Fee Speech: Signaling, Risk-Sharing, and the Impact of Fee Structures on Investor Welfare

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The fee structure used to compensate investment advisers is central to the study of fund design, and affects investor welfare in at least three ways: (i) by influencing the portfolio-selection incentives of the adviser, (ii) by affecting risk-sharing between adviser and investor, and (iii) through its use as a signal of quality by superior investment advisers. In this paper, we describe a model in which all of these features are present, and use it to compare two popular and contrasting forms of fee contracts, the "fulcrum" and the "incentive" types, from the standpoint of investor welfare. While the former has some undeniably attractive features (that have, in particular, been used by regulators to justify its mandatory use in a mutual fund context), we find surprisingly that it is the latter that is often more attractive from the standpoint of investor welfare. Our model is a flexible one; our conclusions are shown to be robust to many extensions of interest. The results are also extended to consider unrestricted fee structures and competitive markets for fund managers.

1. Introduction

The fee structure used to compensate an investment adviser is unquestionably one of the most sensitive aspects of fund design. As such, it has been the focus of considerable attention, both academic and regulatory. On the academic front, a substantial literature has examined various aspects of the fee structure including its implications for portfolio choice [e.g., Grinblatt and Titman (1989), Admati and Pleiderer (1997)] and its impact in a signaling context [e.g., Huddart (1995)]; section 2 provides a brief review of this literature. On the regulatory side, permissible fee structures for U.S. mutual funds are laid out in the 1970 Amendment to the Investment Advisors Act

We thank Martin Gruber for having introduced us to the topic investigated in this paper; and Steven Huddart, Andre Perold, Priya Raghubir, and seminar participants at the University of Wisconsin—Madison, Santa Clara University, Northeastern University, and the WFA meetings in summer 1999 for their feedback. We are also very grateful to Larry Glosten and an anonymous referee for detailed comments that led to extensive revisions of our original paper. The first author would like to thank the Dean Witter Foundation for support. The second author would also like to thank the National Science Foundation for support under grant SBR 94-10485. Address correspondence to Sanjiv Ranjan Das, Leavey School of Business, Santa Clara University, Santa Clara, CA 95053, or e-mail: srdas@scu.edu.

The Review of Financial Studies Winter 2002 Vol. 15, No. 5, pp. 1465–1497

of 1940. The requirements of the act are quite specific: performance-based compensation contracts are admissible only if they are of the "fulcrum" variety, i.e., contracts in which the adviser's fee is symmetric around a chosen index, decreasing for underperforming the index in the same way in which it increases for outperforming it. In particular, asymmetric "incentive fee" contracts in which advisers receive a base fee plus a bonus for exceeding a benchmark index are prohibited.[1]

The importance of the fee structure in determining investor welfare arises from three distinct sources. First, the fee structure directly affects the *portfolio-selection* incentives of the adviser; indeed, the fulcrum-fee requirement on the mutual fund industry is explicitly motivated by the argument that incentive fees with their option-like payoffs encourage investment advisers to take "excessive" amounts of risk by protecting them from the negative consequences of their actions. Second, for any given distribution of portfolio returns, the fee structure determines the division of returns between investor and adviser, and, ipso facto, plays an important *risk-sharing* role. Third, in the presence of investment advisers of differing abilities, the fee structure affects the way funds can compete, in particular, the potential to *signal information* concerning these abilities.

In this paper, we describe a model in which all of these considerations are present, and use it to examine the equilibrium implications of different fee structures. We are especially interested in the investor's perspective on the choice between two natural benchmarks: (a) fulcrum fees, which are mandated by law for U.S. mutual funds, and (b) incentive fees, which are commonly used in practice where permitted (e.g., by hedge funds), and a fear of whose "adverse" incentive consequences underlies the fulcrum fee requirement for mutual funds. To this end, much of our analysis focuses on a comparison of settings where fee contracts belong to one of these two regimes. By keying in on such a horse race, we aim, of course, to identify conditions under which investors prefer an incentive fee environment to one with fulcrum fees or vice versa; but, more generally, we also aim to exploit the contrasts between these alternatives to extract broad insights into the role of different aspects of the fee structure in influencing equilibrium outcomes. A final section then completes the analysis by examining the alternative of an unrestricted fee structure.[2]

Our model has the following form. There are investment advisers of differing abilities who announce fee contracts (we consider two possible types

[1] We stress the point that incentive fees (or "performance fees" as they have also been called) are necessarily *asymmetric*; they reward good performance without penalizing poor performance.

[2] We focus much of our attention on incentive and fulcrum fees for two reasons. First, the choice between these two widely used structures appears more natural than an unlimited comparison, especially because it is well known that equilibrium contracts in agency models with unrestricted contracting tend to take on far more complex and sensitive forms than observed in reality. Second, the contrasts between the two systems are sharp on every dimension, enabling us to capture how and where each feature of the fee system matters.

of advisers whom we label "informed" and "uninformed"). Advisers aim to maximize expected fees, and have reservation fee levels that they must meet; in our model, these reservation fee levels may be interpreted naturally as entry costs into the industry. The fee structures announced by the advisers (a) carry implicit information about the portfolio selections advisers may make, (b) determine the division of realized returns between investor and adviser, and (c) act as signals of adviser's abilities. Taking all these factors into account, investors observe announced fee contracts and make their investment decisions. The advisers then choose portfolios, allocating the amount invested with them between the available securities, and the participant's final rewards are realized. Equilibrium is defined in the usual way. As mentioned, much of our analysis concentrates on a comparison of two settings: one where the chosen fee contracts are of the fulcrum form, and one where they are of the incentive form.

Expectedly, we find that incentive fees lead to the adoption of more risky portfolios than fulcrum fees. For instance, uninformed advisers operating in a fulcrum-fee environment select only moderately risky portfolios, but even such advisers switch to extreme—and, in a precise sense, sub-optimal—portfolios under incentive fees. Strikingly, however, we find that equilibrium investor welfare may be strictly higher under incentive fees than fulcrum fees under robust conditions. Indeed, we identify specific sets of conditions of interest under which incentive fees are actually dominant: that is, they are never worse for investor welfare than fulcrum fees, and for a range of parameterizations do strictly better. Then, extending these findings more generally, we show that incentive fees typically provide higher investor welfare whenever the uninformed adviser's reservation fee level is small (i.e., the uninformed adviser faces low entry costs), while fulcrum fees do better for the investor when this parameter is large.

What drives the possible superiority of incentive fees? The investor's equilibrium utility derives from a trade-off between two forces: the risk-sharing and portfolio selection properties of the fee structure on the one hand, and its signaling efficacy on the other. When investors are risk-averse, fulcrum fees provide better risk-sharing than incentive fees, since they transfer weight from the tails of the return distribution to its middle—they raise investor's payoffs when returns are low and lower them when they are high. Moreover, they reduce the adviser's incentive to choose overly risky portfolios. These aspects of fulcrum fees work to the investor's benefit.

Balancing this, fulcrum fees also make it easier for the informed adviser to *separate* himself from the uninformed adviser: fulcrum fees increase the downside risk to the uninformed adviser from choosing the "wrong" portfolio, and so make mimicking a more expensive proposition. Thus, fulcrum fees provide the informed adviser with the ability to set a "higher" level of fees while still inhibiting mimicking. This facilitates extraction of a greater degree of surplus utility from the investor, lowering the investor's equilibrium utility.

Thus, which fee structure delivers higher investor welfare depends on which of these forces dominates. When the uninformed adviser has a low reservation fee, the informed adviser faces only a limited ability to "increase" fees without violating the nonmimicking constraint, so the facility provided by the fee structure towards separation becomes key. The superiority of fulcrum fees in this regard also means the informed adviser is able to extract a greater degree of the investor's surplus; consequently, incentive fees become preferable from the investor's viewpoint in this case.[3] However, at high reservation utility levels, separation overall becomes easier for the informed adviser, and the facilitation of separation becomes much less important. Thus, the superior risk-sharing and portfolio-selection incentives of fulcrum fees begin to dominate, resulting in fulcrum fees being preferable from the investor's perspective.

We first verify these intuitive arguments in a model with risk-neutral investors, a setting which affords the advantage that the risk-sharing properties of the fees are irrelevant. In this case, based on the above arguments, we would expect that (i) the investor is strictly better off with incentive fees when the reservation–fee level of the uninformed adviser is small, but that (ii) the two regimes are equivalent when this level is large. This is exactly what we find (section 5.1). Building on this, we show that the arguments hold more generally even with a risk-averse investor (sections 5.2 and 5.3), though more intricate patterns may arise in the presence of very high volatility (section 5.3). Most strikingly, when the adviser cannot use leveraged strategies, incentive fees unambiguously dominate fulcrum fees from the investor's perspective regardless of risk-aversion considerations (section 5.2).

In the last part of our paper, we examine a number of modifications and extensions of our basic model. In all cases barring one, we find that our conclusions on the inferiority of fulcrum fees vis-à-vis incentive fees remain substantially unaltered. The exception arises when our imperfectly competitive market setting is replaced by one of a perfectly competitive market for advisers. We find in this setting that fulcrum fees become unambiguously superior to incentive fees from the standpoint of investor welfare. This reversal is stark but unsurprising. In a competitive market for advisers, the entire surplus from interaction accrues to the investor. This surplus is higher under fulcrum fees than incentive fees not only because fulcrum fees have better risk-sharing and portfolio-selection features, but also because they are more efficient at separation. Under imperfect competition, this last factor partially offsets the positive impact of the first two, but in a world of competitive advisers, it also works to enhance investor welfare.

[3] For example, when this reservation level is near zero, equilibrium fee levels under incentive fees must also be near zero to facilitate separation (intuitively, since incentive fees have nonnegative payoffs, any suitably high nonzero choice of fees by the informed adviser can be profitably mimicked by the uninformed adviser). Thus, almost the entire surplus here goes to the investor. Under fulcrum fees, however, by employing the "fulcrum" judiciously, downside risk can be exaggerated, facilitating both separation and extraction of the investor's surplus.

Two empirical implications of our results are worth noting. First, if one regards the mutual fund industry in the United States as a competitive one, which is reasonable, our results provide some theoretical backing for the existing legislation since they show that fulcrum fees lead to higher investor welfare in this setting than incentive fees. Second, the hedge fund industry may, also quite naturally, be viewed as an imperfectly competitive one with high entry costs. Under these circumstances, our analysis shows that investor welfare is typically lower, and the adviser's payoff typically higher, under incentive fees than fulcrum fees. Thus, advisers choosing a contracting environment (as they may in the absence of regulatory restrictions) would choose incentive fees. This is in line with the prevalence, in practice, of incentive fees in the hedge fund industry.[4]

Finally, we note an important change in perspective in our model from the traditional principal/agent approach to contracting. In the usual approach, control of the compensation contract is with the principal, i.e., the *investor* in his role as fund shareholder. In our model, the *adviser*—the "agent" in the traditional approach—controls this decision. Two factors favor our approach. First, casual empiricism suggests that it may simply be a more appropriate assumption that advisers, not investors, control the compensation contract. Mutual funds are, for example, controlled by their shareholders in principle, but in practice, the relationship between funds and advisers tends to be very close. Indeed, management companies are often responsible for establishing the funds that they advise. Second, the existence of regulations on the form of permissible fee contracts in some segments of the industry can be viewed as a tacit recognition that advisers control the choice of compensation contract. Indeed, if investors controlled this decision, restrictions on the forms of the contract can hurt, but certainly cannot enhance, investor welfare.

