect dominates.

Somewhat symmetrically to $\partial f/\partial C < 0$ and $\partial T/\partial C < 0$, it is possible that $\partial T/\partial\theta > 0$ even as $\partial f/\partial\theta > 0$. That is, high-skill managers may both earn a higher fee and have more total assets under management than their low-skill counterparts.[27] The intuition is similar to that for C. Higher quality managers have more actively managed assets, A; the increase in these assets may be so large as to dominate any decrease in passively managed assets, $T - A$, possibly due to the increase in fees, f.

To understand the intuition for the result $sgn\{\partial[A/T]/\partial\theta\} = sgn\{\partial f/\partial\theta\} = -sgn\{dR(A,\theta)/d\theta\}$, recall (14)

$$\frac{A}{T} = \left[\frac{1-f}{f}\left(R(A,\theta) - r\right)\right]^{-1}(1+r).$$

Essentially, this states that active share is inversely proportional to active per-dollar return (recall that the fee itself is inversely proportional to active per-dollar return). Active share makes possible the abnormal return that compensates investors for paying the fee. Because the fee is inversely related to active per-dollar return, managers that have lower active per-dollar return charge a higher fee, which requires them to have higher active share. This accords with Petajisto's (2013) finding that high-fee funds also have higher active share.

We now consider gross returns on total assets under management, T, and assets under active management, A. By analogy to Equations (15) and (16), these are

$$1 + R_{G,T} = \left(\frac{f}{1-f} + 1\right)(1+r)$$

[27] This can easily be seen by totally differentiating (11) with respect to θ to obtain

$$f(1+r)\frac{\partial T}{\partial\theta} = -\left[\left(R(A,\theta) - r\right)A + (1+r)T\right]\frac{\partial f}{\partial\theta} + (1-f)\left[AR'(A,\theta) + R(A,\theta) - r\right]\frac{\partial A}{\partial\theta} + (1-f)\frac{\partial R(A,\theta)}{\partial\theta}A.$$

Note the term $(1-f)A\partial R(A,\theta)/\partial\theta$, which has no counterpart in the corresponding equation (13) for C; this term represents the direct effect of managerial quality on the equilibrium condition for total funds under management.

and

$$1 + R_{G,A} \equiv \frac{(1 + R(A,\theta))\, A}{A} = 1 + R(A,\theta).$$

As for C and for the same reason, we have $sgn\,\{\partial R_{G,T}/\partial\theta\} = sgn\,\{\partial f/\partial\theta\}$. Regarding $R_{G,A}$, it follows immediately that the condition (17) that determines the sign of $dR(A,\theta)/d\theta$—as well as those of $\partial f/\partial\theta$ and $\partial\,[A/T]\,/\partial\theta$—also determines the sign $\partial R_{G,A}/\partial\theta$. Specifically,

$$\begin{aligned} sgn\,\{\partial R_{G,A}/\partial\theta\} &= sgn\,\{dR(A,\theta)/d\theta\} \\ &= (= -sgn\,\{\partial f/\partial\theta\} = -sgn\,\{\partial\,[A/T]\,/\partial\theta\} = -sgn\,\{\partial R_{G,T}/\partial\theta\})\,. \end{aligned}$$

Gross returns on assets under active management vary in manager skill in step with active per-dollar returns: gross returns on assets under active management are higher where active returns are higher and lower where active returns are lower.

6 Extensions and evidence

6.1 Subsidies and soft dollars

We now depart from the preceding analysis in that we assume that reputation effects fail to lower fees and to raise assets to the level the manager can profitably manage actively; that is, we assume $T < A^{opt}$ at f^r in (7). We argue in the present section that soft dollars can be viewed as a form of research subsidy which, by reducing the cost the manager incurs for active management, decreases his gain from shirking and thereby decreases the minimum fee to the point at which $T = A = A^{opt}$.[28]

Soft dollars brokerages bundle the cost of research into the brokerage commission the portfolio pays for securities trades. More research brings more trading and vice-versa.[29] Formally, let a broker offer the manager research subsidies SA in return for a brokerage fee premium of the same amount. The manager's payoff is then

$$f\,(1 + R(A) - S)\,A - (C - S)\,A \tag{18}$$

[28] Note there are no passively managed assets because the purpose of the subsidy is to raise actively managed assets to the optimal level A^{opt}.

[29] Horan and Johnsen (2008) examine the role soft dollars play in subsidizing research while assuring the quality of the broker's execution.

Investors' payoff remains unchanged at $(1 + r)\, A$ because of open access

$$(1 - f)\,(1 + R(A) - S)\, A = (1 + r)\, A \tag{19}$$

We show

Proposition 5 *The soft dollar subsidy, S, can be used to decrease f to the point at which $A = A^{opt}$. The subsidy and fee are such that*

$$S = 1 + R(A^{opt}) - \frac{1 + r}{1 - f} \tag{20}$$

and

$$f\left(R(A^{opt}) - r - S\right) = C - S - \frac{R(A^{opt}) - r - C}{r}, \tag{21}$$

respectively.

Note that the choice of $A = A^{opt}$ is optimal for the manager, whose payoff in (18) can be rewritten using the equation for investors' return in (19)

$$\begin{aligned} f\,(1 + R(A) - S)\, A - (C - S)\, A &= (1 + R(A) - S)\, A - (1 + r)\, A - (C - S)\, A \\ &= (1 + R(A))\, A - (1 + r)\, A - CA; \end{aligned}$$

the last expression is maximized at A^{opt}. There is, however, a need to limit the use of soft dollars to (20), because use in excess of that level combined with the fee in (21) would decrease investors' return below the normal rate.

Can such a limit be enforced where the manager cannot commit ex ante to limiting his use of soft dollars? Agency law appears to do so by providing shareholders with an ex post cause of action for fiduciary breach. One established statement of an agent's fiduciary duty is that he must act on behalf of the principal with the same care and prudence he would use to conduct his own affairs. This implies that the manager should use the subsidy to buy research up to the point at which a dollar of research generates no less than one dollar in returns for the fund. Any use of soft dollars beyond this point risks suit for breach of fiduciary duty. This requirement recalls Equation (20) defining the optimal level of soft dollars, which can be rewritten as

$$(1 - f)\, S = (1 - f)\left(1 + R(A^{opt})\right) - 1 + r. \tag{22}$$

In equilibrium, the fraction of soft dollar expenses borne by investors must generate net-of-fee abnormal returns of zero in percentage terms.

Note that soft dollars decrease the minimum level of fees only where they are used to subsidize research costs. This is clear from Equation (21), which suggests that fees would increase rather than decrease in S if the term $C-S$ were replaced by C, i.e., if soft dollars were used to subsidize other than research costs. In accordance with that requirement, Section 28(e) of the Securities Exchange Act (1934) provides a safe harbor to managers from fiduciary suits as long as they use the subsidy strictly for "brokerage and research services." The U.S. Securities & Exchange Commission could bring civil actions against managers who use soft dollars to acquire things it believes do not qualify as research, and although the acquisition of such items does not necessarily violate state agency law or federal securities law most fund boards rely on the SEC's interpretation as a policy limitation to their managers' use of soft dollars.

Soft dollars S need not be contractible as they are not specifically part of the management contract between shareholders and managers.[30] Ex post verifiability differs from ex ante contractibility, however. Private parties can, and have, brought civil actions against managers that have used soft dollars to buy things that are clearly did not qualify as brokerage and research services, suggesting that the legitimate use of soft dollars S can be verified ex post. More generally, our model requires only two quantities to be contractible, specifically fees f and gross payout $(1+R(A))\,A+(1+r)\,(T-A)$.

6.2 Imperfect and costly detection of shirking

Up to this point we have assumed fund shareholders detect shirking with certainty after one period. We now assume they detect shirking with a probability $\gamma \leqslant 1$. The no shirking condition, (5), then becomes

$$\begin{aligned}
&\frac{f\left[(1+R(A))\,A+(1+r)\,(T-A)\right]-CA}{r} \\
&\geqslant \frac{f\,(1+r)\,T}{1+r}+(1-\gamma)\,\frac{f\,(1+r)\,T}{(1+r)^2}+(1-\gamma)^2\,\frac{f\,(1+r)\,T}{(1+r)^3}+\ldots \\
&=\frac{f\,(1+r)\,T}{1+r}\left(\frac{1}{1-\frac{1-\gamma}{1+r}}\right). \qquad (23)
\end{aligned}$$

[30] SEC regulations require funds to disclose in their prospectus the tota ldollar value of brokerage commissions they pay and to disclose the fact that the manager sometimes receives unspecified amounts of brokerage and research services from brokers.

which we rewrite as

$$f \geqslant \frac{C}{R(A)-r} - \left(1 - \frac{C}{R(A)-r}\right)\frac{\gamma}{r} \equiv f^r$$

$$\Leftrightarrow f^r \left(R(A)-r\right) = C - \gamma \frac{R(A)-r-C}{r}. \tag{24}$$

Equation (24) differs from our earlier treatment of certain detection (8) in that the value to the manager of remaining in the relationship with investors, $(R(A)-r-C)\,A/r$, is lost only in case of detection, which occurs with probability γ. Setting f equal to its lower bound, the System of Equations (9)-(11) that defines the equilibrium becomes

$$(\gamma + rf)\,(R(A)-r) - (\gamma + r)\,C = 0, \tag{25}$$

$$R(A) - r + AR'(A) - C = 0, \tag{26}$$

and

$$(1-f)\,(R(A)-r)\,A - f\,(1+r)\,T = 0. \tag{27}$$

Proposition 6 *Assets under active management are unaffected by the probability of detection ($\partial A/\partial\gamma = 0$). Both the fee and active share decrease ($\partial f/\partial\gamma < 0$ and $\partial\left[A/T\right]/\partial\gamma < 0$) and total assets under management increase in the probability of detection ($\partial T/\partial\gamma > 0$).*

Assets under active management are unaffected by the probability of detection, γ, because unlike costs, C, and skill, θ, that probability has no bearing on the value of the manager's human capital, which determines $A = A^{opt}$. An increase in the probability of detection decreases the fee premium because the need for bonding declines. The lower fee necessarily increases total funds under management because, unlike our analysis of costs and skill, there can be no offsetting effect through actively managed funds.

We have thus far assumed monitoring to detect shirking is done at no cost. Suppose this remains true for some minimal probability of detection γ_0, but that it is possible to increase the probability of detection to $\gamma > \gamma_0$ at a cost $C(\gamma)\,A$, such that $C'(.) > 0$, $C''(.) > 0$, with $C(\gamma_0) = 0$ and $\lim_{\gamma\to\gamma_0} C'(\gamma) = 0$. Would the parties wish to spend resources to increase the probability of detection?

The answer is no where $T \geqslant A^{opt}$ at the level of fees f_0 such that Equation (25) holds with probability of detection γ_0, i.e., at f_0 such that

$$(\gamma_0 + r f_0)\left(R(A^{opt}) - r\right) = (\gamma_0 + r)\, C.$$

There is no need to incur the cost of detection $C(\gamma)\, A^{opt}$ where quality assurance can be achieved at no cost through a premium fee, f_0. Because shareholders receive the normal rate of return they must be compensated by the manager for any detection costs they might bear, and the manager's payoff is reduced by the amount of such costs, from $(R(A^{opt}) - r - C)\, A^{opt}$ to $(R(A^{opt}) - r - C - C(\gamma))\, A^{opt}$. As long as $T > A^{opt}$, resources spent detecting shirking are a pure social waste, and society is better off if shareholders remain rationally ignorant. Keep in mind that this is true even under the assumption that the information one shareholder gathers to detect shirking is nonrivalrous. With rivalrous information the duplication problem would further increase the benefits of quality assurance.

Suppose however that $T < A^{opt}$ at f_0. The premium fee required for quality assurance is now so high that it reduces funds under management, T, below A^{opt}. As in Section 6.1, the lower level of funds under management precludes the manager from receiving the full value of his human capital. Instead, he receives

$$(R(A_0) - r - C)\, A_0 < \left(R(A^{opt}) - r - C\right) A^{opt},$$

where A_0 solves $(1 - f_0)(1 + R(A))\, A = (1 + r)\, A$. We show

Proposition 7 *Where $T < A^{opt}$ at f_0, the manager will compensate investors for bearing the costs, $C(\gamma)$, of increasing the probability of detection γ beyond γ_0.*

The manager is willing to compensate investors for bearing the costs of detecting shirking, to some extent at least, because he can increase funds under management towards A^{opt} in so doing. Recall from Proposition 6 that $\partial T/\partial\gamma > 0$ and note that all funds are actively managed, $A = T$, as long as funds under management are less than A^{opt}. Funds are required to disclose their specific portfolio holdings to the SEC periodically with a 60-day lag. Myers, Poterba, Shackelford, and Shoven (2001) report that in the past various funds disclosed more frequently than required.

Under the quality assurance hypothesis for fund fees, the lower costs institutional investors face detecting shirking explains why they pay a lower fee, even to the same fund manager who serves individual retail investors. An alternative, but not necessarily conflicting hypothesis, is that there are fixed costs in servicing accounts with average costs declining in total assets in the account (Deli, 2002). The larger and fewer accounts of institutions are cheaper to service per dollar invested in the fund than are the smaller accounts of individual investors. In any event, neither hypothesis is consistent with the claim that management fees are so high as to expropriate shareholders.

6.3 Expropriation

Khorana, Servaes, and Tufano (2009) find that mutual fund fees are higher in countries with weak judicial systems and poor investor protection. The prevailing explanation is that unaccountable managers in these countries are able to expropriate investors by arbitrarily setting higher fees. Compared to setting high reported fees, however, surely it would be far easier for a manager to siphon wealth from a fund by selling assets to it at inflated prices, or buying assets from it a bargain prices, or by using soft dollars to pay personal expenditures. Competition for the right to manage a fund should then cause fees in these countries to be lower rather than higher, with the manager's gains from misappropriation being part of his compensation. Our analysis predicts that fees in countries with weal judiciaries and poor investor protection should be higher to allow managers to bond themselves against expropriating shareholders.