Concomitantly, our model also departs from the traditional framework in the role of the investor. The canonical principal/agent model does not involve a portfolio choice by the investor; rather, the typical framework involves a single fund or adviser, and focuses on the choice of compensation contract by the principal, and the adviser's response to this choice. Our study, however, seeks to capture competition among funds for the investor's dollar and the role played by the fee structure in this process. Thus, our framework involves a multiple asset/multiple fund setting in which the investor chooses with whom to invest based on a comparison of the return distributions anticipated from each alternative.

The remainder of this paper is organized as follows. Section 2 indicates the related literature. Sections 3 and 4 describe our model and the optimization problems whose solutions identify the game's equilibria. Section 5 compares equilibrium outcomes under the different fee structures. Section 6 describes

[4] These thoughts on empirical implications were motivated by the referee's comments on an earlier draft of this paper.

several extensions and modifications of our analysis. Section 7 concludes. Appendices A–D contain proofs omitted in the main body of the text.

2. Literature Review

The literature related to our paper may be divided into three main groups. First, there is the considerable body of work that has focused on the fund managers optimal reaction to a given fee structure. Papers in this vein include Kritzman (1987), Ferguson and Leistikow (1997), and Goetzmann, Ingersoll, and Ross (1998). Especially relevant here is the work of Grinblatt and Titman (1989), who examine the theoretical incentive effects of fulcrum fees compared to asymmetric incentive fees; and Davanzo and Nesbit (1987) and Grinold and Rudd (1987), who find empirical evidence for increased risk-taking in the presence of incentive fees.

A second set of papers takes a more "equilibrium" approach to the study of fee structures. For example, Admati and Pfleiderer (1997) study the desirability of benchmarking in a setting where a fund manager has superior information to the investor and faces a given fulcrum fee structure.[5] (This is in contrast to our paper where we take benchmarking as given and look at the desirability of different fee structures.) Das and Sundaram (1998) also study the questions that concern us here, but in a context with only one risky and one riskless asset, and no signaling considerations. Heinkel and Stoughton (1994) aim to explain the predominance of fraction-of-funds fees in the money management industry using a two-period model in which moral hazard and adverse selection are both present; see also Lynch and Musto (1997) who study a pure moral hazard model.

Finally, there is the literature that looks at signaling in a money management context. Huberman and Kandel (1993) study a model in which fund managers face a given flat fee structure and use portfolio selections to signal their abilities. They find that the signaling motive significantly affects manager behavior and equilibrium outcomes. Huddart (1995) too studies a model with exogenously given flat fees in which signaling of abilities is done via portfolio choices. However, Huddart also shows that the adoption of an incentive fee can mitigate undesirable reputation effects and make investors better off.

The empirical literature on incentive fees is somewhat limited. Lin (1993) finds little effect of incentive fees on performance; see also Golec (1988, 1992). A recent study by Blake, Elton, and Gruber (2001) finds that funds with incentive fees do not, on average, outperform their benchmarks, though they do better than funds without incentive fee structures. Their empirical evidence is generally supportive of the theoretical results in this paper; among other

[5] Biais and Germain (2001) look at a related question, namely, how to incentivize an informed adviser to trade in the interests of the client.

things, they find that funds with incentive fees tend to take more risk and pursue non-benchmark strategies.

3. The Model

We study a model with two fund managers/investment advisers and a representative investor. One of the advisers, whom we shall refer to as the "informed" adviser, is assumed to have superior ability at generating information concerning returns on the model's risky securities. The other adviser lacks such ability and is termed "uninformed." An adviser's type is private information and is not observable by the investor; rather, the investor must infer this information from the adviser's actions. The advisers are assumed to be risk-neutral, and have as their objective the maximization of expected fees received.[6] The reservation utility levels of the informed and uninformed adviser are denoted by π_I and π_N, respectively.

The investor, a representative stand-in for a large number of identical investors, has an initial wealth of w_0 (normalized to \$1). The investor's objective is to maximize the utility of terminal wealth $\tilde{w}$ at the end of the model's single period. We assume this utility has the mean-variance form

$$E(\tilde{w}) - \frac{1}{2}\gamma \mathrm{Var}(\tilde{w}), \tag{1}$$

where $E(\cdot)$ and $\mathrm{Var}(\cdot)$ represent, respectively, the expectation and variance operators, and $\gamma > 0$ is a parameter indicating the investor's aversion to variance.

3.1 The sequence of events

Events in our model evolve as follows. The investment advisers move first and simultaneously announce their fee structures. After observing these fee structures, the investor decides with which adviser to invest; for analytic simplicity, we assume that the investor must invest with only a single adviser.[7] Next, the informed adviser receives information concerning the return distribution on the risky securities; the uninformed adviser receives no information at this stage. Lastly, the advisers decide on their portfolio compositions, and final rewards are realized. The remainder of this section discusses these components in greater detail.

[6] While risk neutrality provides analytic tractability, the intuition behind our results appears compelling, and should not be qualitatively altered under risk aversion.

[7] Intuitively, the funds in our model may be thought of as operating in the same sector, so this assumption is not too restrictive. Allowing the investor to make an unrestricted portfolio allocation amongst the available alternatives makes the model intractable, since the investor's responses enter various decision problems [as we shall see later, notably (7) and (8)] in a central way.

Table 1
Returns distributions on the risky securities

Outcome	Prob under Π_1	Prob under Π_2
(H, H)	q	q
(H, L)	p	r
(L, H)	r	p
(L, L)	q	q

The gross returns on either of the two risky securities can take on two values, H and L. We assume $H > 1 > L$ and $H + L > 2$. The "true" joint distribution of returns is either Π_1 or Π_2; these distributions are assumed a priori equiprobable. The table above describes the probabilities of each outcome under Π_1 and Π_2. The first entry in each outcome corresponds to the return on the first security, and the second to that on the second security. The probabilities in the table are taken to satisfy (i) $p + 2q + r = 1$, (ii) $p, q, r > 0$, and (iii) $p > r$.

3.2 Securities and returns distributions

There are three securities in our model, a riskless security and two risky securities. The net return on the riskless security is normalized to zero. The "true" joint return distribution on the two risky securities is either Π_1 or Π_2; Π_1 and Π_2 are assumed equiprobable. The informed adviser knows the true distribution before making his investment decision. The uninformed adviser only knows the prior probabilities of the two distributions.

Table 1 describes our assumptions concerning these distributions. Each security follows a binomial process in which the returns are either H or L. Under Π_1, security 1 returns H with a strictly higher probability than security 2, but their roles are reversed under Π_2. The symmetry in this set-up ensures that the uninformed adviser has no return-based reason to prefer one mix of the securities to another since the a priori distribution of returns from the two securities is the same (each security returns H with probability 1/2). Of course, as we shall see below, such preferences can be induced by the fee structure in place.

3.3 Fees

The fees charged by an adviser may depend on the realized returns r_p on the adviser's portfolio, as well as on the realized returns r_b on a "target" or "benchmark" portfolio. The fees, denoted $F(r_p, r_b)$, are assumed to be received at the end of the period, and are deducted from the gross returns r_p on the adviser's portfolio. Thus, given the fee structure F and realized returns r_p and r_b, the net-of-fees return to the investor is $r_p – F(r_p, r_b)$.

The distribution of returns r_p on the adviser's portfolio depends on the composition of this portfolio. We discuss the imperatives that go into the construction of this portfolio below. We take the benchmark portfolio as exogenously given, and assume it to be a portfolio consisting of half a unit each of the two risky securities.[8]

[8] Taking the benchmark portfolio as exogenous, rather than as a strategic choice, is broadly consistent with observed reality: funds using fulcrum fees in practice tend overwhelmingly to use a widely-recognized index (such as the S&P 500) as the benchmark. See Lin (1993) or Das and Sundaram (1998).

3.4 The investor's decision

The fee structure plays three roles. First, it implies a particular division of returns between adviser and investor, and so performs a risk-sharing function. Second, it affects the adviser's portfolio selection incentives, and thereby the distribution of returns on the adviser's portfolio. Third, the selection of particular fee levels may send a signal to the investor about the type of the adviser who chooses that fee. A fee profile is *separating* if it reveals adviser types to the investor; it is *pooling* otherwise.

Taking all this into account, the investor in our model decides on the choice of adviser with whom to invest. If the fee profile chosen by the advisers is separating, the investor compares the utility obtained by investing with the informed adviser to that from investing with the uninformed adviser, and selects the adviser who delivers the higher utility of net-of-fees returns. If the fees are pooling, the investor assumes that each adviser is informed with probability 1/2, and assigns the dollar to the adviser whose net-of-fees returns (under this assumption) are more attractive. Finally, in all cases, we assume that if the investor finds the advisers equally attractive, then he randomizes between them, so each adviser receives the dollar with probability 1/2.

3.5 The advisers' portfolio choices

The final move in our model is made by the advisers selecting their portfolios. The informed adviser can condition this choice on the "true" state of the world. The uninformed adviser must choose the same portfolio in both states. In choosing their portfolios, advisers take as given the fee structure choices made earlier, and choose an allocation between the three securities that will maximize their expected fees.

We assume there is a ceiling on the maximum extent of leveraging permitted; specifically, there is $a^{\max} \geq 1$ such that the total amount invested in the risky securities cannot exceed $a^{\max}$. (The case of no leveraging corresponds to $a^{\max} = 1$.) Finally, we also assume that short positions are not permitted in the risky securities. This is only for expositional convenience; our results remain unaffected if it is replaced by a ceiling on the maximum size of short positions allowed.

3.6 Fee structures of special interest

Much of our focus in the sequel is on two natural benchmark fee structures. The first is the class of fulcrum fees, which existing regulation requires mutual funds to use. Such fees are defined by a symmetry requirement: they must increase for outperforming the benchmark in the same way they decrease for underperforming it. We restrict attention to linear fulcrum fees, which are by far the most common type used in practice. These are described by

$$F(r_p, r_b) = b_1 r_p + b_2 (r_p - r_b), \tag{2}$$

where b_1 and b_2 are nonnegative constants denoting, respectively, the base fee and the performance-adjustment component. When $b_2 = 0$, the fees are simply a constant fraction b_1 of the total returns r_p; such fees are called "flat fees" or "fraction-of-funds" fees.[9]

The second class of fees of interest is that of incentive fees. Like fulcrum fees, incentive fees are described by two parameters b_1 and b_2, with b_1 denoting the base fee level, and b_2 the performance-adjustment component. However, the performance-adjustment component in this case has an option-like form and remains nonnegative: the total fee is given by

$$F = b_1 r_p + b_2 \max\{r_p - r_b, 0\}. \tag{3}$$

As emphasized earlier, a substantial part of our analysis over the next two sections will compare the equilibrium level of the investor's utility under fulcrum fee structures to those that would obtain under incentive fee structures. To complete the analysis, the situation of unrestricted fees is studied in section 6.3 and compared to both fulcrum and incentive fees.