Formally, under the zero profit condition for fund management, and in the absence of expropriation, we have

$$f\left[\left(1+R(A)\right)A+\left(1+r\right)\left(T-A\right)\right]=CA.$$

With expropriation possible at rate η per dollar of asset under management, the preceding equation becomes

$$\left(f+\eta\right)\left[\left(1+R(A)\right)A+\left(1+r\right)\left(T-A\right)\right]=CA.$$

Clearly, $\partial f/\partial \eta<0$; the fee decreases in the rate of expropriation. This is consistent with the empirical work finding that, all else being equal, civil servants' salaries are lower in countries in which there is more corruption (Van Rijckeghem and Weder, 1997).

Now consider the case where the fee is intended to assure manager quality, which in this case consists not only of refraining from shirking but also refraining from expropriating investors. The fee must be such that

$$\frac{f\left[\left(1+R(A)\right)A+\left(1+r\right)\left(T-A\right)\right]-CA}{r}\geqslant\frac{\left(f+\eta\right)\left(1+r\right)T}{1+r}.$$

We can rewrite the preceding condition as

$$f\geqslant\frac{C}{R(A)-r}-\left(1-\frac{C}{R(A)-r}\right)\frac{1}{r}+\frac{\eta\left(1+r\right)}{R(A)-r}\frac{T}{A}\equiv f^{r},$$

with $\partial f^{r}/\partial\eta>0$, consistent with what Khorana, et al. (2009) find. Intuitively, the fee must be higher to deter the manager from expropriating investors. To show the intuition for the inequality, we rewrite it as

$$f\left(R(A)-r\right)A\geqslant CA-\frac{\left(R(A)-r-C\right)A}{r}+\eta\left(1+r\right)T.$$

The potential gain from expropriation now counteracts the potential gain from remaining in the relationship. The gains from expropriation apply to total funds under management, T, while the value of the relationship applies to actively managed assets, A. That is, both actively and passively managed funds are vulnerable to expropriation, whereas the value of the relationship lies in making it possible for the manager to realize the value of his human capital through active management. We have shown

Proposition 8 *The fee will be higher the higher the manager's scope for expropriation.*

It may be worth saying a few words about the similarities between our analysis in sections 6.2 and 6.3 and efficiency wages in labor economics. As already noted, quality-assuring fees are similar to efficiency wages in that they deter shirking by fund managers whereas efficiency wages deter shirking by workers (Akerlof and Yellen, 1986). Workers paid efficiency wages have more to lose from being fired for shirking. Two predictions (and findings) of efficiency wage theory are of particular interest to us: (i) wages will be lower where there is closer supervision (Krueger, 1991), (ii) wages will be lower where there are fewer opportunities for shirking. Prediction (i) is consistent with Proposition 6 and the observation of lower fees paid by institutional investors, which can be presumed to monitor fund managers more closely than can individual investors.

Prediction (ii) is consistent with Proposition 8 and the Khorana, et al. (2009) findings of higher fees in countries with weaker judiciaries and poorer investor protection, which allow more opportunities for expropriation. In the U.S., we would also expect funds specializing in illiquid securities for which there is no published performance benchmark to have higher fees, as this makes it more difficult for shareholders to assess performance.

6.4 Closed-end funds

The central difference between open- and closed-end funds is that in closed-end funds total assets under management, T, cannot be reduced through investors' redemptions. We show that

Proposition 9 *The fee must be higher in the case of closed-end funds, ceteris paribus. Formally*

$$f \geqslant \frac{C}{R(A) - r} > f^r \text{ in (7)}$$

The minimum level of quality-assuring fees is higher for closed-end funds than it is for open-end funds (Deli, 2002), precisely because the threat of denying the manager the value of his human capital should he shirk is virtually inoperative.

6.5 Some observations and evidence

Brown, Harlow, and Starks (1996) empirically assess the behavior of growth-oriented fund managers. They suggest that fund managers are engaged in a kind of tournament because of the positive effect superior returns in one prior have on fund inflows in subsequent periods. They find that managers whose interim performance during a reporting period has been poor have a tendency to inefficiently increase portfolio risk as the date of reporting looms in hopes of recouping the losses. Yet they also find this tendency to be smaller for managers with strong past performance records. According to our analysis, this is because these managers face the loss of back-end loaded fees in the asset-based component of their compensation. The threat that investors will punish inefficient increases in risk by withdrawing funds is a greater deterrent to managers with a good track record.

Elton, Gruber, and Blake (2003) analyze the effect on manager behavior from what they characterize as 'incentive' fees, in which the manager earns a higher one-off fee based on current-period fund returns rather than a fee based strictly on total assets. Their analysis suggests that this fee structure provides fund managers with incentives superior to asset-based fees, even though they recognize that use of incentive fees in the mutual fund setting is rare. Our analysis suggests that asset-based fees have a strong positive effect on manager incentives because, being recurrent rather than one-off, they are back-end loaded and conditional on the manager's satisfactory performance. This is especially so where the management relationship is expected to persist over time and where fund shareholders cannot engage in actual contract negotiations.

The downside to incentive fees is that they are one-off, possibly giving the manager a perverse incentive to 'bet the farm' in the event a bad performance report looms. This explains why the performance component of the manager's fee is often paid out on a deferred basis, presumably conditional on some contractible metric of satisfactory long-term performance, thereby mimicking the incentives created by asset-based fees. It also explains why incentive fees are much more common for private money managers, who contract their services to institutional investors. These investors have the wherewithal to closely monitor the manager to identify and punish misbehavior, and in fact they routinely pay substantial fees to consultants to help them do so.[31]

7 Summary and concluding remarks

Some excessive fee critics have relied on behavioral theory to explain why investors are persistently duped by excessive fund fees. Following the seminal work of Berk and Green (2004), in which mutual fund fees are irrelevant to investor returns, we have shown using a simple moral hazard model how a higher fee benefits fund investors by assuring that active managers fulfill their implicit promise to engage in costly research effort. Our analysis fully explains away many of the criticisms leveled at fund managers for charging excessive fees, most importantly the seemingly damning criticism that institutional investors pay far lower fees for what are arguably the same management services. Although this observation is also consistent with scale economies in the administration of ac-

[31] We abstract from the distinction between the adviser and the manager. Most mutual fund portfolio managers are either employees of a sub-adviser or an advisory firm, which typically administers a family of funds. The adviser is paid an asset-based fee, while the employee-manager is often paid in part on a performance fee basis. This is consistent with our monitoring hypothesis.

counts, neither view supports the inference that fund managers are able to take persistent advantage of investors by charging excessive, out-of-equilibrium fees.

One criticism of our model is that if all investors index they can earn r, so why invest in active funds in which they can expect to earn only r? This is exactly the question Pástor and Stambaugh (2012) address, and in any event all competitive models find that the marginal consumer earns no excess returns. Only those with special talents—fund managers in our model—earn Ricardian rents. Since managers are members of society, society is better off. Our view is that active fund management in its entirety is a sufficiently large share of the investment universe that it draws funds from alternative investments and very likely moves investors, as suppliers of capital, along an upward sloping supply curve. Thus, expected returns across the investment universe should be higher owing to the active form of mutual fund organization.

Appendix

Proof of Proposition 1: Problem (3) has first-order conditions

$$(1+R(A))\,A+(1+r)\,(T-A)-\lambda\,[(1+R(A))\,A+(1+r)\,(T-A)]=0$$

$$[f+\lambda\,(1-f)]\,[1+R(A)+AR'(A)-(1+r)]-C=0$$

$$f\,(1+r)+\lambda\,[(1-f)\,(1+r)-(1+r)]=0$$

and

$$(1-f)\,[(1+R(A))\,A+(1+r)\,(T-A)]=(1+r)\,T.$$

where λ denotes the Lagrange Multiplier associated with (4).