4. Equilibrium: A Description

This section describes the optimization problems whose solutions identify the equilibria under the two fee regimes described above. Section 4.1 deals with fulcrum fees, while section 4.2 handles incentive fees. The problems described here are used in later in the paper to compute and compare the investor's equilibrium payoffs under the two regimes. Since our focus in this paper is on separating equilibria, we avoid spurious generality and look only at this case here and in the sequel.

4.1 Equilibrium under fulcrum fees

Identifying equilibria in this multi-stage game involves a backward-induction procedure. In the first step, we identify the portfolios that would be chosen by the two advisers in the game's final stage, given an arbitrary fulcrum fee (b_1, b_2); this is accomplished in section 4.1.1. Then, in section 4.1.2, the return distributions arising from these choices are used to describe the equilibrium optimization problems for the investor and the adviser.

[9] The base fee captures that portion of the fees that are based solely on the size of assets under management. Our formulation of this component implicitly presumes that the portfolio is marked-to-market at the end of the period and fees are calculated based on asset size at this point. We could also have assumed (as was pointed out by this paper's editor) that the base fee is predicated on assets under management at the period's beginning, so $F(r_p, r_b) = b_1 + b_2(r_p - r_b)$. There is no unique resolution of this ambiguity, but it is also, happily, not a central concern since most of the "action" in the sequel is generated by the performance-dependent component b_2.

4.1.1 Portfolio choices and returns under fulcrum fees. We denote a typical portfolio choice for either adviser by (a_0, a_1, a_2), where a_0, a_1, and a_2 represent, respectively, the amounts invested in the riskless security, and the first and second risky securities. To be feasible, the vector (a_0, a_1, a_2) must satisfy (i) $a_0 + a_1 + a_2 = 1$, since the total investment must equal \$1; (ii) $a_1, a_2 \geq 0$, since short selling of the risky securities is prohibited; and (iii) $a_1 + a_2 \leq a^{\max}$, since the maximum extent of leveraging is $a^{\max}$.

Proposition 4.1 *Given any fulcrum fee* (b_1, b_2)*, the optimal portfolio choice for*:

- *the informed adviser is* $(1 - a^{\max}, a^{\max}, 0)$ *under* Π_1 *and* $(1 - a^{\max}, 0, a^{\max})$ *under* Π_2.
- *the uninformed adviser is any portfolio of the form* $(1 - a^{\max}, m, a^{\max} - m)$ *for* $m \in [0, a^{\max}]$.

Proposition 4.1 is intuitive. The informed adviser can condition his choice on whether Π_1 or Π_2 is the true distribution. Thus, regardless of the exact parameters of the fee structure, his expected fees are maximized by investing the maximum feasible amount in the superior security under that distribution (security 1 under Π_1 and security 2 under Π_2). On the other hand, the uninformed adviser receives no information concerning Π_1 and Π_2, and so has no particular grounds for preferring one risky security to the other. Since the fee structure is symmetric, he is also indifferent between any combination of the securities. We omit a formal proof of this proposition. Interested readers can find the details in our working paper [Das and Sundaram (2000)].

To proceed with the backwards induction, we must compute the ex-ante distribution of returns that would arise from investing with either adviser. For the informed adviser, this is a simple task since Proposition 4.1 identifies the contingent choice of portfolio by this adviser uniquely. For the uninformed adviser, however, there is some ambiguity, since there is a range of portfolios over which the adviser is indifferent. We assume, without loss, that he picks the portfolio among these that maximizes the investor's expected utility. (This would also maximize the chance of his receiving the investment.) A simple computation shows that this occurs when the uninformed adviser selects the risky securities in the same proportions as the market portfolio, that is, selects the portfolio $(1 - a^{\max}, a^{\max}/2, a^{\max}/2)$.

Table 2 describes the ex ante return distributions on the advisers' portfolios under these portfolio choices. From an ex ante perspective, there are eight possible states of the world: the true distribution can be either Π_1 or Π_2, and under each of these distributions, there are four possible outcomes on the risky securities $[(H, H), (H, L), (L, H)$, and $(L, L)]$. The probabilities of these states are taken from Table 1.

Now, given any choice of (b_1, b_2), the payoffs to the advisers and investor can be determined from the information in Table 2. Let $F_I(b_1, b_2)$ and $F_N(b_1, b_2)$ denote the fees received by the informed and uninformed adviser,

Table 2
Ex ante returns distributions under fulcrum fees

State	Ex ante prob.	Gross return: informed adviser	Gross return: uninformed adviser	Return on benchmark
$(\Pi_1; H, H)$	$q/2$	$1-a^{\max}+a^{\max}H$	$1-a^{\max}+a^{\max}H$	H
$(\Pi_1; H, L)$	$p/2$	$1-a^{\max}+a^{\max}H$	$1-a^{\max}+a^{\max}(H+L)/2$	$(H+L)/2$
$(\Pi_1; L, H)$	$r/2$	$1-a^{\max}+a^{\max}L$	$1-a^{\max}+a^{\max}(H+L)/2$	$(H+L)/2$
$(\Pi_1; L, L)$	$q/2$	$1-a^{\max}+a^{\max}L$	$1-a^{\max}+a^{\max}L$	L
$(\Pi_2; H, H)$	$q/2$	$1-a^{\max}+a^{\max}H$	$1-a^{\max}+a^{\max}H$	H
$(\Pi_2; H, L)$	$r/2$	$1-a^{\max}+a^{\max}L$	$1-a^{\max}+a^{\max}(H+L)/2$	$(H+L)/2$
$(\Pi_2; L, H)$	$p/2$	$1-a^{\max}+a^{\max}H$	$1-a^{\max}+a^{\max}(H+L)/2$	$(H+L)/2$
$(\Pi_2; L, L)$	$q/2$	$1-a^{\max}+a^{\max}L$	$1-a^{\max}+a^{\max}L$	L

This table describes the **ex ante** gross returns distributions under fulcrum fees on three portfolios: those of (a) the informed adviser, (b) the uninformed adviser, and (c) the benchmark. The advisers' portfolio decisions are as described in Proposition 4.1 and the discussion following it. Note that, ex ante, there are eight possible states of the world: the true return distribution can be Π_1 or Π_2, and under each of these there are four possible outcomes for the risky securities. These possibilities and their probabilities were defined in Table 1.

respectively. Similarly, let $Y_I(b_1, b_2)$ and $Y_N(b_1, b_2)$ denote the net-of-fees returns received by the investor from investing with the informed and uninformed adviser, respectively. Ex ante, of course, F_I, F_N, Y_I, and Y_N are all random variables; denote their expectations by $E[\cdot]$, and their variances by $\mathrm{Var}[\cdot]$. Then, given (b_1, b_2), the investor's utility from investing with the informed adviser is

$$U_I(b_1, b_2) = E[Y_I(b_1, b_2)] - \frac{1}{2}\gamma \mathrm{Var}[Y_I(b_1, b_2)], \tag{4}$$

while the utility from investing with the uninformed adviser is

$$U_N(b_1, b_2) = E[Y_N(b_1, b_2)] - \frac{1}{2}\gamma \mathrm{Var}[Y_N(b_1, b_2)]. \tag{5}$$

4.1.2 Separating equilibrium under fulcrum fees. For an equilibrium in this model to be separating, it must satisfy two conditions: (i) the fee structure chosen by the informed adviser must be one that the uninformed adviser would not wish to mimic, and (ii) the investor receives at least as much expected utility from investing with the informed adviser as he could from investing with the uninformed adviser. Thus, identifying a separating equilibrium requires a two step procedure. First, we look at the maximum utility the investor could obtain from the uninformed adviser, subject to the latter receiving at least his reservation expected fee level. That is, with U_N defined by (5), we solve:

$$\begin{aligned} &\text{Maximize} && U_N(b_1, b_2) \\ &\text{subject to} && E[F_N(b_1, b_2)] \geq \pi_N \\ & && b_1, b_2 \geq 0 \end{aligned} \tag{6}$$

Let U_N^* denote the maximized value of the objective function in this problem. In the second step, we look for the fee structure that maximizes the expected fee of the informed adviser subject to two constraints: providing the investor with at least his "reservation" utility level U_N^*, and ensuring the nonmimicking condition.[10]

$$\begin{aligned} \text{Maximize} \quad & E[F_I(b_1, b_2)] \\ \text{subject to} \quad & U_I(b_1, b_2) \geq U_N^* \\ & E[F_N(b_1, b_2)] \leq \pi_N \\ & b_1, b_2 \geq 0 \end{aligned} \tag{7}$$

Let EF_I^* denote the maximized value of the objective function in (7), and U_I^* the expected utility of the investor in a solution. Any solution to (7) that satisfies $EF_I^* \geq \pi_I$ is a separating equilibrium of this model.[11]

4.2 Equilibrium under incentive fees

We identify equilibrium under incentive fees in sections 4.2.1 and 4.2.2 using the same steps as under fulcrum fees. Given the similarity in the procedure, the exposition is kept brief.

4.2.1 Portfolio choices and returns under incentive fees. The adviser's optimal portfolio choices for a given incentive fee are as follows:

Proposition 4.2 *Given any incentive fee* (b_1, b_2), *the optimal portfolio choice for*:

- *the informed adviser is* $(1 - a^{\max}, a^{\max}, 0)$ *under* Π_1 *and* $(1 - a^{\max}, 0, a^{\max})$ *under* Π_2.
- *the uninformed adviser is either* $(1 - a^{\max}, a^{\max}, 0)$ *or* $(1 - a^{\max}, 0, a^{\max})$ *when* $b_2 > 0$. *If* $b_2 = 0$, *any portfolio of the form* $(1 - a^{\max}, m, a^{\max} - m)$ *for* $m \in [0, a^{\max}]$ *is optimal.*

Proposition 4.2 is also intuitive. For the informed adviser, who can condition his choice of portfolio on his knowledge of the true distribution, it is clearly optimal to invest maximally in the security which offers the best returns (security 1 under Π_1 and security 2 under Π_2). The uninformed adviser must choose the same portfolio under both Π_1 and Π_2. Given the option-like convex payoff structure of incentive fees, the optimal action for

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[10] Literally speaking, for the chosen fee to signal the informed adviser's type unambiguously, the nonmimicking constraint [the second constraint in (4.4)] should have a strict inequality. Alternatively—given that optimization problems with strict inequality constraints may have no solutions—we could replace the right-hand side of the second constraint with $\pi_N - \epsilon$ for some small $\epsilon > 0$. This would not affect the qualitative nature of our results, so we ignore these mathematical niceties.

[11] Such equilibria may, of course, fail to exist for arbitrary parameterizations (e.g., when π_I is very large relative to expected portfolio returns). For reasonable parameter values, existence is not a problem. Note that in a separating equilibrium only one fund (namely, that run by the informed adviser) will remain in the market. The other, unable to meet its reservation fee level, will exit. However, it is the threat of competition offered by the uninformed adviser that drives the equilibrium.

him is to choose a portfolio which maximizes variance of returns; since the securitie's ex ante returns are symmetric, either extreme portfolio is optimal. The only exception to this situation occurs when $b_2 = 0$. In this case, only the expected return on the chosen portfolio matters, and this is maximized by any combination of investment in the two risky securities. We do not formalize these intuitive arguments here; interested readers are referred to our working paper [Das and Sundaram (2000)].