From the first equation, we have $\lambda = 1$. Substituting into the second equation it is clear that the fee has no effect on the amount actively managed, which equals the optimal amount, A^{opt}, by comparison with Equation (2). Substituting $\lambda = 1$ into the third equation, we have $0 = 0$. The fourth equation implies that there are no optima for f and T; an increase in one is offset by a decrease in the other. These offsetting changes leave the manager's profit unchanged regardless of the fee. ■

Proof of Corollary 1: To establish the necessity of the manager's option to resort to indexing, $T \neq A$, suppose to the contrary that the manager is denied that option and must actively manage all invested assets, $T = A$. Equation (1) becomes

$$(1-f)\,(1+R(A))=1+r, \tag{28}$$

which combined with (2) implies

$$(1-f)\,(1+R(A))=1+R(A^{opt})+A^{opt}R'(A^{opt})-C, \tag{29}$$

which in turn implies that $A = A^{opt}$ if and only if $f = f^{opt}$ with

$$f^{opt}=\frac{-A^{opt}R'(A^{opt})+C}{1+R(A^{opt})}. \tag{30}$$

Absent the option for the manager to resort indexing, it is no longer the case that fees do not affect the level of actively managed assets: $A \lesseqgtr A^{opt}$ if and only if $f \gtreqless f^{opt}$. Note that optimal fees f^{opt} are the equivalent for a mutual fund of Knight's (1924) optimal toll for a private road. ■

Proof of Corollary 2: Assume the manager chooses to limit inflows to $T^{li} < T$, with T being the level of assets induced by the fee absent the limit on inflows. Investor returns are

$$\frac{(1-f)\left[(1+R(A))\,A+(1+r)\left(T^{li}-A\right)\right]}{T^{li}}=\frac{f\,(1+r)\,T}{T^{li}}+(1-f)\,(1+r)>1+r$$

$$\Rightarrow (1-f)\left[(1+R(A))\,A+(1+r)\left(T^{li}-A\right)\right]>(1+r)\,T^{li},$$

where we have used (1) to obtain the equality. The manager's returns therefore are

$$\begin{aligned}
&f\left[(1+R(A))\,A+(1+r)\left(T^{li}-A\right)\right]-CA\\
&=\left[(1+R(A))\,A+(1+r)\left(T^{li}-A\right)\right]-CA-(1-f)\left[(1+R(A))\,A+(1+r)\left(T^{li}-A\right)\right]\\
&<\left[(1+R(A))\,A+(1+r)\left(T^{li}-A\right)\right]-CA-(1+r)\,T^{li}\\
&=(R(A)-r)\,A-CA\\
&\leqslant\left(R(A^{opt})-r\right)A^{opt}-CA^{opt},
\end{aligned}$$

where the last inequality is true by the definition of A^{opt}. ■

Proof of Corollary 3: Break-even fees, f^{be}, and assets under management, A^{be}, are such that

$$f^{be}\left(1+R(A^{be})\right)A^{be}=CA^{be} \tag{31}$$

and

$$\left(1-f^{be}\right)\left(1+R(A^{be})\right)A^{be}=(1+r)\,A^{be}. \tag{32}$$

Equations (31) and (32) together imply

$$R(A^{be})-C=r. \tag{33}$$

Comparing (33) with (2) and recalling that $R'(.)<0$ in turn imply $A^{be}>A^{opt}$ and, from the definition of A^{opt}

$$\left(R(A^{be})-r-C\right)A^{be}<\left(R(A^{opt})-r-C\right)A^{opt}. \tag{34}$$

Using (32) to write

$$r=\left(1-f^{be}\right)\left(1+R(A^{be})\right)-1, \tag{35}$$

likewise writing[32]

$$r=\left(1-f^{opt}\right)\left(1+R(A^{opt})\right)-1, \tag{36}$$

[32] Equations (35) and (36) both express the driving of investor returns down to the normal rate r.

and substituting (35) and (36) into the LHS and the RHS of (34), respectively, we get

$$f^{be}\left(1+R(A^{be})\right)A^{be}-CA^{be}<f^{opt}\left(1+R(A^{opt})\right)A^{opt}-CA^{opt}.$$

Note that (35), (36), $R'(.)<0$, and $A^{be}>A^{opt}$ together imply $f^{be}<f^{opt}$. ■

Proof of Proposition 2: Using the result that managers earn the value of their human capital, we can replace the numerator in the RHS of (6) by $(1+R(A^{opt}))A^{opt}-(1+r)A^{opt}-CA^{opt}$ and then solve for f to obtain

$$f\geqslant\frac{1}{r}\left[C\left(\frac{1+r}{R(A^{opt})-r}\right)-1\right]\equiv f^{r}. \tag{37}$$

■

Proof of Proposition 3: Totally differentiating the System of Equations (9)-(11) with respect to C, we have

$$\mathbf{AX}=\mathbf{B},$$

where

$$\mathbf{A}=\left[\begin{array}{ccc}(1+rf)\,R'(A) & r\,(R(A)-r) & 0\\ 2R'(A)+AR''(A) & 0 & 0\\ (1-f)\,[AR'(A)+R(A)-r] & -\left[(R(A)-r)\,A+(1+r)\,T\right] & -f\,(1+r)\end{array}\right],$$

$$\mathbf{X}=\left[\begin{array}{c}\frac{\partial A}{\partial C}\\ \frac{\partial f}{\partial C}\\ \frac{\partial T}{\partial C}\end{array}\right],$$

and

$$\mathbf{B}=\left[\begin{array}{c}1+r\\ 1\\ 0\end{array}\right].$$

Note, initially, that

$$|\mathbf{A}|=[2R'(A)+AR''(A)]\,r\,(R(A)-r)\,f\,(1+r)<0,$$

by the second order condition for actively managed assets. We use Cramer's rule to obtain

$$\frac{\partial A}{\partial C}=\frac{r\,(R(A)-r)\,f\,(1+r)}{|\mathbf{A}|}<0,$$

$$\frac{\partial f}{\partial C}=\frac{[-(1+rf)\,R'(A)+(1+r)\,(2R'(A)+AR''(A))]\,f\,(1+r)}{|\mathbf{A}|}\lesseqgtr 0,$$

and

$$\frac{\partial T}{\partial C}=\frac{\begin{array}{c}\left[(1+rf)\,R'(A)-(1+r)\,(2R'(A)+AR''(A))\right]\left[(R(A)-r)\,A+(1+r)\,T\right]\\+(1-f)\left[AR'(A)+R(A)-r\right]r\,(R(A)-r)\end{array}}{|\mathbf{A}|}\lesseqgtr 0.$$

A necessary and sufficient condition for $df/dC>0$ and sufficient condition for $\partial T/\partial C<0$ is

$$-(1+rf)\,R'(A)+(1+r)\,(2R'(A)+AR''(A))<0.$$

Although it is possible to compute the derivative of active share, A/T, directly, we compute it by using (11) to write

$$\frac{A}{T}=\left[\frac{1-f}{f}\,(R(A)-r)\right]^{-1}(1+r)\,. \tag{38}$$

We have just shown A to decrease and therefore $R(A)$ to increase in C. A sufficient condition for active share to decrease in C is that the fee decreases in costs, C. ■

Proof of Proposition 4: Totally differentiating the System of Equations with respect to θ, we have

$$\mathbf{CY}=\mathbf{D},$$

where

$$\mathbf{C}=\begin{bmatrix}(1+rf)\,R'(A,\theta) & r\,(R(A,\theta)-r) & 0\\ 2R'(A,\theta)+AR''(A,\theta) & 0 & 0\\ (1-f)\left[AR'(A,\theta)+R(A,\theta)-r\right] & -\left[(R(A,\theta)-r)\,A+(1+r)\,T\right] & -f\,(1+r)\end{bmatrix},$$

$$\mathbf{Y}=\begin{bmatrix}\frac{\partial A}{\partial\theta}\\ \frac{\partial f}{\partial\theta}\\ \frac{\partial T}{\partial\theta}\end{bmatrix},$$

and

$$\mathbf{D}=\begin{bmatrix}-(1+rf)\,\frac{\partial R(A,\theta)}{\partial\theta}\\ -\left(\frac{\partial R(A,\theta)}{\partial\theta}+A\frac{\partial R'(A,\theta)}{\partial\theta}\right)\\ -(1-f)\,\frac{\partial R(A,\theta)}{\partial\theta}A\end{bmatrix}.$$

Note that

$$|\mathbf{C}|=\left[2R'(A,\theta)+AR''(A,\theta)\right]r\,(R(A,\theta)-r)\,f\,(1+r)<0,$$

by the second order condition for actively managed funds A. Use Cramer's rule to obtain

$$\frac{\partial A}{\partial\theta}=-\frac{r\,(R(A,\theta)-r)\,f\,(1+r)}{|\mathbf{C}|}\left(\frac{\partial R(A,\theta)}{\partial\theta}+A\frac{\partial R'(A,\theta)}{\partial\theta}\right)>0,$$

$$\frac{\partial f}{\partial \theta} = \frac{f\,(1+r)\,(1+rf)}{|\mathbf{C}|} \times$$
$$\left[R'(A,\theta)\left(\frac{\partial R(A,\theta)}{\partial \theta} + A\frac{\partial R'(A,\theta)}{\partial \theta}\right) - \left(2R'(A,\theta) + AR''(A,\theta)\right)\frac{\partial R(A,\theta)}{\partial \theta}\right] \lesseqgtr 0,$$

$$\begin{aligned}
\frac{\partial T}{\partial \theta} &= \frac{1}{|\mathbf{C}|} \times \\
&\left[\begin{array}{c}
-\left(1+rf\right)R'(A,\theta)\left[\left(R(A,\theta)-r\right)A + (1+r)\,T\right]\left(\frac{\partial R(A,\theta)}{\partial \theta} + A\frac{\partial R'(A,\theta)}{\partial \theta}\right) \\
+\left(2R'(A,\theta) + AR''(A,\theta)\right)r\left(R(A,\theta)-r\right)(1-f)\,\frac{\partial R(A,\theta)}{\partial \theta}A \\
+\left(2R'(A,\theta) + AR''(A,\theta)\right)\left[\left(R(A,\theta)-r\right)A + (1+r)\,T\right](1+rf)\,\frac{\partial R(A,\theta)}{\partial \theta} \\
-\left(1-f\right)\left[AR'(A,\theta) + R(A,\theta) - r\right]r\left(R(A,\theta)-r\right)\left(\frac{\partial R(A,\theta)}{\partial \theta} + A\frac{\partial R'(A,\theta)}{\partial \theta}\right)
\end{array}\right]. \\
&= \frac{1}{|\mathbf{C}|} \times \\
&\left\{\begin{array}{c}
-\left[\left(\frac{\partial R(A,\theta)}{\partial \theta} + A\frac{\partial R'(A,\theta)}{\partial \theta}\right)R'(A,\theta) - \left(2R'(A,\theta) + AR''(A,\theta)\right)\frac{\partial R(A,\theta)}{\partial \theta}\right] \times \\
\left[(1+rf)\left[\left(R(A,\theta)-r\right)A + (1+r)\,T\right] + (1-f)\,r\left(R(A,\theta)-r\right)A\right] \\
-\left(1-f\right)r\left(R(A,\theta)-r\right)^2\left(\frac{\partial R(A,\theta)}{\partial \theta} + A\frac{\partial R'(A,\theta)}{\partial \theta}\right)
\end{array}\right\} \lesseqgtr 0,
\end{aligned}$$

and

$$\begin{aligned}
\frac{\partial\left[A/T\right]}{\partial \theta} &= \frac{1}{T^2}\left[\frac{\partial A}{\partial \theta}T - A\frac{\partial T}{\partial \theta}\right] \\
&= \frac{1}{T^2}\frac{1}{|\mathbf{C}|} \times \\
&\left[\begin{array}{c}
-r\left(R(A,\theta)-r\right)f\,(1+r)\left(\frac{\partial R(A,\theta)}{\partial \theta} + A\frac{\partial R'(A,\theta)}{\partial \theta}\right)T \\
+\left(1+rf\right)R'(A,\theta)\left[\left(R(A,\theta)-r\right)A + (1+r)\,T\right]\left(\frac{\partial R(A,\theta)}{\partial \theta} + A\frac{\partial R'(A,\theta)}{\partial \theta}\right)A \\
-\left(2R'(A,\theta) + AR''(A,\theta)\right)r\left(R(A,\theta)-r\right)(1-f)\,\frac{\partial R(A,\theta)}{\partial \theta}A^2 \\
-\left(2R'(A,\theta) + AR''(A,\theta)\right)\left[\left(R(A,\theta)-r\right)A + (1+r)\,T\right](1+rf)\,\frac{\partial R(A,\theta)}{\partial \theta}A \\
+\left(1-f\right)\left[AR'(A,\theta) + R(A,\theta) - r\right]r\left(R(A,\theta)-r\right)\left(\frac{\partial R(A,\theta)}{\partial \theta} + A\frac{\partial R'(A,\theta)}{\partial \theta}\right)A
\end{array}\right] \\
&= \frac{1}{T^2}\frac{1}{|\mathbf{C}|} \times \\
&\left[\begin{array}{c}
-r\left(R(A,\theta)-r\right)\left(\frac{\partial R(A,\theta)}{\partial \theta} + A\frac{\partial R'(A,\theta)}{\partial \theta}\right)\left\{f\,(1+r)\,T - (1-f)\left[AR'(A,\theta) + R(A,\theta) - r\right]A\right\} \\
+\left(1+rf\right)R'(A,\theta)\left[\left(R(A,\theta)-r\right)A + (1+r)\,T\right]\left(\frac{\partial R(A,\theta)}{\partial \theta} + A\frac{\partial R'(A,\theta)}{\partial \theta}\right)A \\
-\left(2R'(A,\theta) + AR''(A,\theta)\right)r\left(R(A,\theta)-r\right)(1-f)\,\frac{\partial R(A,\theta)}{\partial \theta}A^2 \\
-\left(2R'(A,\theta) + AR''(A,\theta)\right)\left[\left(R(A,\theta)-r\right)A + (1+r)\,T\right](1+rf)\,\frac{\partial R(A,\theta)}{\partial \theta}A
\end{array}\right].
\end{aligned}$$