Proposition 4.2 summarizes, in a sense, the argument behind existing regulations on fee structures that allowing for incentive fees will lead to "excessive" amounts of risk. Under fulcrum fees, as we saw, the most reasonable choice of portfolio for the uninformed adviser was one that held the risky assets in the same proportions as the benchmark. Under incentive fees, however, the uninformed adviser chooses an extreme portfolio. Crucially, unlike the informed adviser's choice, this could be the *wrong* extreme portfolio; a priori, the portfolios $(1-a^{\max}, a^{\max}, 0)$ and $(1-a^{\max}, 0, a^{\max})$ are both optimal for the uninformed adviser, but, obviously, the second one is an inferior choice under Π_1, and the first an inferior choice under Π_2. Thus, the downside protection encourages the adviser to take on extreme positions that cannot be justified by informational considerations.[12]

Using the portfolio choices given in Proposition 4.2, Table 3 describes the distribution of returns on the two adviser's portfolios under incentive fees. The table looks at the case $b_2 > 0$, and assumes, without loss of generality, that the extreme portfolio chosen by the uninformed adviser is $(1-a^{\max}, a^{\max}, 0)$. (Thus, under Π_1 the returns of the informed and uninformed adviser are the same, but under Π_2, the informed adviser does strictly better.) If $b_2 = 0$, then the informed adviser's returns are unaffected and remain as presented in this table. However, there is ambiguity in the uninformed adviser's choice in this case. As earlier, we make the natural assumption that the ambiguity is resolved in the investor's favor, so the uninformed adviser picks the symmetric portfolio $(1-a^{\max}, a^{\max}/2, a^{\max}/2)$ and his returns will be as in Table 2.

Given any (b_1, b_2), the net returns of the advisers and investor can be determined from Table 3. Let $G_I(b_1, b_2)$ and $G_N(b_1, b_2)$ denote the fees received by the informed and uninformed adviser, respectively. Similarly, let $X_I(b_1, b_2)$ and $X_N(b_1, b_2)$ denote the net-of-fees returns to the investor from investing with the informed and uninformed adviser, respectively. Denoting expectations by $E[\cdot]$ and variances by $\mathrm{Var}[\cdot]$, the investor's utility from investing with the informed adviser is

$$V_I(b_1, b_2) = E[X_I(b_1, b_2)] - \frac{1}{2}\gamma \mathrm{Var}[X_I(b_1, b_2)]. \tag{8}$$

[12] This result was subsequently supported empirically in the work of Blake, Elton, and Gruber (2001).

Table 3
Ex ante returns distributions under incentive fees

State	Ex ante prob.	Gross return: informed adviser	Gross return: uninformed adviser	Return on benchmark
$(\Pi_1; H, H)$	$q/2$	$1-a^{\max}+a^{\max}H$	$1-a^{\max}+a^{\max}H$	H
$(\Pi_1; H, L)$	$p/2$	$1-a^{\max}+a^{\max}H$	$1-a^{\max}+a^{\max}H$	$(H+L)/2$
$(\Pi_1; L, H)$	$r/2$	$1-a^{\max}+a^{\max}L$	$1-a^{\max}+a^{\max}L$	$(H+L)/2$
$(\Pi_1; L, L)$	$q/2$	$1-a^{\max}+a^{\max}L$	$1-a^{\max}+a^{\max}L$	L
$(\Pi_2; H, H)$	$q/2$	$1-a^{\max}+a^{\max}H$	$1-a^{\max}+a^{\max}H$	H
$(\Pi_2; H, L)$	$r/2$	$1-a^{\max}+a^{\max}L$	$1-a^{\max}+a^{\max}H$	$(H+L)/2$
$(\Pi_2; L, H)$	$p/2$	$1-a^{\max}+a^{\max}H$	$1-a^{\max}+a^{\max}L$	$(H+L)/2$
$(\Pi_2; L, L)$	$q/2$	$1-a^{\max}+a^{\max}L$	$1-a^{\max}+a^{\max}L$	L

This table describes the **ex ante** gross returns distributions under incentive fees on three portfolios: those of (a) the informed adviser, (b) the uninformed adviser, and (c) the benchmark. The advisers' portfolio decisions are as described in Proposition 4.2; the table assumes, without loss, that the uninformed adviser chooses the portfolio $(1-a^{\max}, a^{\max}, 0)$. The table also assumes $b_2>0$; if $b_2=0$, the informed adviser's portfolio returns remain as described in this table, but the uninformed adviser's portfolio returns are as described in Table 2. The eight possible states of the world ex ante and their probabilities are as described in Table 2.

Similarly, the investor's utility from investing with the uninformed adviser is

$$V_N(b_1,b_2)=E[X_N(b_1,b_2)]-\frac{1}{2}\gamma\mathrm{Var}[X_N(b_1,b_2)]. \tag{9}$$

4.2.2 Separating equilibrium under incentive fees. The first step in identifying a separating equilibrium is identifying the maximum utility the investor could receive from the uninformed adviser subject to the adviser receiving at least his reservation utility level. That is, we solve

$$\begin{aligned} \text{Maximize} \quad & V_N(b_1,b_2) \\ \text{subject to} \quad & E[G_N(b_1,b_2)] \geq \pi_N \\ & b_1, b_2 \geq 0 \end{aligned} \tag{10}$$

Let V_N^* denote the maximized value of the objective function in this problem. In the second step, we look for the fee structure that maximizes the expected fee of the informed adviser subject to two constraints: providing the investor with at least his "reservation" utility level V_N^*, and ensuring the nonmimicking condition.

$$\begin{aligned} \text{Maximize} \quad & E[G_I(b_1,b_2)] \\ \text{subject to} \quad & V_I(b_1,b_2) \geq V_N^* \\ & E[G_N(b_1,b_2)] \leq \pi_N \\ & b_1, b_2 \geq 0 \end{aligned} \tag{11}$$

Any solution to (11) is part of a separating equilibrium of the game under incentive fees.

5. Comparison of Equilibrium Outcomes

Our intuitive expectation of the results was outlined in the introduction. To recall the main points, we anticipate that, in general, incentive fees provide superior investor welfare at low values of the key parameter π_N while fulcrum fees do so at higher values; while, when specialized to the particular case of a risk-neutral investor, we expect incentive fees to become "dominant," providing strictly higher investor welfare than fulcrum fees at low values of π_N, and providing the same level at higher values.

These intuitive expectations are verified in several steps. First, in section 5.1, it is shown that when the investor is risk-neutral ($\gamma = 0$), incentive fees do dominate fulcrum fees in the manner anticipated. Building on this, section 5.2 then shows that even when the investor is risk-averse, incentive fees continue to dominate fulcrum fees from the investor's viewpoint in a case of particular interest: that of zero leverage ($a^{\max} = 1$). Finally, section 5.3 considers the general case of both risk-aversion and leverage, and shows, once again, that the intuitive arguments are borne out, though an additional interesting twist may also occur at high return volatilities.

5.1 A risk-neutral investor

Our analysis of the case of a risk-neutral investor ($\gamma = 0$) begins with a characterization of separating equilibrium payoffs under fulcrum fees. Denote by R_N and R_I, respectively, the gross returns from the uninformed and informed adviser in a fulcrum fee regime (see Table 2), and by R_B the return on the benchmark portfolio. Now, define the quantity T_{ff} by

$$T_{\text{ff}} = E(R_N - R_B). \tag{12}$$

The significance of the quantity T_{ff} is captured in the following result:

Proposition 5.1 *If $\pi_N < T_{\text{ff}}$, the investor's utility in a separating equilibrium under fulcrum fees is strictly higher than his "reservation" level U_N^*. If $\pi_N \geq T_{\text{ff}}$, the investor's equilibrium utility is equal to the reservation level U_N^*.*

Proof. See Appendix A. ■

In words, Proposition 5.1 states that the investor receives a surplus over his reservation level U_N^* at low values of π_N, but is forced down to the reservation level for high π_N. What drives this result? The separating equilibrium problem (7) involves two constraints: (a) that the investor must be provided at least his reservation utility level U_N^*, and (b) that the uninformed adviser's expected fee from mimicking the chosen fee structure should be below π_N. Now, as the informed adviser "increases" the level of fees in the separation problem, both constraints move closer to binding. On the one hand, the investor's expected utility from the informed adviser is pushed down towards his reservation level; on the other, mimicking is now more profitable for the uninformed adviser. For small π_N, the latter constraint will bind first; thus, the investor will receive a surplus over the reservation level. At higher values of π_N, however, the former constraint will bind first, so the investor only receives his reservation utility U_N^*.

Of course, the same intuitive arguments may also be applied to the separation problem (11) under incentive fees, and, indeed, our second result, Proposition 5.2, provides the incentive fee-analog of Proposition 5.1. Some notation first. The distribution of returns from the informed adviser and the benchmark portfolio are the same under incentive fees as under fulcrum fees (see Tables 2 and 3); thus, we continue denoting them by R_I and R_B, respectively. However, the uninformed adviser chooses different portfolios under incentive fees and fulcrum fees whenever the performance-adjustment component b_2 of the fee structure is positive (again, see Tables 2 and 3, and the accompanying discussion). To emphasize this, we will denote the returns from the uninformed adviser under incentive fees by $\mathcal{R}_N$; note that $\mathcal{R}_N$ is computed from Table 3 except in the special case $b_2 = 0$, when we use Table 2. Now, define

$$T_{\text{if}} = \frac{E[(\mathcal{R}_N - R_B)^+] \cdot [E(R_I) - E(\mathcal{R}_N)]}{E[(R_I - R_B)^+] - E[(\mathcal{R}_N - R_B)^+]} \tag{13}$$

Proposition 5.2 *If $\pi_N < T_{\text{if}}$, the investor's utility in a separating equilibrium under incentive fees is strictly higher than his "reservation" level V_N^*. However, if $\pi_N \geq T_{\text{if}}$, then the investor's utility in a separating equilibrium is equal to V_N^*.*

Proof. See Appendix B. ■

Remark. Note the important point that the intuitive arguments behind Propositions 5.1 and 5.2 make no use of risk neutrality, so, qualitatively similar results should also hold under risk aversion, i.e., the investor receives a surplus over his reservation levels at low π_N, but is forced down to the reservation levels at high π_N. ■

Here is this subsection's main result on the inferiority of fulcrum fees:

Proposition 5.3 *If $\pi_N < T_{\text{if}}$, then the investor is strictly better off under incentive fees than under fulcrum fees. If $\pi_N \geq T_{\text{if}}$, the investor's equilibrium utility is the same in the two cases.*

Proof. See Appendix C. ■

The proof of Proposition 5.3 consists of three parts. First, note that since there are no risk-sharing considerations here, the investor's reservation utility levels U_N^* and V_N^* under the two systems coincide. From Propositions 5.1 and 5.2, the investor receives this common reservation level under fulcrum fees if $\pi_N \geq T_{\text{ff}}$, and under incentive fees if $\pi_N \geq T_{\text{if}}$.