Now, note that

$$\begin{aligned}
f\,(1+r)\,T - (1-f)\left[AR'(A,\theta) + R(A,\theta) - r\right]A &= (1-f)\left(R(A)-r\right)A - (1-f)\,CA \\
&= (1-f)\left(R(A)-r-C\right)A > 0,
\end{aligned}$$

so that

$$\frac{\partial\left[A/T\right]}{\partial\theta}=\frac{1}{T^2}\frac{1}{|\mathbf{C}|}\times$$
$$\left[\begin{array}{c} -r\left(R(A,\theta)-r\right)\left(\frac{\partial R(A,\theta)}{\partial\theta}+A\frac{\partial R'(A,\theta)}{\partial\theta}\right)(1-f)\left(R(A)-r-C\right)A \\ +\left(1+rf\right)R'(A,\theta)\left[\left(R(A,\theta)-r\right)A+\left(1+r\right)T\right]\left(\frac{\partial R(A,\theta)}{\partial\theta}+A\frac{\partial R'(A,\theta)}{\partial\theta}\right)A \\ -\left(2R'(A,\theta)+AR''(A,\theta)\right)r\left(R(A,\theta)-r\right)(1-f)\frac{\partial R(A,\theta)}{\partial\theta}A^2 \\ -\left(2R'(A,\theta)+AR''(A,\theta)\right)\left[\left(R(A,\theta)-r\right)A+\left(1+r\right)T\right]\left(1+rf\right)\frac{\partial R(A,\theta)}{\partial\theta}A \end{array}\right].$$

In turn note that

$$\begin{aligned}
&-r\left(R(A,\theta)-r\right)\left(\frac{\partial R(A,\theta)}{\partial\theta}+A\frac{\partial R'(A,\theta)}{\partial\theta}\right)(1-f)\left(R(A)-r-C\right)A \\
&-\left(2R'(A,\theta)+AR''(A,\theta)\right)r\left(R(A,\theta)-r\right)(1-f)\frac{\partial R(A,\theta)}{\partial\theta}A^2 \\
&=-r\left(R(A,\theta)-r\right)(1-f)A\left[\begin{array}{c}\left(\frac{\partial R(A,\theta)}{\partial\theta}+A\frac{\partial R'(A,\theta)}{\partial\theta}\right)\left(R(A)-r-C\right) \\ +\left(2R'(A,\theta)+AR''(A,\theta)\right)\frac{\partial R(A,\theta)}{\partial\theta}A\end{array}\right] \\
&=-r\left(R(A,\theta)-r\right)(1-f)A\left[\begin{array}{c}-\left(\frac{\partial R(A,\theta)}{\partial\theta}+A\frac{\partial R'(A,\theta)}{\partial\theta}\right)AR'(A,\theta) \\ +\left(2R'(A,\theta)+AR''(A,\theta)\right)\frac{\partial R(A,\theta)}{\partial\theta}A\end{array}\right] \\
&=r\left(R(A,\theta)-r\right)(1-f)A^2\left[\begin{array}{c}\left(\frac{\partial R(A,\theta)}{\partial\theta}+A\frac{\partial R'(A,\theta)}{\partial\theta}\right)R'(A,\theta) \\ -\left(2R'(A,\theta)+AR''(A,\theta)\right)\frac{\partial R(A,\theta)}{\partial\theta}\end{array}\right].
\end{aligned}$$

We can therefore write

$$\begin{aligned}
\frac{\partial\left[A/T\right]}{\partial\theta}&=\frac{1}{T^2}\frac{1}{|\mathbf{C}|}\left[\begin{array}{c}\left(\frac{\partial R(A,\theta)}{\partial\theta}+A\frac{\partial R'(A,\theta)}{\partial\theta}\right)R'(A,\theta) \\ -\left(2R'(A,\theta)+AR''(A,\theta)\right)\frac{\partial R(A,\theta)}{\partial\theta}\end{array}\right]\times \\
&\quad\left[r\left(R(A,\theta)-r\right)(1-f)A^2+\left(1+rf\right)\left[\left(R(A,\theta)-r\right)A+\left(1+r\right)T\right]A\right].
\end{aligned}$$

A necessary and sufficient condition for $\partial f/\partial\theta<0$ and $\partial\left[A/T\right]/\partial\theta<0$ is

$$R'(A,\theta)\left(\frac{\partial R(A,\theta)}{\partial\theta}+A\frac{\partial R'(A,\theta)}{\partial\theta}\right)-\left(2R'(A,\theta)+AR''(A,\theta)\right)\frac{\partial R(A,\theta)}{\partial\theta}>0.$$

The condition is also sufficient for $\partial T/\partial\theta>0$. ■

Proof of Proposition 5: The fee, f, is now such that

$$\begin{aligned}
&f\left(1+r\right)A-f\left(1+R(A)-S\right)A+\left(C-S\right)A \\
&=\frac{f\left(1+R(A)-S\right)A-\left(C-S\right)A}{r} \\
&\Leftrightarrow f\left(R(A)-r-S\right)=C-S-\frac{R(A)-r-C}{r}.
\end{aligned}$$

As $f < 1$, it is clear that $\partial f / \partial S < 0$, keeping A constant. The fee necessary for bonding decreases in the soft dollar subsidy. The solution is therefore characterized by $A = A^{opt}$ and S and f such that[33]

$$(1 - f) \left(1 + R(A^{opt}) - S\right) A^{opt} = (1 + r) A^{opt}$$

$$\Leftrightarrow S = 1 + R(A^{opt}) - \frac{1 + r}{1 - f}$$

and

$$f \left(R(A^{opt}) - r - S\right) = C - S - \frac{R(A^{opt}) - r - C}{r}.$$

■

Proof of Proposition 6: Totally differentiating the System of Equations (25)-(27) with respect to γ, we have

$$\mathbf{EZ} = \mathbf{F},$$

where

$$\mathbf{E} = \begin{bmatrix} (\gamma + rf) R'(A) & r (R(A) - r) & 0 \\ 2R'(A) + AR''(A) & 0 & 0 \\ (1 - f) [AR'(A) + R(A) - r] & -[(R(A) - r) A + (1 + r) T] & -f (1 + r) \end{bmatrix},$$

$$\mathbf{Z} = \begin{bmatrix} \frac{\partial A}{\partial \gamma} \\ \frac{\partial f}{\partial \gamma} \\ \frac{\partial T}{\partial \gamma} \end{bmatrix},$$

and

$$\mathbf{F} = \begin{bmatrix} -(R(A) - r - C) \\ 0 \\ 0 \end{bmatrix}.$$

Initially note that

$$|\mathbf{E}| = [2R'(A) + AR''(A)] \, r (R(A) - r) f (1 + r) < 0,$$

by the second order condition for actively managed funds, A. Now use Cramer's rule to obtain

$$\frac{\partial A}{\partial \gamma} = \frac{0}{|\mathbf{E}|} = 0,$$

[33] Note that the LHS of the equation that follows is increasing in S. To see this, differentiate and use

$$\frac{\partial f}{\partial S} = -\frac{1 - f}{R(A^{opt}) - r - S}.$$

$$\frac{\partial f}{\partial \gamma} = -\frac{\left[2R'(A) + AR''(A)\right]\left(R(A) - r - C\right) f\,(1+r)}{|\mathbf{E}|} < 0,$$

and

$$\frac{\partial T}{\partial \gamma} = \frac{\left[2R'(A) + AR''(A)\right]\left[\left(R(A) - r\right) A + (1+r)\,T\right]\left(R(A) - r - C\right)}{|\mathbf{E}|} > 0.$$