Table 4
The investor's equilibrium payoffs under risk neutrality

Panel A: $H = 1.20$, $L = 0.90$, $a^{\max} = 1.50$

π_N	0.01	0.02	0.03	0.04	0.05
U_I^*	1.1055	1.0685	1.0450	1.0350	1.0250
V_I^*	1.1288	1.1152	1.1015	1.0879	1.0742
U_N^* & V_N^*	1.0650	1.0550	1.0450	1.0350	1.0250

Panel B: $H = 1.50$, $L = 0.90$, $a^{\max} = 1.50$

π_N	0.025	0.050	0.075	0.100	0.150
U_I^*	1.3763	1.3175	1.2588	1.2000	1.1500
V_I^*	1.4010	1.3671	1.3331	1.2991	1.2312
U_N^* & V_N^*	1.2750	1.2500	1.2250	1.2000	1.1500

This table presents sample equilibrium outcomes under fulcrum and incentive fees when the investor is risk-neutral. The probabilities p, q, and r of Table 1 are fixed at 0.50, 0.15, and 0.20, respectively. As in the text, U_I^* and V_I^* are the equilibrium utility levels of the investor under fulcrum and incentive fees, respectively, while U_N^* and V_N^* are the respective reservation utility levels for the investor. In both panels, the investor's equilibrium utility under fulcrum fees is forced down to the reservation level quickly (when $\pi_N \geq 0.025$ and $\pi_N \geq 0.10$, respectively). In contrast, under incentive fees, the investor's utility level is forced down to the reservation level only for $\pi_N \geq 0.185$ and $\pi_N \geq 0.376$, respectively.

In the second step, we prove that $T_{\text{ff}} < T_{\text{if}}$, i.e., the investor is pushed down to the common reservation level faster under fulcrum fees than incentive fees. This reflects the superior facility for separation—and, thereby, for rent-extraction from the investor—provided by the "fulcrum." Combining the first two parts, we see that (a) the investor's equilibrium utility is strictly higher under incentive fees than fulcrum fees when $\pi_N \in [T_{\text{ff}}, T_{\text{if}})$, and (b) the two regimes are equivalent for the investor when $\pi_N \geq T_{\text{if}}$.

In the third and final step, we complete the proof by showing that when $\pi_N < T_{\text{ff}}$, the investor is strictly better off under incentive fees than fulcrum fees. This last step is again a consequence of the greater separation and rent-extraction capabilities of the fulcrum fee structure.

Table 4 provides a numerical illustration of equilibria under risk-neutrality. For the parameterizations used in the upper panel in the table, it is easily checked that $T_{\text{ff}} = 0.025$ and $T_{\text{if}} = 0.1845$; while, for the lower panel, we have $T_{\text{ff}} = 0.10$ and $T_{\text{if}} = 0.3764$. Thus, the investor is forced down to his reservation level far more quickly under fulcrum fees, and, as the table indicates, the resulting differences in the investor's equilibrium utilities may be substantial.

5.2 Risk-averse investors I: the case of no leverage

We turn now to the general case where $\gamma > 0$. A particular case of interest here is where no leverage is permitted in the adviser's portfolios ($a^{\max} = 1$).[13] The advantage of this setting is that closed-form solutions for the equilibria

[13] The suggestion that we examine the no-leverage case separately came from the referee.

are easily computed. Indeed, we have:

Proposition 5.4 *When* $a^{\max} = 1$, *the investor's equilibrium utility under incentive fees dominates that under fulcrum fees—i.e., it is never lower and could be strictly higher.*

Proof. Appendix D shows the "never lower" part. That the investor could be strictly better off under incentive fees is shown by the parameterizations in Table 5 (see the discussion below). ■

Remark. It is worth pointing out that the proof in Appendix D makes no use of the specific returns distributions we have assumed. ■

What drives Proposition 5.4? Consider a fulcrum fee regime first. When leverage is not permitted, the expected fee of the uninformed adviser is unaffected by the performance-adjustment component b_2, since the expected return on his portfolio equals the expected return on the benchmark portfolio. Thus, in a fulcrum fee regime, the informed adviser may change the value of b_2 without affecting the nonmimicking constraint. It follows that, in equilibrium, b_2 will be raised high enough to ensure the investor only receives his reservation level U_N^*.

Under incentive fees, however, this is not the case. Here, because of the asymmetric nature of the fees, the performance-adjustment component b_2 has a positive impact on the expected fees of the uninformed adviser whenever the uninformed adviser does not choose the benchmark portfolio. As a consequence, any attempt by the informed adviser to extract investor surplus by raising b_2 will also affect the nonmimicking constraint. This limits the extent to which investor surplus can be reduced, so the investor's equilibrium utility will typically strictly exceed his reservation level V_N^*. (Note the interesting point here that the "adverse" portfolio effect of incentive fees—namely, the fact that incentive fees will induce even the uninformed adviser to choose an extreme portfolio—actually works to the investor's advantage!) To complete the proof, we show that, if there is no leveraging, then U_N^* can never exceed V_N^*.

Table 5 gives numerical expression to the superiority of incentive fees in this case. The parameterizations used are similar to those in Table 2 except that (i) leverage is not permitted here, so we have $a^{\max} = 1$, and (ii) the investor is risk-averse, so we allow for $\gamma > 0$. As expected, the investor always receives only his reservation fee under fulcrum fees; however, under incentive fees, he receives a strict surplus over the reservation level. As π_N increases, the investor is pushed down towards his reservation level even under incentive fees (for the reasons discussed in the previous subsection); thus, the extent of dominance of incentive fees also declines.[14]

[14] The parameters in this table are similar to those used for illustration in the rest of the paper. Larry Glosten, this paper's editor, pointed out that these numbers imply a slim negative correlation in the returns on the two risky securities, which increases the value of the diversification generated by fulcrum fees. This makes it all the more striking that incentive fees could lead to higher investor welfare than fulcrum fees even when investors are risk-averse, the case we consider later in the paper.

Table 5
Separating equilibrium outcomes with no leverage

Panel A: $H = 1.20$, $L = 0.90$, $\gamma = 0.50$

π_N	0.01	0.02	0.03	0.04	0.05
U_I^*	1.0383	1.0284	1.0184	1.0084	0.9985
V_I^*	1.0763	1.0626	1.0488	1.0349	1.0209
U_N^*	1.0383	1.0284	1.0184	1.0084	0.9985
V_N^*	1.0383	1.0284	1.0184	1.0084	0.9985

Panel B: $H = 1.50$, $L = 0.90$, $\gamma = 1.00$

π_N	0.025	0.050	0.075	0.100	0.150
U_I^*	1.1621	1.1376	1.1131	1.0887	1.0397
V_I^*	1.2202	1.1901	1.1587	1.1260	1.0568
U_N^*	1.1621	1.1376	1.1131	1.0887	1.0397
V_N^*	1.1621	1.1376	1.1131	1.0887	1.0397

This table presents sample separating equilibrium outcomes under fulcrum and incentive fees when leverage is disallowed. The probabilities p, q, and r of Table 1 are fixed at 0.50, 0.15, and 0.20, respectively. As in the text, U_I^* and V_I^* are the equilibrium utility levels of the investor under fulcrum and incentive fees, respectively, while U_N^* and V_N^* are the respective reservation utility levels for the investor.

5.3 Risk-averse investors II: the general case

We now turn to the general case where $a > 1$ and $\gamma > 0$ are both permitted.

5.3.1 Separating equilibria under fulcrum fees. When $\gamma > 0$ and $a^{\max} > 1$, general solutions to the separation problems (6) and (7) are hard to obtain, because of the large number of parameters involved. For any specific parameterization, however, these problems present no special obstacles. The first one has a particularly simple structure: the objective function is quadratic and the constraint is linear in (b_1, b_2). The second problem is only a little more complex: it has a linear objective, and although it has two constraints, one is linear and the other quadratic. Consequently, for specific parameterizations, these problems are easily solved. Table 6 presents the investor's equilibrium utility level U_I^* and "reservation" utility level U_N^* for a range of parameter values. The numbers behave much as expected. In particular, in all cases, for small values of π_N, the investor receives a surplus over his reservation utility level but for higher values, he is pushed down to his reservation level.

5.3.2 Separating equilibria under incentive fees. The reservation utility problem (10) under incentive fees is a little more complex than its counterpart (6) under fulcrum fees, since there are two possible distributions for G_N and X_N depending on the value of (b_1, b_2). Thus, we must compare the maximum conditional on $b_2 > 0$ with the maximum conditional on $b_2 = 0$. The larger of these is the "reservation" utility level V_N^*.

The added complication is minor; for specific parameterizations, problems (10) and (11) are easy to solve. Table 7 presents the investor's equilibrium utility level V_I^* and reservation utility level V_N^* for the range of parameter values used in Table 6. Once again, as π_N increases, the investor's equilibrium

Table 6
Investor's equilibrium payoffs under fulcrum fees

Panel A: $H = 1.20,\ L = 0.90,\ \gamma = 0.50$

π_N	0.01	0.02	0.03	0.04	0.05
U_I^*	1.0999	1.0661	1.0436	1.0342	1.0246
U_N^*	1.0621	1.0530	1.0436	1.0342	1.0246

Panel B: $H = 1.20,\ L = 0.90,\ \gamma = 1.00$

π_N	0.01	0.02	0.03	0.04	0.05
U_I^*	1.0942	1.0638	1.0423	1.0333	1.0242
U_N^*	1.0593	1.0509	1.0423	1.0333	1.0242

Panel C: $H = 1.20,\ L = 0.90,\ \gamma = 2.00$

π_N	0.01	0.02	0.03	0.04	0.05
U_I^*	1.0830	1.0591	1.0395	1.0317	1.0233
U_N^*	1.0536	1.0468	1.0395	1.0317	1.0233

Panel D: $H = 1.50,\ L = 0.90,\ \gamma = 0.50$

π_N	0.025	0.050	0.075	0.100	0.150
U_I^*	1.3461	1.2992	1.2483	1.1933	1.1462
U_N^*	1.2622	1.2395	1.2165	1.1933	1.1462

Panel E: $H = 1.50,\ L = 0.90,\ \gamma = 1.00$

π_N	0.025	0.050	0.075	0.100	0.150
U_I^*	1.3160	1.2810	1.2378	1.1865	1.1424
U_N^*	1.2495	1.2289	1.2079	1.1865	1.1424

Panel F: $H = 1.50,\ L = 0.90,\ \gamma = 2.00$

π_N	0.025	0.050	0.075	0.100	0.150
U_I^*	1.2557	1.2444	1.2169	1.1730	1.1348
U_N^*	1.2240	1.2078	1.1908	1.1730	1.1348

This table presents sample separating equilibrium outcomes under fulcrum fees. The probabilities p, q, and r of Table 1 are fixed at 0.50, 0.15, and 0.20, respectively, and the maximum leverage allowed at $a^{\max} = 1.50$. A range of values is considered for the remaining parameters H, L, γ and π_N. As usual, U_I^* and U_N^* are the investor's equilibrium and "reservation" utility levels.

utility level drops towards the reservation level. However, unlike the fulcrum fee case, the investor's equilibrium utility level remains strictly above the reservation level for the parameter values in the table; that is, the investor gets pushed down to his reservation level more slowly under incentive fees than fulcrum fees.

5.3.3 Comparison of outcomes. A perusal of Tables 6 and 7 immediately substantiates the intuitive arguments stated in the Introduction and elsewhere in the paper. In particular:

1. The investor's "reservation" utility level U_N^* under fulcrum fees is higher in each case than the level V_N^* under incentive fees, indicating the superior risk-sharing and portfolio-selection features of the former.

Table 7
Investor's equilibrium payoffs under incentive fees

Panel A: $H = 1.20$, $L = 0.90$, $\gamma = 0.50$

π_N	0.01	0.02	0.03	0.04	0.05
V_I^*	1.1184	1.1057	1.0930	1.0802	1.0673
V_N^*	1.0613	1.0513	1.0414	1.0315	1.0215

Panel B: $H = 1.20$, $L = 0.90$, $\gamma = 1.00$

π_N	0.01	0.02	0.03	0.04	0.05
V_I^*	1.1079	1.0962	1.0844	1.0724	1.0604
V_N^*	1.0575	1.0477	1.0378	1.0280	1.0181

Panel C: $H = 1.20$, $L = 0.90$, $\gamma = 2.00$

π_N	0.01	0.02	0.03	0.04	0.05
V_I^*	1.0869	1.0772	1.0672	1.0570	1.0465
V_N^*	1.0501	1.0404	1.0306	1.0209	1.0112

Panel D: $H = 1.50$, $L = 0.90$, $\gamma = 0.50$

π_N	0.025	0.050	0.075	0.100	0.150
V_I^*	1.3601	1.3310	1.3014	1.2715	1.2105
V_N^*	1.2604	1.2360	1.2115	1.1871	1.1391

Panel E: $H = 1.50$, $L = 0.90$, $\gamma = 1.00$

π_N	0.025	0.050	0.075	0.100	0.150
V_I^*	1.3192	1.2948	1.2967	1.2438	1.1899
V_N^*	1.2458	1.2219	1.1980	1.1741	1.1262

Panel F: $H = 1.50$, $L = 0.90$, $\gamma = 2.00$

π_N	0.025	0.050	0.075	0.100	0.150
V_I^*	1.2374	1.2226	1.2063	1.1885	1.1485
V_N^*	1.2166	1.1938	1.1711	1.1482	1.1025

This table presents sample separating equilibrium outcomes under incentive fees. The probabilities p, q, and r of Table 1 are fixed at 0.50, 0.15, and 0.20, respectively, and the maximum leverage allowed at $a^{\max} = 1.50$. A range of values is considered for the remaining parameters H, L, γ and π_N. As usual, V_I^* and V_N^* are the investor's equilibrium and "reservation" utility levels.

2. The investor in each case gets pushed down to his reservation utility faster under fulcrum fees than under incentive fees.

To facilitate a direct comparison of the investor's equilibrium payoffs under the two regimes, Table 8 distills just these payoffs from the information in Tables 6 and 7. The first five panels of the table behave exactly as expected: the investor's equilibrium utility under incentive fees is higher than that under fulcrum fees, but this difference diminishes as π_N increases. Moreover, although the tables do not show this, as π_N becomes large enough, fulcrum fees begin to dominate as the investor gets pushed down to reservation under either regime. Thus, for "small" π_N, the adviser is better off under fulcrum fees than incentive fees, but this is reversed at high π_N.

Table 8
Comparison of investor's equilibrium payoffs

Panel A: $H = 1.20$, $L = 0.90$, $\gamma = 0.50$

π_N	0.01	0.02	0.03	0.04	0.05
U_I^*	1.0999	1.0661	1.0436	1.0342	1.0246
V_I^*	1.1184	1.1057	1.0930	1.0802	1.0673

Panel B: $H = 1.20$, $L = 0.90$, $\gamma = 1.00$

π_N	0.01	0.02	0.03	0.04	0.05
U_I^*	1.0942	1.0638	1.0423	1.0333	1.0242
V_I^*	1.1079	1.0962	1.0844	1.0724	1.0604

Panel C: $H = 1.20$, $L = 0.90$, $\gamma = 2.00$

π_N	0.01	0.02	0.03	0.04	0.05
U_I^*	1.0830	1.0591	1.0395	1.0317	1.0233
V_I^*	1.0869	1.0772	1.0672	1.0570	1.0465

Panel D: $H = 1.50$, $L = 0.90$, $\gamma = 0.50$

π_N	0.025	0.050	0.075	0.100	0.150
U_I^*	1.3461	1.2992	1.2483	1.1933	1.1462
V_I^*	1.3601	1.3310	1.3014	1.2715	1.2105

Panel E: $H = 1.50$, $L = 0.90$, $\gamma = 1.00$

π_N	0.025	0.050	0.075	0.100	0.150
U_I^*	1.3160	1.2810	1.2378	1.1865	1.1424
V_I^*	1.3192	1.2948	1.2967	1.2438	1.1899

Panel F: $H = 1.50$, $L = 0.90$, $\gamma = 2.00$

π_N	0.025	0.050	0.075	0.100	0.150
U_I^*	1.2557	1.2444	1.2169	1.1730	1.1348
V_I^*	1.2374	1.2226	1.2063	1.1885	1.1485

This table summarizes the equilibrium payoffs for the investor under fulcrum fees and incentive fees presented in Tables 6 and 7, respectively. The parameter configurations are as presented in those tables. U_I^* and V_I^* represent, respectively, the separating equilibrium payoffs under fulcrum fees and incentive fees.

An interesting twist, however, is observed in the last panel of the table. Rather than incentive fees being dominant for investor welfare at all small π_N, fulcrum fees are initially dominant (see, e.g., $\pi_N = 0.025$), but as π_N increases, incentive fees become superior. Intuitively, the superiority of fulcrum fees for investor welfare at very low π_N appears to be the feature that for the parameter values considered in this panel, return volatility is very high given the investor's aversion to variance. This makes risk sharing very important. Although fulcrum fees permit more surplus extraction than incentive fees, they also permit better risk-sharing. At very low values of π_N, overall surplus extraction capability under either regime is limited, so the superior risk sharing under fulcrum fees results in their providing better investor welfare. At interim values of π_N, however, the greater surplus extraction facilitated by the fulcrum outweighs the risk sharing features, so incentive fees become dominant. As in the earlier cases, at very high values of π_N (not shown in the table), fulcrum fees will again be better for the investor, and again for the same reason: at very high π_N, the investor gets pushed down to his reservation level under both regimes and this reservation level is higher under fulcrum fees for reasons mentioned above.

6. Extensions and Modifications

In this section, we examine a number of extensions and modifications to our model. We begin in section 6.1 with examining the impact of providing the investor with other natural investment alternatives. In section 6.2, we look at a simpler (and more traditional) signaling model than the one studied in this paper. Then, in section 6.3, we compare fulcrum and incentive fee outcomes to those under an unrestricted fee structure. Finally, to round off the analysis, we look in section 6.4 at a competitive market setting for advisers.

6.1 Expanding the investment alternatives

The analysis thus far has assumed that there are just three investment alternatives available to the investor, namely, the two advisers and the riskless asset. A natural addition to consider to this list is an "index fund" that provides the same returns as the benchmark portfolio. From an analytic standpoint, this adds a third constraint to the separation problem: that the utility from investing with the informed adviser must also be at least that from investing in the index.

It is easily shown that this does not affect our results substantively. Fix any value of π_N, and, as usual, let U_N^* and V_N^* denote the investor's "reservation" utility levels obtained from the problems (6) and (10), respectively. For expositional simplicity, we will assume that $U_N^* \geq V_N^*$ (as will typically be the case). In addition, let U^I denote the utility from the index. Three possibilities arise:

1. $V_N^* \geq U^I$.
2. $U_N^* \geq U^I > V_N^*$.
3. $U^I > U_N^*$.

Suppose now that when the new constraint is not present, the equilibria are such that the investor's equilibrium utility is higher under incentive fees than fulcrum fees. Then, in cases 1 and 2, adding the new constraint cannot change equilibrium payoffs: the equilibrium utility under fulcrum fees must be at least U_N^*, and, by hypothesis, the equilibrium utility under incentive fees is at least that under fulcrum fees. Thus, the new constraint is irrelevant in these cases.[15] In case 3 alone, this may not be true: equilibrium utility levels

[15] Note the important and relevant point that incentive fees are likely to dominate fulcrum fees for small π_N, and it is precisely for small values of π_N that we would expect cases 1 or 2 to hold.

under both regimes may now be affected. However, a moment's reflection shows that only two possibilities result as a consequence: either the strict dominance of incentive fees continues to obtain, or the investor's utility under either regime equals that from the index.

Analogous arguments show that if fulcrum fees originally provided superior investor utility, adding the third constraint will again result in either continued dominance of fulcrum fees or indifference between the index and either regime. Thus, the new constraint potentially creates new payoff patterns, but it does not alter much else.

6.2 An alternative signaling framework

The model studied in this paper considers a setting where there are two advisers available to the investor, but it is not known which is the informed one. A more traditional signaling-game approach is to use a simpler setting in which there is just a single adviser whose type is unknown to the investor. The separation problem then involves the nonmimicking constraint (as we have it in this paper) and a "reservation utility" constraint that investing with the adviser must provide the investor with at least as much utility as some exogenous alternative (e.g., an index fund).

How does this affect our conclusions? When π_N is small, the nonmimicking constraint will, as usual, be the binding one that restricts how high fees can be raised. The greater surplus extraction facilitated by fulcrum fees in this case means that incentive fees will typically provide a higher level of investor welfare. For higher π_N, the investor would be forced down to the reservation utility level, but this is now independent of the fee regime in place. Thus, in this simpler setting, a stronger version of our conclusion will typically obtain: either incentive fees provide superior investor welfare, or the two regimes are equivalent from the investor's perspective.

6.3 Unrestricted fee structures

Thus far in the paper, we have restricted attention to fulcrum and incentive fee structures. This restriction was motivated by multiple considerations: the mutual-fund regulation that requires the use of fulcrum fees, the widespread use of incentive fee structures in practice (where permitted), and, not least, the fact that unrestricted equilibrium contracts in theoretical agency models tend to be unrealistically complex. It is of interest, nonetheless, to see how investor utility under fulcrum and incentive fee structures compare with that in an unrestricted environment.

So suppose the fee structure is unrestricted. Consider first the "reservation utility" problem of identifying the maximum utility obtainable from the uninformed adviser. In this problem, it is clearly optimal for the risk-neutral adviser to assume all the risk leaving the risk-averse investor with a certainty payoff. Since the expected fee of the uninformed adviser must be at least π_N, it is immediate that the maximum utility level the investor can obtain from the uninformed adviser, denoted W_N^* say, is given by $W_N^* = E(R_N) - \pi_N$.

Now consider the separation problem in an unrestricted environment. Since there are only two constraints, it is immediate that in any solution to this problem, the investor will be pushed down to his reservation utility level W_N^*. Thus, the investor's equilibrium utility in an unrestricted setting is itself W_N^*, and the question becomes: how does W_N^* compare to equilibrium utility levels under fulcrum and/or incentive fees?