That $\partial\left[A/T\right]/\partial\gamma < 0$ is immediate from the two results $\partial A/\partial\gamma = 0$ and $\partial T/\partial\gamma > 0$. ■

Proof of Proposition 7: Note that f and A corresponding to $\gamma > \gamma_0$ are such that

$$(1-f)\,(1+R(A))\,A = (1+r)\,A + C\,(\gamma)\,A$$

and

$$\frac{f\,(1+R(A))\,A - CA}{r} = \frac{f\,(1+r)\,A}{1+r}\left(\frac{1}{1-\frac{1-\gamma}{1+r}}\right).$$

We obtained the latter equation by writing inequality (23) as an equality and setting $T = A$. We obtained the former by adjusting Equation (27) to allow for investor compensation for the cost $C\,(\gamma)\,A$ of increasing the probability of detection to $\gamma > \gamma_0$. These two equations can be rewritten as, respectively,

$$(1-f)\,(1+R(A)) - (1+r) - C\,(\gamma) = 0 \tag{39}$$

and

$$(r+\gamma)\left[f\,(1+R(A)) - C\right] - rf\,(1+r) = 0. \tag{40}$$

Totally differentiating with respect to γ and solving for $\partial A/\partial\gamma$, we have

$$\begin{aligned}\frac{\partial A}{\partial \gamma} &= \frac{\begin{vmatrix} -\left(1+R(A)\right) & C'\,(\gamma) \\ (r+\gamma)\,(1+R(A)) - r\,(1+r) & -\left[f\,(1+R(A)) - C\right]\end{vmatrix}}{\begin{vmatrix} -\left(1+R(A)\right) & (1-f)\,R'(A) \\ (r+\gamma)\,(1+R(A)) - r\,(1+r) & (r+\gamma)\,fR'(A)\end{vmatrix}} \\ &= \frac{(1+R(A))\left[f\,(1+R(A)) - C\right] - \left[(r+\gamma)\,(1+R(A)) - r\,(1+r)\right]C'\,(\gamma)}{-R'(A)\left[(1+R(A))\,(r+\gamma)\,f + \left[(r+\gamma)\,(1+R(A)) - r\,(1+r)\right](1-f)\right]}.\end{aligned}$$

Note that $\partial A/\partial\gamma > 0$ at $\gamma = \gamma_0$.[34] Assuming for simplicity that investment in detection is contractible, the manager's problem is

$$\underset{\gamma \geqslant \gamma_0}{Max}\,\left(R(A) - r - C - C\,(\gamma)\right) A,$$

[34] Use Equation (40) to conclude that both $f\,(1+R(A)) - C$ and $(r+\gamma)\,(1+R(A)) - r\,(1+r)$ are positive.

where the manager course recognizes the dependence of A (and f) on γ. This problem has FOC

$$(R(A) - r - C - C(\gamma) + AR'(A)) \frac{\partial A}{\partial \gamma} - AC'(\gamma) + \lambda = 0,$$

where λ is the Lagrange multiplier associated with the inequality constraint $\gamma \geqslant \gamma_0$. At $\gamma = \gamma_0$ and $A = A_0$, the FOC becomes

$$\lambda = -(R(A_0) - r - C + A_0 R'(A_0)) \left.\frac{\partial A}{\partial \gamma}\right|_{\gamma=\gamma_0} < 0,$$

which is a contradiction.[35] The constraint is therefore slack; that is, $\gamma > \gamma_0$. ■

Proof of Proposition 9: In closed-end funds as in open-end funds, it is beneficial to preclude shirking, where shirking is again defined as closet indexing. Absent investors' ability to withdraw funds, the fee must be such that

$$\frac{f\left[(R(A) - r)A + (1+r)T\right] - CA}{r} \geqslant \frac{f(1+r)T}{r} \tag{41}$$

$$\begin{aligned} \Leftrightarrow f &\geqslant \frac{C}{R(A) - r} \\ &> \frac{C}{R(A) - r} - \frac{1}{r}\left(1 - \frac{C}{R(A) - r}\right) = f^r, \end{aligned}$$

where we have used the definition of f^r in Equation (7).[36] Note that the RHS of inequality (41) recognizes that total funds under management, T, remain in the fund even if the manager should shirk. ■

[35] Use $R(A_0) - r + A_0 R'(A_0) - C > 0$ for $A_0 < A^{opt}$.
[36] We again drop superscripts for simplicity.

References

Akerlof, G., J. Yellen, Efficiency wage models of the labor market, 1st ed. (Cambridge: Cambridge University Press, 1986).

Barras, L., O. Scaillet, R. Wermers, 2010, False discoveries in mutual fund performance: Measuring luck in estimated alphas. Journal of Finance 65, 179-216.

Barzel, Y., 1997, Economic Analysis of Property Rights, 1st ed. (Cambridge: Cambridge University Press, 1997).

Berk, J., J. van Binsbergen, 2012, Measuring managerial skill in the mutual fund industry. Mimeo, Stanford University.

Berk, J., R. Green, 2004, Mutual fund flows and performance in rational markets. Journal of Political Economy 112, 1265-1295.

Brown, D.C., S. Davies, 2014, Closet indexing: The cost of falling asset management fees. Mimeo, University of Arizona and University of Colorado.

Brown, K., W. Harlow, L. Starks, 1996, Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry. Journal of Finance 51, 85-110.

Carhart, M., 1997, On Persistence in Mutual Fund Performance. Journal of Finance 52, 57-82.

Chevalier, J., G. Ellison, 1997, Risk taking by mutual funds as a response to incentives. Journal of Political Economy 105, 1167-1200.

Chevalier, J., G. Ellison, 1999, Some mutual fund managers better than others? Cross sectional patterns in behavior and performance. Journal of Finance 54, 875-899.

Cremers, M., A. Petajisto, 2009, How active is your fund manager? A new measure that predicts performance. Review of Financial Studies 22, 3329-3365.

Del Guercio, D., J. Reuter, 2014, Mutual fund performance and the incentive to invest in active management. Journal of Finance 69, 1673-1704.

Deli, D., 2002, Mutual fund advisory contracts: An empirical investigation. Journal of Finance 57, 109-133.

Demsetz, H., 1967, Toward a theory of property rights. American Economic Review 57, 347-359.

Elton, E., M. Gruber, 2011, Mutual funds. Mimeo, New York University.