When π_N is large, the investor receives only his reservation utility levels U_N^* and V_N^* under the two regimes. Now, we must always have $W_N^* \geq \max\{U_N^*, V_N^*\}$, since the solution to the reservation utility problem cannot be improved by adding restrictions to the fee structure. Thus, in all circumstances where the investor only receives his reservation utility under a given fee regime, his welfare would be higher under an unrestricted fee regime.

On the other hand, when π_N is small, equilibrium utility levels under either regime will strictly exceed the respective reservation level. In such circumstances, it is easy to see that equilibrium utility levels under either regime may also exceed W_N^*, so the unrestricted setting may now understate equilibrium investor welfare compared to either regime. A particular example where this occurs is the parameterization $H = 1.5$, $L = 0.9$, $a^{\max} = 1.5$, with the probabilities being as in Tables 6 or 7. A simple calculation shows that $W_N^* = 1.30 - \pi_N$. For $\gamma = 0.5$ or $\gamma = 1$ and for $\pi_N \leq 0.075$, the tables show that W_N^* is strictly less than the equilibrium utility levels under fulcrum or incentive fees.

6.4 A competitive model

We have assumed thus far an imperfectly competitive market environment for informed advisers in which the latter are able to extract part or all of the surplus from the investor. We examine in this subsection the consequences of assuming this market to be competitive, i.e., of assuming that all the surplus now accrues to the investor.

To identify equilibrium outcomes under a fulcrum fee regime when the market for informed advisers is competitive, we solve the following optimization problem:

$$\begin{aligned} \text{Maximize} \quad & U_I(b_1, b_2) \\ \text{subject to} \quad & E[F_N(b_1, b_2)] \leq \pi_N \\ & E[F_I(b_1, b_2)] \geq \pi_I \\ & b_1, b_2 \geq 0 \end{aligned} \tag{14}$$

The first constraint ensures separation of the adviser types, while the second constraint ensures that the informed adviser nets at least his reservation fee level. Subject to these considerations, the optimization problem ensures that the surplus utility all accrues to the investor. Equilibrium outcomes under incentive fees are identified analogously, with the obvious changes in (14).

A little reflection shows that under these competitive market conditions, fulcrum fees must do better than incentive fees for the investor. On the one

Table 9
Equilibrium outcomes with competitive advisers

$H = 1.20,\ L = 0.90,\ \gamma = 0.50$

π	0.01	0.02	0.03	0.04	0.05
U_I^*	1.1228	1.1145	1.1060	1.0972	1.0883
V_I^*	1.1218	1.1125	1.1032	1.0939	1.0845

$H = 1.50,\ L = 0.90,\ \gamma = 1.00$

π_N	0.025	0.050	0.075	0.100	0.150
U_I^*	1.3324	1.3205	1.3071	1.2922	1.2581
V_I^*	1.3255	1.3078	1.2897	1.2711	1.2329

This table presents equilibrium investor utility levels under fulcrum and incentive fees when the market for informed advisers is competitive. The parameterizations are identical to earlier tables; for example, the probabilities p, q, and r of Table 1 are fixed at 0.50, 0.15, and 0.20, respectively, and the maximum leverage allowed at $a^{\max} = 1.50$. As usual, U_I^* and V_I^* are the investor's equilibrium utility levels under fulcrum and incentive fees, respectively.

hand, fulcrum fees possess superior risk-sharing and portfolio-selection properties. On the other hand, they make the problem of separation easier. In an imperfectly competitive world, the latter consideration worked to reduce investor welfare; here, it is unambiguously to the good.

Table 9 provides a numerical illustration of these arguments. The table shows competitive equilibrium outcomes under the two regimes for the same range of parameterizations used earlier in the paper. As anticipated, fulcrum fees provide superior investor welfare across the board, including, in particular, parameterizations where incentive fees provided superior investor welfare under imperfect competition.

7. Conclusion

The fee structure adopted by an investment adviser plays three roles: (i) it influences trading behavior and portfolio choice by affecting investment adviser incentives, (ii) it determines the distribution of returns between investor and adviser and ipso facto serves a risk-sharing function, and (iii) it may be used as a device for signaling ability. Our paper describes a multisecurity, multifund model in which all three factors are present, and uses this to compare investor welfare under two regimes: symmetric “fulcrum” fees (which are mandated by law for the mutual fund industry) and asymmetric “incentive” fees (which are commonly used in practice where permitted, and which, it is suggested, induce advisers to take “excessive” risk).

In a break from the traditional approach, the choice of fee structure in our model is made not by the investor, but by the investment adviser, who also selects the risk profile of the fund's portfolio. Investors respond to these decisions by making portfolio decisions. We identify and characterize general conditions in this model under which the use of incentive fees results in superior investor welfare compared to fulcrum fees. The existence of such conditions is particularly striking since incentive fees have, in general, poorer risk-sharing properties than fulcrum fees, and also a definite adverse impact on portfolio choice.

Finally, we examine a number of extensions and modifications of our model. Our conclusions remain largely unchanged qualitatively except in one important case. When the market for advisers is perfectly competitive, we find that fulcrum fees emerge as unambiguously superior to incentive fees for investor welfare.

Appendix A: Proof of Proposition 5.1

We prove the result by deriving the equilibrium payoffs under a fulcrum fee regime. Let EF_I^* denote the informed adviser's equilibrium expected fee, U_I^* denote the investor's equilibrium expected utility, and U_N^* the investor's "reservation" utility defined via (6). We will show that

$$\left.\begin{aligned} EF_I^* &= \frac{E(R_I - R_B)}{E(R_N - R_B)}\pi_N \\ U_I^* &= E(R_I) - EF_I^* \end{aligned}\right\} \qquad \text{if } \pi_N < T_{\text{ff}} \tag{A.1}$$

$$\left.\begin{aligned} EF_I^* &= E(R_I - R_N) + \pi_N \\ U_I^* &= E(R_N) - \pi_N \end{aligned}\right\} \qquad \text{if } \pi_N \geq T_{\text{ff}} \tag{A.2}$$

$$U_N^* = E(R_N) - \pi_N, \qquad \text{for all } \pi_N. \tag{A.3}$$

First, observe that when the investor is risk-neutral, we must have $E(U_N) + E(F_N) = E(R_N)$ and $E(U_I) + E(F_I) = E(R_I)$. From the first expression, it is immediate that any solution to the investor's "reservation utility" problem (6) results in $U_N^* = E(R_N) - \pi_N$, whence (A.3) follows. To prove the rest, we substitute these expressions into the separation problem (7), and use the full forms for the expected fees $EF_I = b_1 E(R_I) + b_2 E(R_I - R_B)$ and $EF_N = b_1 E(R_N) + b_2 E(R_N - R_B)$. After some rearranging, the separation problem (7) now becomes

$$\begin{aligned} \text{Maximize} \quad & b_1 E(R_I) + b_2 E(R_I - R_B) \\ \text{subject to} \quad & b_1 E(R_N) + b_2 E(R_N - R_B) \leq \pi_N \\ & b_1 E(R_I) + b_2 E(R_I - R_B) \ \leq \pi_N + E(R_I) - E(R_N) \\ & b_1, b_2 \geq 0 \end{aligned} \tag{A.4}$$

When $b_2 = 0$, the first constraint imposes an upper bound on b_1 of $\pi_N / E\ (R_N)$, while the second constraint imposes an upper-bound on b_1 of $[\pi_N + E(R_I) - E(R_N)]/E(R_I)$. A simple calculation shows that the first bound is smaller than the second whenever $\pi_N \leq E(R_N)$. This latter inequality must hold in any sensible definition of the problem: the reservation fee cannot be greater than the total expected returns. Thus, at $b_2 = 0$, the second constraint is always slack.

When $b_1 = 0$, the first constraint imposes an upper-bound on b_2 of $\pi_N / E\ (R_N - R_B)$, while the second constraint imposes an upper-bound of $[\pi_N + E(R_I) - E(R_N)]/E(R_I - R_B)$. The first of these bounds is smaller if, and only if, $\pi_N < E(R_N - R_B)$, which may or may not hold.

To sum up, there are two possibilities:

1. If $\pi_N < E(R_N - R_B)$, the second constraint is always slack, so the feasible set of fee parameters is determined by the first constraint. This case is illustrated in Figure A1. Given the linear objective function, the solution must lie on the first constraint at $b_1 = 0$ or at $b_2 = 0$. An easy computation shows that the maximum in problem (A.4) occurs when $b_1 = 0$, leading to the equilibrium payoffs (A.1).

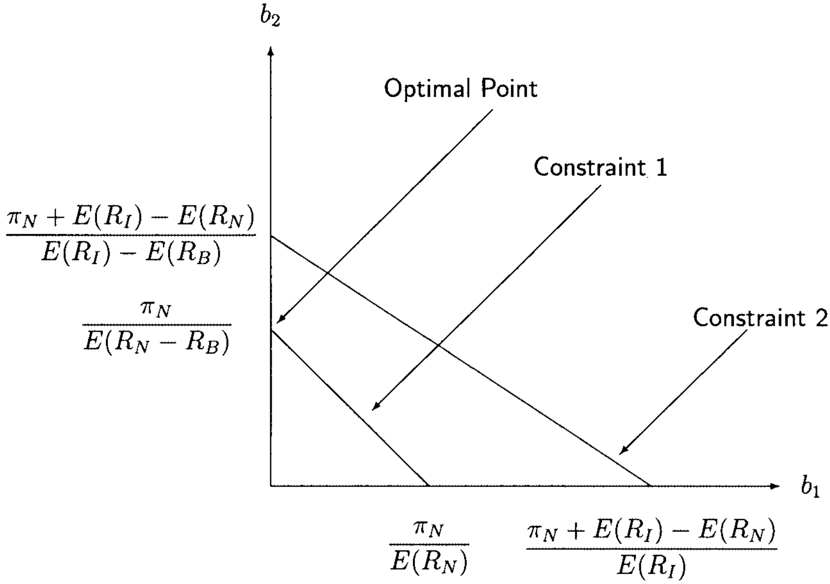

Figure A1
The separation problem (A.4) when π_N is low
This figure depicts the optimization problem (A.4) for the informed adviser in the case where $\pi_N < E(R_N - R_B)$. As explained in the text, only Constraint 1 is binding in this case.

2. If $\pi_N \geq E(R_N - R_B)$, the second constraint is also relevant in determining the feasible set. This case is illustrated in Figure A2. One solution to the problem (there are many as the figure shows) is $b_1 = [\pi_N - E(R_N - R_B)]/E(R_B)$ and $b_2 = 1 - b_1$. This leads to the payoffs (A.2).