Elton, E., M. Gruber, C. Blake, 2003, Incentive fees and mutual funds. Journal

of Finance 58, 779-804.
Fama, E. K. French, 2010, Luck versus skill in the cross-section of mutual fund returns. Journal of Finance 65, 1915-1947.
Freeman, J., S. Brown, 2001, Mutual fund advisory fees: The cost of conflicts of interest. Journal of Corporation Law 26, 609-673.
Friend, I., 1962, Wharton School of Finance and Commerce: A Study of Mutual Funds, United States House of Representatives Report No. 87-2274.
Glode, V., 2011, Why mutual funds "underperform." Journal of Financial Economics 99, 546-559.
Gruber, M.., 1996, Another puzzle: The growth in actively managed funds. Journal of Finance 51, 783-810.
Henderson, T., 2010, Justifying *Jones*. University of Chicago Law Review 77, 1027-1053.
Horan, S., D. Johnsen, 2008, Can third-party payments benefit the principal? The case of soft dollar brokerage. International Review of Law and Economics 28, 56-77.
Investment Company Institute, 2012, Mutual Fund Factbook (http://www.icifactbook.org)
Ippolito, R., 1992, Consumer reaction to measures of poor quality: Evidence from the mutual fund industry. Journal of Law and Economics 35, 45-70.
Jensen, M., 1968, The performance of mutual funds in the period 1945-1964. Journal of Finance 23, 389-416.
Johnsen, D., 2010, Myths about mutual fund fees: Economic insights on *Jones v. Harris*. Journal of Corporate Law 35, 561-614.
Kacperczyk, M., S. van Nieuwerburgh, L. Veldkamp, 2014, Time-varying fund manager skill. Journal of Finance 69, 1455-1484.
Klein, B., K. Leffler, 1981, The role of market forces in assuring contractual performance. Journal of Political Economy 89, 615-641.
Khorana, A., H. Servaes, P. Tufano, 2009, Mutual fund fees around the world. Review of Financial Studies 22, 1279-1310.
Knight, F., 1924, Some fallacies in the interpretation of social cost. Quarterly Journal of Economics 38, 582-606.
Krueger, A., 1991, Ownership, agency, and wages: An examination of franchising in the fast food industry. Quarterly Journal of Economics 106, 75-101.
Lueck, D., 1995, The rule of first possession and the design of the law. Journal of Law and Economics 38, 393-436.

Malkiel, B., 1995, Returns from investing in equity mutual funds 1971 to 1991. Journal of Finance 50, 549-572.

Frank, M., J. Poterba, J., D. Shackelford, and J. Shoven, 2004, Copycat Funds: Information Disclosure Regulation and the Returns to Active Management in the Mutual Fund Industry. Journal of Law and Economics 47, 515-541.

Pástor, Ĺ., R. Stambaugh, 2002, Mutual fund performance and seemingly unrelated assets. Journal of Financial Economics 63, 315-349.

Pástor, Ĺ., R. Stambaugh, 2012, On the size of the active management industry. Journal of Political Economy 120, 740-781.

Petajisto, A., 2013, Active share and mutual fund performance. Financial Analysts Journal 69, 73-93.

Sirri, E., P. Tufano, 1998, Costly search and mutual fund flows. Journal of Finance 53, 1589-1622.

Stambaugh, R., 2014, Presidential address: Investment noise and trends. Journal of Finance 69, 1415-1453.

Van Rijckeghem, C. and B. Weder, 1997, Corruption and the rate of temptation: do low wages in the civil service cause corruption? WP 97/93, IMF, Washington, D.C.

Wermers, R., 2000, Mutual Fund Performance: An empirical decomposition into stock-picking talent, style, transactions costs, and expenses. Journal of Finance 55, 1655-1695.

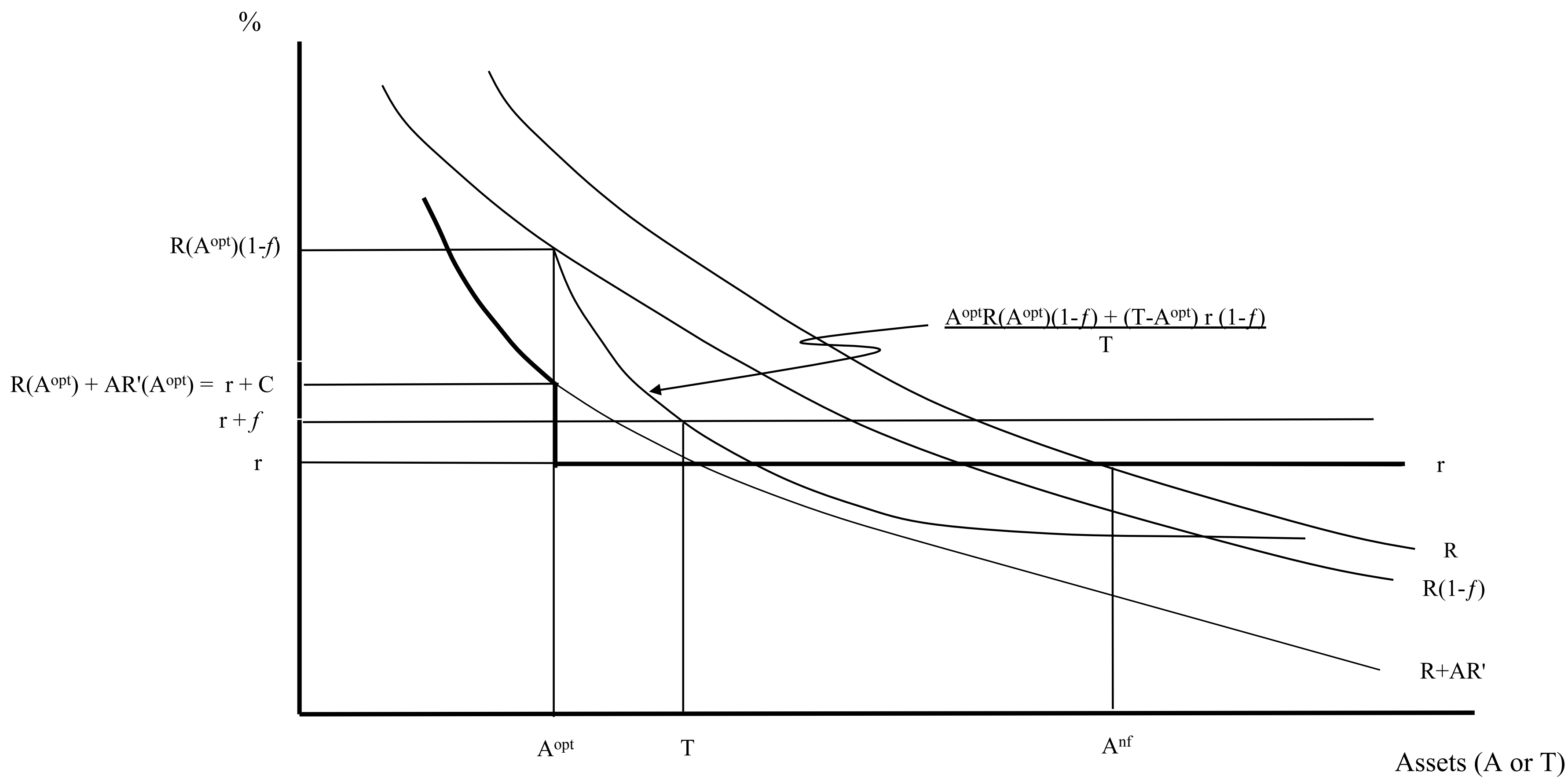

Figure 1
Return on Contributed Assets