This completes the proof of Proposition 5.1. ■

Appendix B: Proof of Proposition 5.2

The proof of Proposition 5.2 follows similar steps to the proof of Proposition 5.1. Let EG_I^* denote the informed adviser's equilibrium expected fee under incentive fees, V_I^* denote the investor's equilibrium expected utility, and V_N^* the investor's "reservation" utility defined via (6). We will show that

$$\left.\begin{aligned} EG_I^* &= \frac{E[(R_I - R_B)^+]}{E[(\mathcal{R}_N - R_B)^+]}\pi_N \\ V_I^* &= E(R_I) - EG_I^* \end{aligned}\right\}. \qquad \text{if } \pi_N < T_{\text{if}} \tag{B.1}$$

$$\left.\begin{aligned} EG_I^* &= E(R_I) - E(\mathcal{R}_N) + \pi_N \\ V_I^* &= E(\mathcal{R}_N) - \pi_N \end{aligned}\right\} \qquad \text{if } \pi_N \geq T_{\text{if}} \tag{B.2}$$

$$V_N^* = E(\mathcal{R}_N) - \pi_N, \qquad \text{for all } \pi_N. \tag{B.3}$$

Note first that the "reservation utility" V_N^* is equal to $E(\mathcal{R}_N) - \pi_N$ for the same reason as in Proposition 5.1. Thus, we only have to show that the remaining values follow from the separation

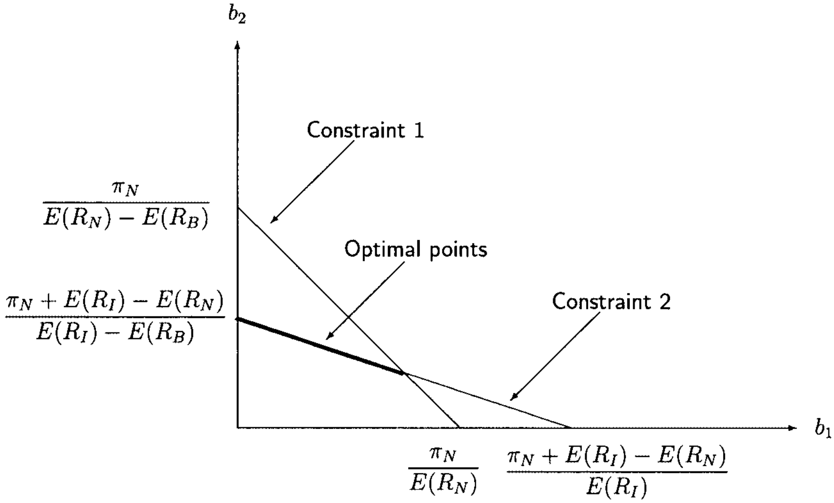

Figure A2
The separation problem (A.4) when π_N is high
This figure depicts the optimization problem (A.4) for the informed adviser in the case where $\pi_N \geq E(R_N - R_B)$. As explained in the text, now both constraints are relevant in determining the feasible set.

problem (11). To this end, note that the separation problem in this case may be rewritten as

$$\begin{array}{ll} \text{Maximize} & b_1 E(R_I) + b_2 E[(R_I - R_B)^+] \\ \text{subject to} & b_1 E(\mathcal{R}_N) + b_2 E[(\mathcal{R}_N - R_B)^+] \leq \pi_N \\ & b_1 E(R_I) + b_2 E[(R_I - R_B)^+] \quad \leq \pi_N + E(R_I) - E(R_N) \\ & b_1, b_2 \geq 0 \end{array} \tag{B.4}$$

When $b_2 = 0$, the first constraint implies an upper bound on b_1 of $\pi_N / E[\mathcal{R}_N]$, while the second constraint implies an upper-bound of $[\pi_N + E(R_I) - E(\mathcal{R}_N)]/E[R_I]$. The first of these bounds is smaller than the second if and only if $\pi_N \leq E[\mathcal{R}_N]$, which must hold in any sensible definition of the problem. Consequently, the second constraint is always slack when $b_2 = 0$.

When $b_1 = 0$, the first constraint implies an upper bound on b_2 of $\pi_N / E[(\mathcal{R}_N - R_B)^+]$, while the second constraint implies an upper bound of $[\pi_N + E(R_I) - E(\mathcal{R}_N)]/E[(R_I - R_B)^+]$. It is easily checked that the first of these bounds is smaller than the second if and only if $\pi_N \leq T_{\text{if}}$.

Combining these observations, we have the following. If $\pi_N \leq T_{\text{if}}$, the second constraint is always slack in problem (B.4). Given the linear objective function, the solution must lie on the first constraint at $b_1 = 0$ or at $b_2 = 0$, and an easy computation shows that the solution is at $b_1 = 0$ with the payoffs given by (B.1). If $\pi_N > T_{\text{if}}$, then the second constraint is also binding in equilibrium, and one solution to the problem (there are many) leads to the equilibrium payoffs given in (B.2). ■

Appendix C: Proof of Proposition 5.3

The steps of the proof were outlined in the text following the statement of the proposition. The first of these steps—that the investor receives the same "reservation" utility under fulcrum as incentive fees—was accomplished in the course of the proofs of Propositions 5.2–5.3. We fill in the remaining details here, namely that (a) it must be that $T_{\text{if}} > T_{\text{ff}}$, and (b) when $\pi_N < T_{\text{ff}}$, the investor is strictly better off in a separating equilibrium under incentive fees.[16]

To see (a), recall that

$$T_{\text{ff}} = E(R_N - R_B).$$

$$T_{\text{if}} = \frac{E[(\mathscr{R}_N - R_B)^+] \cdot [E(R_I) - E(\mathscr{R}_N)]}{E[(R_I - R_B)^+] - E[(\mathscr{R}_N - R_B)^+]}$$

Cross-multiplying, using the fact that $E(\mathscr{R}_N) = E(R_N)$, and rearranging, we see that $T_{\text{if}} > T_{\text{ff}}$ if and only if

$$\frac{E[(R_I - R_B)^+]}{E[R_I - R_B]} < \frac{E[(\mathscr{R}_N - R_B)^+]}{E[\mathscr{R}_N - R_B]}. \tag{C.1}$$

Substituting for the expectations from Table 3, a bit of algebra shows that

$$E[(R_I - R_B)^+] = E[(\mathscr{R}_N - R_B)^+] + \frac{1}{2}(p-r)[1 - a^{\max} + a^{\max}H - (H+L)/2]$$

$$E[(R_I - R_B)] = E[\mathscr{R}_N - R_B] + \frac{1}{2}(p-r)[a^{\max}(H-L)].$$

Thus, (A.9) holds if and only if

$$\left[\frac{E[(\mathscr{R}_N - R_B)^+] + \frac{1}{2}(p-r)[1 - a^{\max} + a^{\max}H - (H+L)/2]}{E[\mathscr{R}_N - R_B] + \frac{1}{2}(p-r)[a^{\max}(H-L)]}\right] < \frac{E[(\mathscr{R}_N - R_B)^+]}{E[\mathscr{R}_N - R_B]} \tag{C.2}$$

which is the same thing as requiring that

$$\frac{E[(\mathscr{R}_N - R_B)^+]}{E[\mathscr{R}_N - R_B]} > \frac{1 - a^{\max} + a^{\max}H - (H+L)/2}{a^{\max}(H-L)}. \tag{C.3}$$

The left-hand side of (C.3) is strictly greater than unity. Thus, the proof will be complete if we show that the right-hand side is strictly less than unity. Since $L < 1$ and $(H+L)/2 > 1$, we have $1 - a^{\max} + a^{\max}L < 1 - a^{\max} + a^{\max} = 1 < (H+L)/2$. Therefore,

$$1 - a^{\max} - (H+L)/2 < -a^{\max}L.$$

Adding $a^{\max}H$ to both sides establishes that the right-hand side of (C.3) is less than unity as required, completing the proof that $T_{\text{if}} > T_{\text{ff}}$.

Finally, it remains to be shown that when $\pi_N < T_{\text{ff}}$, the investor is strictly better off in a separating equilibrium under incentive fees, i.e., that $V_I^* > U_I^*$. Since the total expected returns from the informed adviser coincides under the two fee regimes, this is the same as showing that the informed adviser's fee is strictly lower under incentive fees, i.e., that $EG_I^* < EF_I^*$. But from (A.1) and (B.1), this is the same condition as

$$\frac{E[(R_I - R_B)^+]}{E[R_I - R_B]} < \frac{E[(\mathscr{R}_N - R_B)^+]}{E[\mathscr{R}_N - R_B]}$$

which we have just shown to hold. This completes the proof of Proposition 5.3. ■

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[16] The proof that follows was suggested by this paper's editor, Larry Glosten. Our original proof [see our working paper, Das and Sundaram (2000)] employed a more lengthy algebraic approach.

Appendix D: Proof of Proposition 5.4

Proposition 5.4 is proved in two steps. First, we show that the investor receives only his "reservation" utility level U_N^* in any separating equilibrium under fulcrum fees, regardless of π_N. Then, we show that $U_N^* \leq V_N^*$, where V_N^* is the investor's "reservation" level under incentive fees. This will complete the proof since the investor must necessarily receive at least the reservation level V_N^* in any separating equilibrium under incentive fees.

Equilibrium under fulcrum fees

When $a^{\max} = 1$, the uninformed adviser's portfolio choice under fulcrum fees is simply the benchmark portfolio, so $R_N = R_B$. As a consequence, the performance-adjustment component b_2 in the fulcrum fee is irrelevant to the uninformed adviser, and the "reservation utility" problem (6) is simply one of choosing $b_1 \geq 0$ to maximize the investor's utility subject to the expected fee of the uninformed being at least π_N. The solution evidently lies at $b_1 = \pi_N / E(R_N)$.[17] This results in the investor's reservation utility being

$$U_N^* = (1-b_1)E[R_B] - \frac{1}{2}\gamma(1-b_1)^2 \mathrm{Var}[R_B], \tag{D.1}$$

where $E[R_N] = (H+L)/2$ and $\mathrm{Var}[R_N] = q(H-L)^2/2$.

Turning now to the separation problem (7), we claim that the investor's utility in any solution to this problem will be equal to U_N^*. To see this, note first that since b_2 does not affect the expected fee of the uninformed adviser, its value can be altered without regard to the nonmimicking constraint. Moreover, the expected fee of the informed adviser increases linearly in b_2, so it is optimal for the informed adviser to choose the highest possible b_2 subject to the investor's utility being at least U_N^*. Now, the expected return to the investor decreases linearly in b_2, and, for large enough b_2, the variance of the investor's returns increases in b_2. It easily follows from this that there is a maximum value $\hat{b}_2$ at which the investor receives exactly his reservation U_N^* and such that at any higher value, the investor's utility drops below U_N^*. This establishes the claim.

Equilibrium under incentive fees

In the reservation utility problem (10) under incentive fees, one alternative available is to set b_2 equal to zero. In this case, the uninformed adviser can credibly commit to choosing the benchmark portfolio, and the solution to the problem under this restriction will be exactly equal to U_N^* given by (D.1). Since the overall solution to the problem (10) must do at least as well as this solution under the restriction on b_2, it follows that we must have $V_N^* \geq U_N^*$.

Finally, observe that in any solution to the separation problem (11) under incentive fees, the investor must obtain a utility level of at least V_N^*. It follows that the investor is never worse off under incentive fees than under fulcrum fees. ■

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[17] Strictly speaking, as γ gets arbitrarily large, the investor becomes so variance-averse that he is willing to give up a part of the returns just to avoid this uncertainty. (In the limit as $\gamma \to \infty$, the investor would rather give up all the returns and avoid uncertainty altogether.) We ignore such implausible scenarios here and elsewhere in this proof, and assume that γ takes on only reasonable values.

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